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RS54/RS46 – Waste Water Modeling – Tailings NorthMet Project - DRAFT

Report Prepared for

PolyMet Mining Inc

Report Prepared by

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Executive Summary

PolyMet Mining Inc (PolyMet) is proposing to develop the NorthMet Project (former Dunka Road Project of US Steel) near Babbitt, Minnesota. As a part of the Minnesota Department of Natural Resources (MDNR) "Permit to Mine" process a complete "mine waste characterization" is required (Minnesota Rules Chapter 6132.1000). This document describes geochemical characterization of tailings from other nearby mineral deposits by the MDNR, geochemical characterization of NorthMet Project tailings produced by PolyMet pilot plant testing and water quality predictions.

PolyMet's characterization plan was developed in close consultation with the MDNR and considered results from the MDNR's historical testwork. The MDNR has tested tailings produced by pilot plants run on ore grade rock from the Babbitt Deposit. This testwork is ongoing and showed that tailings containing 0.2% sulfur did not generate acidic leachate after four years. The protocol used for testing appeared to have a strong influence on the results, a finding that has been incorporated into predictions of the geochemical performance of the tailings under site conditions.

PolyMet's characterization program included bulk chemical tests, mineralogical evaluation and kinetic dissolution tests produced by pilot testing of three ore composites. The pilot testing evaluated the use of copper sulfate to enhance flotation of pyrrhotite. As a result, four bulk tailings containing a range of sulfur concentrations (0.10 to 0.23%) were available for geochemical testing. Size fractions of the tailings were also produced so that the different characteristics of tailings dams, beaches and slimes could be assessed. As of March 23, 2007, kinetic testing on NorthMet Project tailings has been underway for 52 to 80 weeks.

Interpretation of the MDNR's testwork on both rock (reported in RS42, SRK 2007b) and other tailings, and PolyMet's testwork on NorthMet Project tailings indicates that tailings containing less than 0.2% sulfur will not generate acidic leachate despite the absence of carbonate minerals. Long term weathering behavior can be predicted by assuming that weathering of abundant silicate minerals in the tailings results in generation of bicarbonate alkalinity, a conventional weathering process. This alkalinity perpetually offsets the acid produced by sulfide mineral oxidation.

Leaching of nickel appears to be sensitive to pH near 7. The MDNR's testwork on bulk tailings in small reactor tests and PolyMet's humidity cell testwork on coarse (>200 mesh fraction) tailings has shown that nickel and cobalt leaching accelerates when pH falls below 7 due to re-leaching of weathering products formed at higher pH. PolyMet's coarse tailings are likely susceptible to moderate pH depression possibly because the silicate mineral particles have less surface area than the fine (<200 mesh) tailings. Bulk tailings and fine sand tailings have not shown accelerated leaching of nickel.

Testing on LTV Steel Mining Company (LTVSMC) taconite tailings showed that the carbonate content of these tailings makes them more leachable in terms of major (calcium, magnesium and alkalinity) ions than the NorthMet Project tailings. This indicates that the LTVSMC tailings produce hard groundwater with capacity to neutralize acid. Nickel leaching from NorthMet tailings is expected to exceed that of the LTVSMC tailings but the LTVSMC tailings appear to have capacity to attenuate nickel.

The leaching behavior of tailings has been predicted by coupling models of moisture content, oxygen profile and sulfide mineral oxidation. These models have shown that coarser tailings in the dam embankments and beaches near the embankments will be well oxygenated due to the low moisture content and particle size of the tailings. The low sulfide mineral content is also a factor because oxygen is not consumed near the surface as is commonly observed in tailings at other sites containing higher levels of sulfide minerals. Seepage chemistry was predicted using water balance information coupled with the tailings facility design which includes progressive placement of synthetic membranes on the downstream slopes of the dams and a system of horizontal drains to collect seepage.

Water in the Cell 2E horizontal drain system was predicted to have metal concentrations below most stringent water quality standards. PolyMet is not proposing a point discharge but the water quality standards would be the minimum discharge limits and are used as water quality objectives for the project. Sulfate is predicted to exceed the secondary drinking water standard (for odor and taste) during the operational period and again in about mine Year 60.

Water collecting in the Cell 1E horizontal drains is predicted to exceed the water quality standards in the later part of operations until Year 37. This water will be returned to the tailings ponds during operation and pumped to the Mine Site at closure until it reaches quality such that collection is no longer required.

Water collected at the Cell 1E seepage recovery barrier was predicted to contain sulfate concentrations above the secondary drinking water standard during the same period. Cobalt concentrations were also slightly above the Class 2B surface water quality standards. This water will be returned to the tailings ponds during operation and pumped to the Mine Site at closure until it reaches quality such that collection is no longer required. Attenuation by contact with overburden and soils was not included in the evaluation and would be expected to reduce concentrations to below applicable water quality standards.

Operational process water quality in the tailings pond was predicted using a mass balance approach for all inputs and outputs. Water quality in the pond was predicted to meet most surface water quality standards by controlling the chemistry of the Mine Site Waste Water Treatment Facility (WWTF) effluent to the pond.

All uncollected seepage to groundwater that is not collected in the seepage collection system will flow north and northwest toward the Embarrass River. This uncollected seepage was not predicted to exceed applicable water quality standards.

Manganese, silver and thallium concentrations were universally predicted to exceed their water quality standards. Manganese is naturally elevated in local groundwaters and surface waters and often exceed the manganese secondary drinking water standard. The latter two parameters are affected by the use of analytical data with detection limits at or above the standards for natural groundwaters and surface waters.

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1 Introduction

1.1 Background

PolyMet Mining Inc (PolyMet) is proposing to develop the NorthMet Project (former Dunka Road Project of US Steel) near Babbitt, Minnesota. As a part of the Minnesota Department of Natural Resources (MDNR) “Permit to Mine” process a complete “mine waste characterization” is required (Minnesota Rules Chapter 6132.1000).

The potential water quality issues associated with tailings disposal at the NorthMet Project are expected to include acid rock drainage (ARD) and leaching of some heavy metals from the tailings themselves, build-up of solutes in the tailings impoundments due to re-circulation of process water, and effects resulting from interaction between tailings pore waters and the underlying LTV Steel Mining Company (LTVSMC) taconite tailings.

The characterization program for tailings was designed based on extensive consultations with staff at the MDNR resulting in implementation of “Flotation Tailings and Hydrometallurgical Residue Geochemical Characterization Plan NorthMet Project, Minnesota” in May 2006. For reference, Hydrometallurgical Residue Geochemical Characterization is addressed in other documents, RS33 and RS65 (SRK 2007a).

Inputs to the overall water quality predictions for the tailings pond came from a variety of sources detailed elsewhere including pilot plant testwork (RS32, Barr 2006a), tailings pond water balance (RS13, Barr 2007c), tailings pond operation (RS39/40T, Barr 2007a) and mine water treatment testwork (RS29T, Barr 2007b). This report combines the original scopes of RS54 (reporting on tailings characterization) and RS46 (tailings water quality model).

1.2 Objective

The specific objectives of this characterization program included:

- Assessment of the overall reactivity of the tailings solids as required in Minnesota Rules Chapter 6132.1000.
- Development of mass-loading rates for input into water quality predictions for impact assessment and mitigation design.

1.3 Design and Consultation Process

The tailings characterization plan was developed in consultation with staff from the MDNR. The consultation included the following steps:

- June 22, 2005. A draft of the plan was prepared for MDNR Review.

- July 21, 2005. MDNR provided initial comments focused primarily on flotation tailings.
- September 9, 2005. SRK responded to the July 21, 2005 letter.
- September 14, 2005. A conference call was held to discuss the July 21, August 16 and September 9 letters.

The process was begun in June 2005 and concluded with full implementation of “Flotation Tailings and Hydrometallurgical Residue Geochemical Characterization Plan NorthMet Project, Minnesota” in May 2006.

1.4 Structure of Report

This report combines results of two studies. RS54 provides results of characterization of tailings. RS46 is the prediction of leachate chemistry and resulting water chemistry of seepage collected and seepage escaping the facility.

The structure of the RS46 report, which was a combination of RS54 and RS46 was agreed with the MDNR. The final version of the report outline was transmitted to the MDNR on April 26, 2006. The agreed outline has been followed although in places this does not fit with the development of thinking on the project. If any sections are redundant, the section heading is shown with a brief note to explain why the section is no longer relevant.

Information on hydrometallurgical residue characterization and water quality is presented in RS33 and RS65 (SRK 2007a)

2 Water Chemistry Prediction Methods

2.1 Introduction

The final products of this study were chemistry predictions for the tailings pond water, and tailings pore water during operation and closure. The prediction methods to be used were considered as part of the design of the characterization program so that the program would provide the inputs needed to predict water chemistry. The following sections broadly describe the types of modeling approaches considered and the method selected.

2.2 Theoretical Method

Theoretical models for tailings and tailings basins need to couple physical and chemical processes in the tailing profile which include oxygen diffusion, saturated and unsaturated water flow, oxidation of sulfide minerals, dissolution of buffering minerals, oxidation/reduction reactions, ion exchange, and secondary mineral precipitation in addition to basin dynamics.

No single theoretical model has been developed probably because coupling the processes is complex. Models such as RATAP (Scharer et al. 1994) and MINTOX (Wunderly et al. 1996) are best described as “Engineering Models” because they have limited power to reliably predict water quality but provide a good basis to evaluate engineering solutions.

2.3 Analog and Empirical Methods

2.3.1 Analog

The analog method involves direct comparison of the proposed project with existing similar mines. Two analogs were considered. The first would use pond water chemistry from other sites to predict the chemistry of the ponds at the NorthMet Project; however, as ore processing, tailings placement and basin hydrodynamics are unique to every site, direct analogs for tailings management facilities are not easily found.

The second analog would compare the geochemical performance of the tailings solids expected to be produced at NorthMet with the tailings solids from other similar sites. This is a more appropriate comparison because the number of variables or factors affecting geochemical behavior is lower than for the pond water. As will be described below, the MDNR has performed testwork on tailings generated from evaluations of the nearby Babbitt Deposit which is in a similar geological setting.

2.3.2 Empirical

The empirical method uses scale-up of laboratory tests to predict the geochemical performance of the tailings solids. Further explanation of this approach can be found in RS42 (SRK 2007b).

2.4 Method Selected

2.4.1 Tailings Leaching

The method selected to predict the leaching behavior of tailings involved components of the theoretical approach combined with empirical or scale-up methods. The progress of oxidation and pore water chemistry in this case was predicted by combining oxidation rates indicated by laboratory tests with calculation of oxygen diffusion consistent with the moisture content and particle size distribution of the tailings (for example, SRK 2004).

2.4.2 Operational Process Pond

The method used to predict operational process pond water quality is coupled with the tailings leaching prediction but itself is primarily empirical. Experience shows that water quality during closure can be accounted for by carefully tracking all sources and calculating the total masses entering and leaving the tailings impoundment. This is very commonly used approach for prediction of pond chemistry at new and operating mines (e.g. Red Dog Mine – Teck Cominco Alaska; Ekati Diamond Mine - BHP Billiton Diamonds; Kemess North Project - Northgate Resources; Galore Creek - Novagold Resources; Ruby Creek Project – Adanac Molybdenum Corporation).

3 Program Design

The following sections describe geological, geochemical and mine design background considered in the design of the geochemical characterization program for the tailings solids.

3.1 Geological Background

Detailed description of the geological setting of the deposit is provided in ER03 (PolyMet 2007).

The NorthMet Deposit is located in the intrusive Duluth Complex of northern Minnesota. Disseminated copper-nickel-iron sulfides (chalcopyrite, cubanite, pentlandite and pyrrhotite) with associated platinum group element (PGE) mineralization will be extracted from several igneous stratigraphic horizons.

In the vicinity of the NorthMet deposit, the Duluth Complex intruded and assimilated the Virginia Formation, which consists of argillite and greywacke with minor interbeds of siltstone, graphitic argillite, chert, and carbonate. This formation is the stratigraphic footwall of the NorthMet deposit, but also occurs as xenoliths (“inclusions”) within the deposit.

Processing of the ore by flotation will result in removal of sulfide minerals to produce tailings composed almost entirely of silicates. Small quantities of residual sulfide minerals will remain.

3.2 Geochemical Background

The tailings characterization program was designed based largely on experience extrapolated from waste rock characterization conducted by the MDNR beginning in the 1970s (Lapakko et al 2001; MDNR 2004a). The MDNR’s waste rock testwork showed that sulfur content is the primary variable controlling pH of leachate, delay to onset of acidic leachate, oxidation rates, and metal release rates (Lapakko 1993; Lapakko and Antonson 2006).

The MDNR has completed some testwork on tailings generated in the past from processing of the Babbitt Deposit. These results are summarized in the following sections.

3.2.1 AMAX Tailings Test Plot

In 1978, a field test plot was constructed containing tailings produced by processing of ore extracted from a test shaft (MDNR 2004b). The resulting tailings contained 0.38% sulfur (i.e., over two times the planned concentration in NorthMet tailings). The tailings plot was monitored for 3 years during which time leachate pH was generally above 7 but occasionally between 6 and 7 during high runoff periods. Flow-weighted average sulfate concentrations were near 2000 mg/L, copper concentrations were near 0.05 mg/L and nickel concentrations varied from 0.03 to 0.3 mg/L. Lower nickel concentrations were generally found when pH dropped below 7. Based on review of the data, SRK found that drainage yields from the pile were very low which strongly suggests that drought conditions and excessive evaporation may have had a strong influence on water chemistry.

3.2.2 Cominco Tailings

In 2002, Cominco Ltd. produced tailings from processing of ore from the Babbitt Deposit (MDNR 2004b). The resulting tailings contained 0.2% sulfur. The MDNR is conducting eight laboratory kinetic tests on the samples in three different configurations (ASTM, MDNR Reactor with no lid (uncovered) and MDNR Reactor with lid (covered). Leachate chemistry data were provided by Folman (2006a,b). All samples produced leachates that had pH greater than 6.5 but the reactors with lids had lowest pHs (6.5 to 7) compared to without lids (pH 7) and ASTM (7.5 declining to 7) which correlated with greatest sulfate production and nickel release for the reactors with lids (Figure 3-1). Nickel release was lowest for the ASTM test. SRK calculated that 29%, 38% and 55% of sulfur, were depleted from the ASTM, no lid and lid tests, respectively after four years of testing. Copper leaching was hardly detected (Figure 3-1).

3.3 Summary of Impoundment Construction and Operation

Details of impoundment construction and operation are provided in RS39/40T (Barr 2007a). Tailings will be deposited in an existing taconite tailings basin previously operated by LTVSMC. Tailings slurry will be discharged from multiple spigot locations. Natural particle size segregation will occur resulting in deposition of coarse particles near the dams and fine particles in the center of the impoundment. Coarse tailings will be used for ongoing construction of the impoundment using the upstream construction method. Initial deposition will occur in Cell 2E. After 8 years, deposition will begin in the combined Cells 2E and 1E. Downstream faces of tailings dams will be progressively covered with a geosynthetic material to limit infiltration and oxidation of coarser tailings used for dam construction. A system of horizontal drains will be installed in part to allow collection of water that may contain concentrations of regulated parameters above minimum water quality discharge limits.

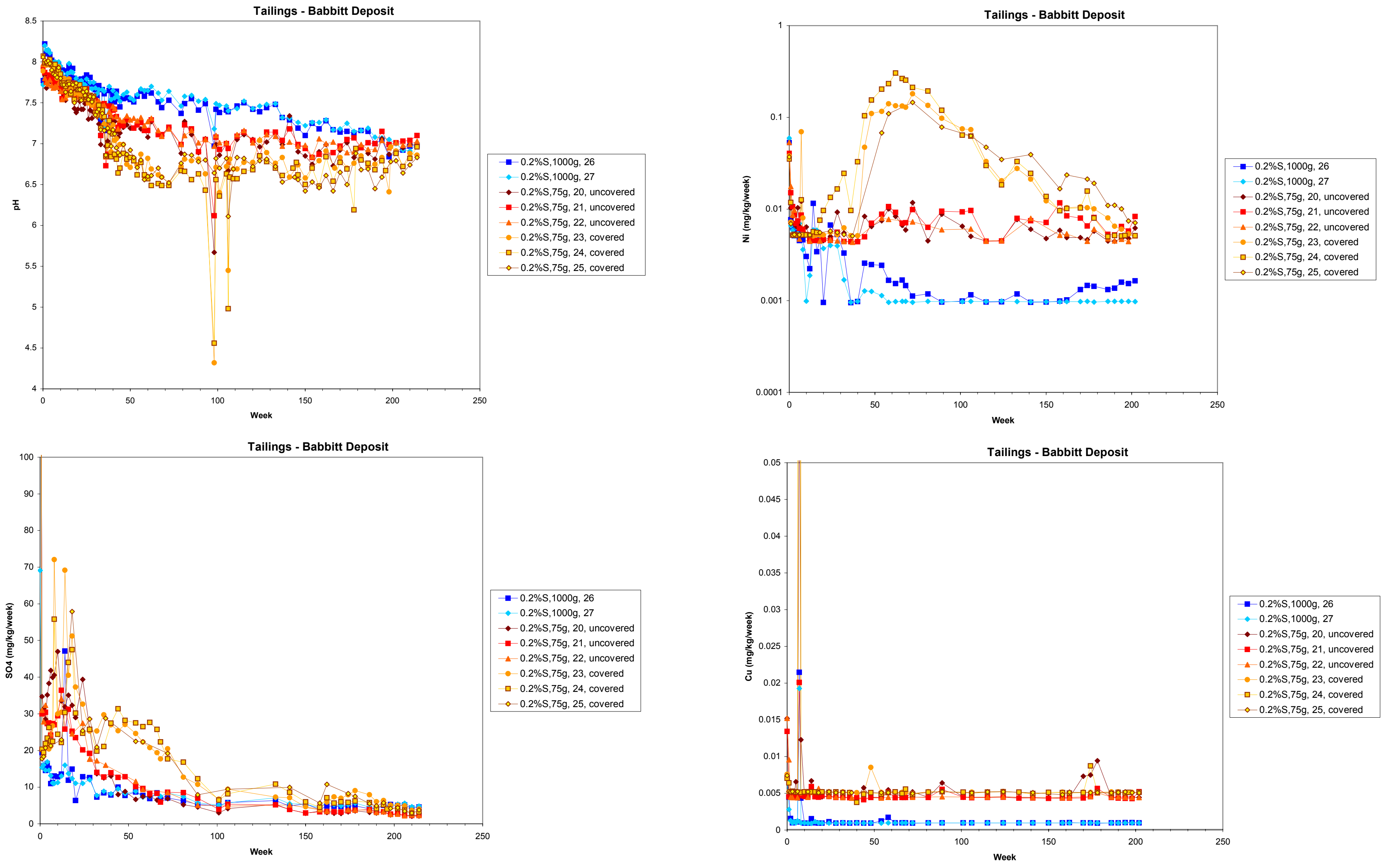


Figure 3-1: Results of MDNR Testing on Cominco Tailings

3.4 Data Requirements

The overall objective of the waste characterization test program was to evaluate the leaching characteristics of the tailings to provide input into prediction of tailings pond water quality and seepage during operation and closure of the impoundments.

3.5 Overall Program Design

The overall characterization program was designed to evaluate the weathering processes that can be expected to occur in exposure of bulk tailings and tailings of different particle sizes as they are deposited. The MDNR's experience has clearly demonstrated that sulfur concentration is an important variable controlling waste rock reactivity and therefore the tailings program was designed to evaluate the effect of sulfur content on reactivity. This was achieved by obtaining tailings samples produced by processing three ore composites with and without the use of copper sulfate to activate the sulfide mineral surfaces to enhance flotation (RS32, Barr 2006a). Tailings produced without copper sulfate contained higher sulfur concentrations than those produced with copper sulfate. The resulting bulk tailings samples were then sieved to obtain three tailings particle size fractions representing coarse to fine sands (+100 mesh, -100+270 mesh and -270 mesh).

An additional factor that could not be evaluated by the MDNR's testwork is that PolyMet intends to deposit the tailings on existing tailings produced by the former LTVSMC taconite operation. Samples of taconite tailings were collected by core sampling to evaluate the interaction between leachates from the NorthMet tailings and the taconite tailing.

4 Sampling and Analytical Methods

4.1 Metallurgical Program

4.1.1 Ore Composite Preparation

Preparation of the three ore composites or parcels (P1-low grade ore, P2-mid grade ore and P3-high grade ore) is described in ER03 (PolyMet 2007).

4.1.2 Production of Tailings Samples

Bulk Tailings

Tailings samples were generated from the three ore parcels using a pilot plant over a three-week period in July and August 2005. Results of environmental sampling of the pilot plant are described in RS32 (Barr 2006b).

Every 2 hours, samples of bulk tailings were collected and analyzed for sulfur content to evaluate the variation of sulfur concentration that could be expected during full-scale production and the degree to which the resulting bulk samples would represent this variability. Results of the sulfur analyses are shown in Figure 4-1.

The trend in sulfur results in tailings are explained by the chronology of the testwork and evaluation of addition of copper sulfate as a reagent:

- Flotation testwork began on July 17 with Parcel 2 without the use of copper sulfate. Parcel 2 was processed entirely without using copper sulfate. As shown, sulfur concentrations varied from 0.05% to 0.25% reflecting adjustment of the process conditions early in the testwork. The average was 0.19%. The composite of Parcel 2 tailings had a sulfur content of 0.2% closely representing the average.

- Testwork continued with Parcel 1 without using copper sulfate. Processing was continuous so one point is shared between Parcel 2 and Parcel 1. The range of sulfur concentrations was 0.19% to 0.28% with an average of 0.24%. The composite sample was 0.23% and is close to the average of the two-hour samples.

- Pilot plant testwork was suspended on July 19 to allow for further bench scale testing on reducing sulfide in tailings.

- The pilot plant resumed on August 8 using Parcel 1. Addition of copper sulfate was evaluated. The effect of copper sulfate on tailings characteristics was immediately apparent for Parcel 1. Total sulfur concentrations decreased to a range of 0.09% to 0.13% (average 0.1%) and the resulting tailings composite was 0.1%.

- Processing continued with Parcel 3 using the copper sulfate additive. Sulfur content of the tailings varied over a wider range (0.09% to 0.25%, average 0.18%) though the range was comparable to the total range indicated by processing of other ore packages. The resulting composite had a total sulfur content of 0.15%.

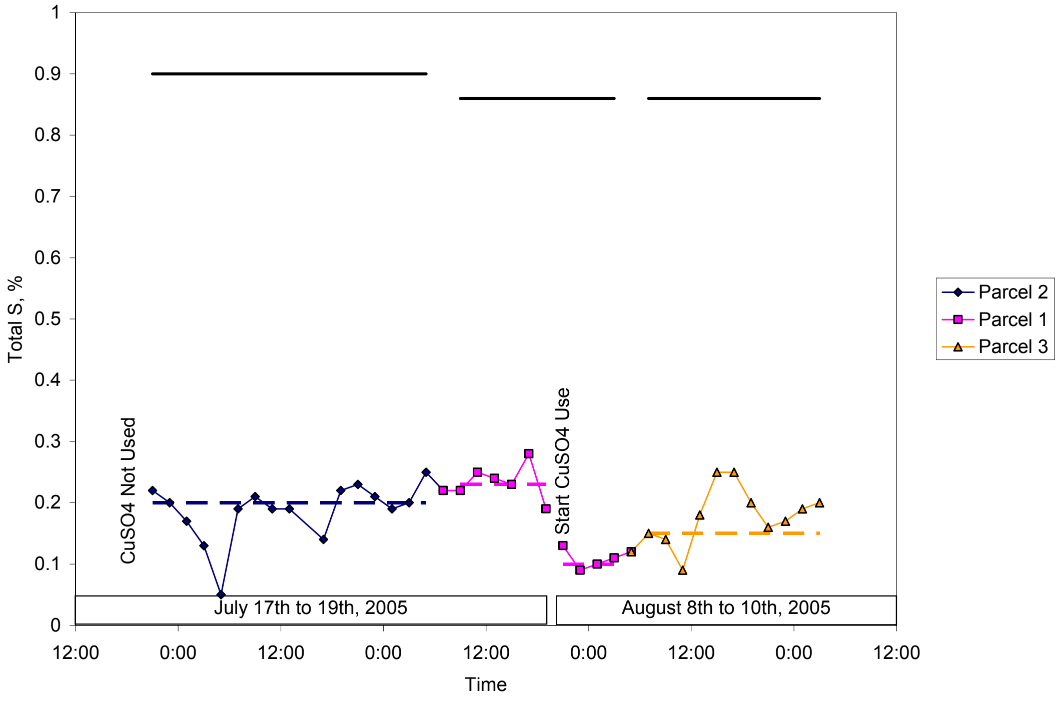


Figure 4-1: Results of 2-Hourly Total Sulfur Analyses. Solid lines and points connect 2-hourly results. Broken solid lines are sulfur concentrations in composite tailings samples representing each stage of testwork. Solid horizontal lines at the top of the graph are the respective ore composite sulfur contents.

In summary, the 2005 Pilot Plant processing resulted in four bulk tailings samples:

- Parcel 2 tailings produced without using copper sulfate.
- Parcel 1 tailings produced without using copper sulfate.
- Parcel 1 tailings produced using copper sulfate.
- Parcel 3 tailings produced using copper sulfate.

The process testwork showed that sulfur concentrations in the tailings can be expected to vary in response to changes in process conditions including the use of copper sulfate. The full scale plant design includes copper sulfate addition. Pilot testing in 2006 using a pilot plant configuration that represents the final plant design demonstrated that full scale plant tailings are expected to be much less than 0.2%S. The average sulfur concentration was 0.12% (range 0.10% to 0.13%).

The lack of copper sulfate for the Parcel 2 and initial Parcel 1 samples may have significantly affected the subsequent reactivity of the residual sulfide minerals in the tailings because copper sulfate would improve flotation of liberated pyrrhotite mineral grains. For the latter part of Parcel 1 and all of Parcel 3, residual sulfide may remain as unliberated or encapsulated grains. These factors indicate that similar sulfur concentrations in samples produced with and without the use of copper sulfate may not represent equivalent reactivity. This particularly affects the evaluation of coarse fraction reactivity.

Tailings Fractions

Initial designs for the tailings impoundments included the use of tailings sands produced using cyclones for construction of the dams. To evaluate the characteristics of the tailings produced from cycloning, bulk tailings samples were screened to produce three size fractions representing the dam material (+100 mesh), beach (-100+200 mesh) and fine sands (-200 mesh). The cycloning concept was not carried through to the Detailed Project Description but instead the dams will be constructed using coarser tailings resulting from natural settling of tailings discharged from spigots. This difference in construction method indicates that the coarse tailings will contain some material finer than 100 mesh entrained during settling and therefore that differences in leaching behavior between the ideal fractions will be less apparent under field conditions.

4.2 LTVSMC Tailings Characterization Program

4.2.1 Drilling

The LTVSMC taconite drilling program plan is described in Appendix A.

Seven holes were drilled in the tailings to a depth exceeding 60 feet using a geoprobe. Mostly continuous samples were obtained from five holes with tailings having the following textural characteristics:

- GP-1 – Mainly coarse sand.
- GP-2 – Interlayered fine sand and slimes.
- GP-3 – Coarse sand grading into fine sand and slimes.
- GP-4 – Interlayered coarse and fine sands.
- GP-5 – Interlayered fine sand and slimes.

Samples were obtained as core and shipped whole to Canadian Environmental and Metallurgical Inc. (CEMI).

4.2.2 Existing Water Quality and Laboratory Testing Data

Existing groundwater and seepage chemistry data for the LTVSMC tailings cells that are proposed for disposal of NorthMet tailings are described in RS64 (Barr 2006d). Data distribution statistics are provided in Table 4-1. Average concentrations were calculated using the absolute value in the case of results reported at the detection limit. The majority of analyses were performed on “unfiltered” samples and therefore concentrations may reflect the presence of suspended matter. Total suspended solids were detected (average 6 mg/L and 11 mg/L for cells 2E and 2W, respectively but with maxima of 47 and 672 mg/L, respectively) which showed that total concentrations can be expected to exceed concentrations in 0.45 µm-filtered waters.

Waters in the impoundment area are bicarbonate-Ca-Mg-Na but sulfate is also an important anion. Fluoride is a minor anion occurring at elevated concentrations compared to typical groundwaters (averaging 2.3 and 3.0 mg/L in Cells 2E and 2W, respectively). Iron concentrations were relatively low (averages of 0.05 and 0.07 mg/L). As shown, manganese concentrations averaged 0.9 and 0.4 mg/L, respectively for the two cells.

Berndt et al. (1999) characterized the LTVSMC tailings as part of a study to evaluate in pit disposal of taconite tailings for several mines. They found that the taconite tailings were composed mainly of quartz (44 to 51%), hematite (3 to 17%) and talc (3 to 12%). Siderite and ankerite were present at concentrations ranging from 4 to 9% each. Elevated fluoride concentrations were believed to be due to the use of wet scrubbers for control of particulate emissions from induration furnaces. The wet scrubbers also remove highly soluble HF gas from the furnace exhaust, resulting in elevated fluoride concentration in the scrubber water.

Table 4-1: Summary Statistics for Groundwater Chemistry in the LTVSMC Tailings Basin

Location Code	Bicarbonate	As	Ba	Be	B	Ca	Cl	Co	Cu	F	Hardness	Fe*	Mg	Total Mn	Mo	Ni	pH	K	Na	SO_4	Zn
	mg/L	µg/L	µg/L	µg/L	µg/L	mg/L	mg/L	µg/L	µg/L	mg/L	mg/L	mg/L	mg/L	mg/L	µg/L	µg/L	su	mg/L	mg/L	mg/L	µg/L
Cell 2E																					
n	67	8	8	1	110	100	9	74	72	110	100	55	100	77	110	61	32	62	72	120	8
Min	270	<2	47	<0.2	85	18	19	<3	<2	<0.1	110	<0.03	15	0.02	<5	<2	6.4	6.2	34	8.1	<10
P5	400	<2	49	<0.2	240	50	20	<1	<2	0.19	370	<0.03	57	0.05	5.5	<2	7	7.6	72	56	<10
Median	490	<2	70	<0.2	400	69	26	<1	<2	2.4	520	0.03	84	0.59	20	<2	7.8	13	98	180	<10
Mean	490	2	73	0.2	380	69	25	1.3	2.4	2.3	510	0.052	81	0.88	21	2.2	7.7	15	97	180	10
P95	550	2.5	100	<0.2	490	85	29	1.4	2.6	3.8	650	0.14	110	2.3	37	2.4	8.1	20	120	300	3.3
Max	630	2.7	110	<0.2	520	94	31	17	24	4.8	760	0.17	130	4	97	5.9	8.8	75	220	470	10
Cell 2W																					
n	130	17	17	3	240	260	13	210	190	250	270	120	260	190	210	180	110	110	120	350	88
Min	120	<2	14	<0.2	<40	1.3	1.2	<3	<2	<0.1	3	<0.03	<0.5	<0.01	<5	<5	6.4	3.3	24	20	<30
P5	240	<2	19	<0.2	240	17	11	<1	<2	0.99	160	<0.03	21	0.01	14	<2	6.8	7.6	44	53	<10
Median	370	<2	30	<0.2	400	54	26	<1	<2	2.8	400	0.03	64	0.34	58	<2	7.7	13	75	170	<10
Mean	370	2	43	0.2	400	55	28	1.4	3.1	3	430	0.071	72	0.43	77	3.5	7.6	14	78	190	11
P95	550	4.7	110	<0.2	560	90	48	3	8.3	5.8	810	0.17	140	1.2	190	11	8.9	22	120	350	13
Max	620	5.3	140	<0.2	630	120	67	8	39	9.6	1100	0.87	190	2.3	290	46	9.4	33	150	530	23

Notes:

1. Element concentrations are for unfiltered samples, except iron.
2. All detectable values are shown to two significant figures.

4.2.3 Sample Collection

At the laboratory, all discrete textural layers were tested for rate of HCl reaction (ie a “fizz” test) and qualitative magnetism as an indicator of magnetite content. Samples were selected from each hole to represent the surface material (i.e. potentially weathered) and two samples of each textural type from each hole. These samples were submitted for relative density, moisture content and particle size determinations, quantitative mineralogy by x-ray diffraction and chemical analysis.

4.3 Dissolution Testwork

4.3.1 Physical Characterization

Physical characterization included density determinations and size fraction analysis as part of the Environmental Sampling and Analysis Plan for the pilot plant test program (RS32, Barr 2006b).

4.3.2 Mineralogy of NorthMet Project Tailings

Optical

Optical analyses were performed by PolyMet on polished thin sections of NorthMet whole tailings samples. Results are provided in Appendix B.1.

Sub-Optical

Results of an extensive evaluation of the elemental composition of minerals present in the NorthMet Deposit are provided in RS42 (SRK 2007b). Results of that study are applicable to the tailings samples.

X-Ray Diffraction

X-ray diffraction was planned but not completed because the optical work provided a better characterization of mineral forms present in ore and tailings than could be expected using XRD.

4.3.3 Analytical Methods

Solids Characterization

A split of each sample was submitted for the following analyses:

- Sulfur forms (total S, S as sulfate).
- Paste pH.
- Neutralization potential and carbonate.
- 50 elements (mostly metals by ICP scan following aqua regia (nitric and hydrochloric acids) digestion).
- Whole rock oxides. This provided total concentrations of major elements in whole tailings.

Results are provided in Appendix B.3.

ASTM Humidity Cell

Humidity cell testing was performed using ASTM Procedure D 5744 – 96 (Reapproved 2001). This procedure was selected for the following reasons:

- Similar procedures have been in use under different names since the late 1980s (e.g. MEND 1991). The results can therefore be evaluated in the context of more than a decade of experience using the procedure.
- It is a standard procedure approved by the ASTM which produces reproducible results (White and Lapakko 2000).

The ASTM procedure provides some options for varying the test procedure. Modifications to the test procedure were described in the overall characterization plan (SRK 2006).

MDNR Reactor

Tailings samples are being tested in an apparatus designed by MDNR to contain 75 g of sample to complement the MDNR's own long term experiments and comparisons using the ASTM humidity cell and MDNR Reactor (Lapakko et al. 2002; Lapakko and White 2000). The procedure was described in the overall characterization plan (SRK 2006).

PolyMet and LTVSMC Tailings Interaction Experiment

Based on the initial understanding of the characteristics of the NorthMet and LTVSMC taconite tailings, the following chemical processes can be expected to occur within the layered tailings basins:

- In NorthMet Tailings
    - Oxidation of residual sulfide minerals resulting in release of acidity, iron, sulfate and trace elements (copper and nickel).
    - Weathering of silicate minerals by carbonic acid resulting in release of alkalinity and base cations.
    - Development and migration of an oxidation front through the tailings.
    - Attenuation of metals as a result of interaction between pore fluids and mineral grains.
- LTVSMC Tailings
    - Dissolution of ankerite, siderite and calcite under saturated conditions resulting in release of calcium, magnesium, reduced (ferrous) iron, reduced manganese and bicarbonate alkalinity.
    - Localized re-precipitation of ferric hydroxides and manganese oxides due to variations in pH and oxidation-reduction conditions.

- Interaction Between NorthMet Tailings Pore Water and LTVSMC Tailings
    - Sorption of metals by ferric hydroxides and manganese oxides, particularly in the immediate contact zone where LTVSMC tailing are probably partially oxidized.
    - Precipitation of metal carbonates, hydroxides and silicates due to alkaline conditions.

To evaluate these processes, a column design was agreed with the MDNR and included the following main features (Figure 4-2):

- Two 5 kg leach columns designed to generate NorthMet tailings pore water as feed into LTVSMC tailings. The leach columns contained bulk tailings P1 and P3 prepared using copper sulfate.
- NorthMet tailings columns open to atmosphere.
- Leachate from the NorthMet tailings directed into a column containing 2 kg of LTVSMC tailings.
- Leachate from first LTVSMC tailings column into a second LTVSMC tailings column.
- Leachate from second LTVSMC tailings column into a third LTVSMC tailings column.
- All connecting pipes between columns and final effluent sampling point operated to allow sampling with exclusion of oxygen to simulate conditions beneath the NorthMet tailings.
- Application of 2 L of deionized water to the NorthMet tailings every week to allow withdrawal of up to 250 mL of water from each of the two intermediate locations and 1.5 L of the final effluent. This application rate represents approximately one pore volume every 4 weeks.

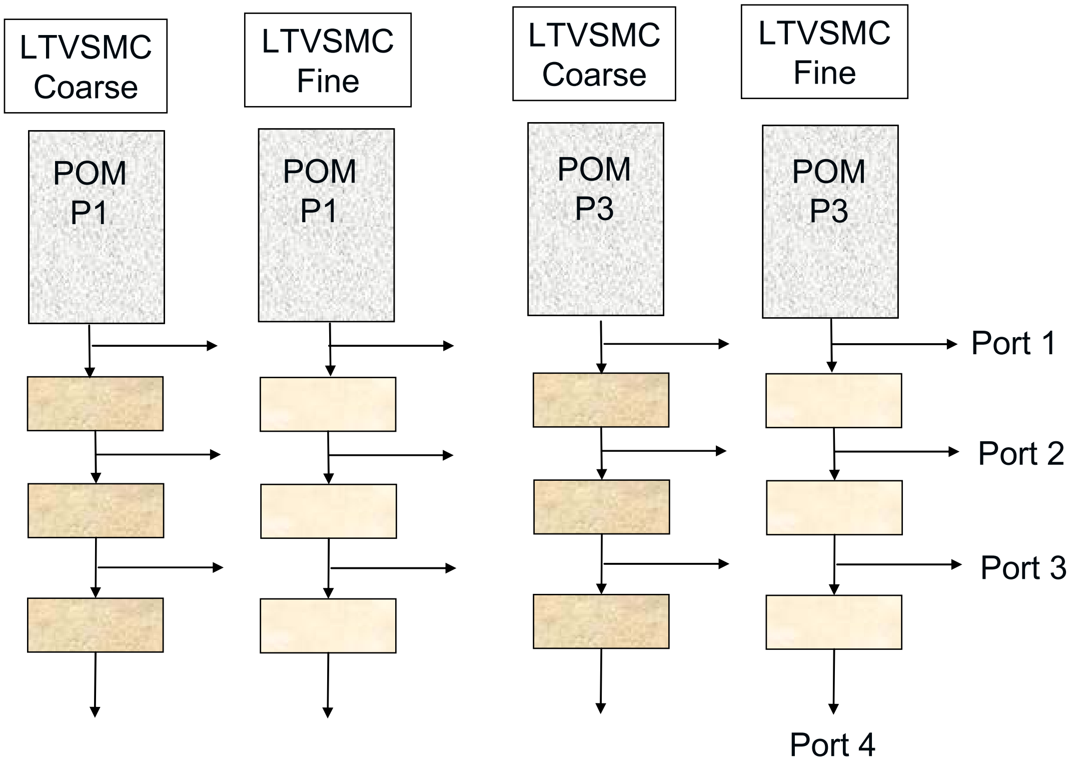


Figure 4-2: Schematic of NorthMet and LTVSMC Taconite Tailings Contact Experiment

Leachate Analysis

Leachates from kinetic tests were analyzed for the parameters indicated in Table 4-2. Conductivity, pH and ORP were analyzed every week. Sulfate, alkalinity, acidity, chloride and fluoride were analyzed on even numbered weeks. Every four weeks beginning on the first rinsing cycle (week 0) the metals indicated in Table 4-2 were analyzed using an ICP-MS scan on filtered samples. On other even numbered weeks (i.e. weeks 2, 6, 10 etc.), the leachates were analysed for a higher level scan (ICP-OES) to evaluate trends in major elements. This scan also provided trace metal concentrations but at higher detection limits.

Leachate analytical results are graphed in Appendix C. Results are available electronically as Microsoft Excel® spreadsheets in the report pocket.

Table 4-2: List of Parameters for Humidity Cell Leachate Analyses. Concentrations in mg/L except where indicated

Parameter	Limit	Parameter	Limit
pH (standard units)	-	Acidity	1
Conductivity (µS/cm)	1	Alkalinity	1
Chloride	0.2	Sulfate	0.5
Fluoride	0.05	Total Inorganic Carbon	1
ORP (mV)	-		
Dissolved Elements (ICPMS Scan)			
Aluminum	0.001	Mercury	0.02 µg/L
Antimony	0.0001	Molybdenum	0.00005
Arsenic	0.0001	Nickel	0.0001 (0.00005)[1]
Barium	0.0001	Potassium	0.02
Beryllium	0.0002	Selenium	0.0002
Bismuth	0.0002	Silicon	0.05
Boron	0.005	Silver	0.00005
Cadmium	0.00004	Sodium	0.01
Calcium	0.01	Strontium	0.0001
Chromium	0.0002	Tellurium	0.0002
Cobalt	0.0001 (0.00005)[1]	Thallium	0.00002
Copper	0.0001	Thorium	0.0001
Iron	0.01	Tin	0.0001
Lead	0.00005	Titanium	0.0002
Lithium	0.0002	Uranium	0.00005
Magnesium	0.005	Vanadium	0.0002
Manganese	0.00005	Zinc	0.001

Notes:
1. Low detection limits are available for cobalt and nickel as shown.

QA/QC

To summarize, QA/QC included the following components:

- Roughly 10% of all solids analyses are performed in duplicate.
- Roughly 10% of all cell and reactor tests are run as duplicates.
- A blank cell and reactor containing no sample is being operated to check for contamination of leachates by construction materials.
- Individual leachate results are reviewed.
- Ion balances on leachate results are reviewed. In general, imbalances of ±10% are considered acceptable. Re-analysis if requested depending on the nature of the imbalance.
- Data of data trends in kinetic test leachates are analyzed to check for anomalies.

Review of antimony data indicated that test apparatus components of the ASTM humidity cell tests constructed from polyvinyl chloride (PVC) were leaching antimony due to the use of antimony oxide in manufacturing. Antimony results from humidity cell results were therefore discarded. The MDNR Reactor tests were unaffected.

4.3.4 Interpretation Methods for Kinetic Tests

Trend Analysis

All results from kinetic plots were plotted as time series which were continually updated as the project progressed to allow trends to be assessed. Results were plotted as raw concentrations and as loadings, or release rates calculated from:

Loading (mg/kg/week) = Concentration (mg/L) x Leachate Recovered (L) / Mass of Sample.

As indicated above, metal concentrations were determined by two different methods on alternate even-numbered weeks. For the purpose of plotting and loading calculations, the following rules were used:

- If the result was determined by ICP-MS and was below the reporting limit, the value on the graph is at the reporting limit.
- If the result was determined by ICP-ES and was determined to be below the reporting limit, no value is plotted.
- If the result was determined by ICP-ES and was determined to be above the reporting limit, the value is plotted.

These rules can result in four cycles between plotted results if the parameter is not detected by ICP-ES (e.g. molybdenum in shake flask leachates).

Occasionally, “sawtooth” trends are apparent in which values alternate between high and low for the ICP-ES and ICP-MS analyses. This results from analytical “noise” around the ICP-ES reporting limit when reported values are slightly above the reporting limit. Aluminum is a particular example that commonly shows reported values above the ICP-ES reporting limit of 0.05 mg/L.

Many graphs are plotted on logarithmic axes to allow data spanning a wide range of concentrations to be compared.

Average Rate Calculations

Average rates (in mg/kg/week) were calculated to evaluate correlations between bulk characteristics (e.g. metal and sulfur content, mineralogical characteristics) and to provide inputs into water quality predictions. The following method was used to calculate average rates:

- The loading trends for sulfate were examined as an indicator of sulfide oxidation rates and the expected main factor driving other parameters such as release of metals and the products of acid neutralization.

- The loading trends typically showed relatively rapid initial release of sulfate followed by decrease, then a longer term trend (stable, increasing, or slow decrease). The initial trend is usually a result of leaching of weathering products produced by oxidation of the sample in storage prior to testing. The trend following the short term effect reflects dissolution of weathering products produced each week. For trends showing relatively stable release, the trend was examined to find the first week when the release rate was below the highest point in the stable trend. If a decreasing or increasing trend was apparent, the trend was visually assessed to estimate when the initial flush ended. The release rates following the development of the stable trend are then used to calculate average release for the entire trend. In the event that the trend showed much more variability than other tests, the average was not calculated.

- Loading trends for other parameters were calculated using the same time period as sulfate so that comparisons between parameters could be made on a consistent basis.

- Some dissolved ions were not determined on a weekly basis, and in some cases have variable analytical frequency depending on detection by ICP-ES or ICP-MS. The average rates for individual weeks were pro-rated between analyses by summing the load leached rather than just averaging weekly rates.

Depletion Calculations

Rates were also used to evaluate depletion of rock components by totaling the load leached over the entire period of the test.

5 Results

5.1 Solids Characteristics

5.1.1 LTVSMC Tailings

Mineralogy

Table 5-1 shows selected data sorted by the main textural groups (coarse sand, fine sand and slimes).

The dominant mineral in all samples was quartz which varied from 58 to 79% (by weight) but was not different in the three textural groups. Residual amounts of the ore minerals (hematite and magnetite) were present as expected. Magnetite was lower in the slimes samples likely resulting from density segregation as the tailings were deposited. Carbonates were a significant mineralogical component varying from 5 to 14%. Total carbonate content was greater in the slimes fraction compared to the coarse sands. Ankerite and siderite dominated and occurred in about equal amounts. The calcite content was lower than either ankerite or siderite.

Pyrite was detected in most samples but at very low levels. The sulfur content of the samples varied from 0.02 to 0.04% equivalent to pyrite content of 0.04 to 0.08%.

Silicates occurring in all samples were hydrobioitite, kaolinite, amphibole (cummingtonite ± grunerite), diopside, ferripyrophyllite (possibly minnesotaite) and albite. Other minerals occurring in a few samples were pyrophyllite, muscovite and hydroxylapatite. There was no evidence that the mineral distribution was related to particle size.

Solids Chemistry

Distribution of metals was also unrelated to particle size with the possible exception of manganese which appeared to be elevated in the slimes (Table 5-1). This is consistent with the higher carbonate content and indicates that manganese is associated with the carbonates.

Table 5-1: Characteristics of LTVSMC Tailings Samples

			Mineralogy Indicated by X-Ray Diffraction											Trace Element Composition											
Core and Tailings Type	Interval Sampled		Quartz	Pyrite	Calcite	Ankerite	Siderite	Hematite	Magnetite	Biotite	Kaolinite	Ferriprophyllite	Albite low	As	Cd	Co	Cr	Cu	Fe	Mn	Ni	P	Pb	S	Zn
	Start ft	Finish ft	%	%	%	%	%	%	%	%	%	%	%	ppm	ppm	ppm	ppm	ppm	%	ppm	ppm	ppm	ppm	%	ppm
Coarse Sand																									
GP-1	8	12	72	0.2	0.3	3	3	3	4	1	1	2	2	31	<0.5	12	100	14	15.85	5970	5	240	7	0.02	14
GP-1	20	40	71	0.2	0.2	5	8	2	2	2	1	2	2	36	<0.5	14	90	25	15.5	7110	8	250	5	0.04	13
GP-3	8	12	58	0	0.4	6	6	2	3	5	1	6	4	16	<0.5	7	42	7	13.7	3420	3	250	4	0.02	9
GP-4	4	16	59	0.1	0.7	2	4	2	3	10	2	2	3	19	<0.5	7	57	9	15.45	3890	1	240	7	0.02	9
GP-4	20	24	79	0	0.1	3	2	2	3	3	1	2	1	21	<0.5	10	45	8	12.85	4010	3	250	5	0.02	34
Fine Sand																									
GP-1	60	72	72	0.1	0.7	3	2	1	1	2	2	2	4	22	<0.5	11	77	20	12.05	7010	3	330	3	0.04	14
GP-2	0	1	60	0	0.2	6	7	2	2	11	4	3	0	15	<0.5	9	27	7	14.4	4270	-1	490	-2	0.02	10
GP-2	24	28	62	0.4	1	6	3	1	2	5	2	3	3	22	<0.5	11	61	13	14.55	5340	3	550	7	0.02	14
GP-3	44	60	68	0.2	0.5	4	3	3	2	4	1	3	1	15	<0.5	12	45	17	13.4	8510	4	400	7	0.03	12
GP-4	18	20	73	0	0.2	7	3	2	2	4	2	2	1	43	<0.5	10	41	12	13.3	4020	2	290	8	0.02	13
GP-5	8	20	78	0.1	0.1	4	2	3	3	3	1	2	1	14	<0.5	7	42	7	13.45	3630	2	270	2	0.02	7
GP-5	36	48	73	0.4	0.4	4	2	2	3	2	1	3	2	14	<0.5	9	53	14	13.55	5820	2	290	4	0.02	8
Slimes																									
GP-2	28	32	62	0	1	4	4	2	1	5	2	3	5	18	<0.5	14	31	10	14.2	7390	3	530	4	0.02	13
GP-3	60	72	62	0	0.7	8	5	3	1	7	2	2	1	15	<0.5	14	33	20	12	10050	4	590	2	0.04	14
GP-5	20	24	70	0.1	0.3	6	4	3	2	6	2	3	1	25	<0.5	9	38	7	13.75	4830	1	460	4	0.02	8
GP-5	48	52	72	0	0.6	4	6	2	1	4	1	2	1	16	<0.5	16	40	19	13.1	12400	3	550	4	0.03	11

5.1.2 PolyMet Tailings

Mineralogy

The mineralogical report on whole tailings characteristics is provided in Appendix B.1. Photomicrographs are provided in Appendix B.2. The dominant mineral in the tailings was plagioclase (50% to 80% by volume) which microprobe work on plagioclase in the NorthMet Deposit is shown to average $An_{59}Ab_{41}$ (labradorite) (RS42, SRK 2007b). Olivine was the next most abundant mineral (10 to 15%) and clinopyroxene (4 to 5%). A component of the tailings was too fine-grained to be distinguished optically. Calcite was not observed, which is consistent with the lack of calcite in the NorthMet Deposit and Duluth Complex in general (PolyMet 2007).

The main visible sulfide was pyrrhotite described as occurring at 0.25% to 0.5%. Chalcopyrite, sphalerite and galena were described as rare and pentlandite and cubanite were not observed.

Solids Chemistry

Selected chemical characteristics of tailings samples being tested in dissolution experiments are shown in Table 5-2. Results are shown for the three ore composites or packets in the order in which they were generated, as described in Section 4.1.2. The solids results illustrate the decrease in sulfur concentrations that occurred for the bulk (whole) tailings after copper sulfate was introduced to activate pyrrhotite. Sulfur concentrations were 0.2% and 0.23% for P2 and P1, respectively processed without copper sulfate, and 0.1 and 0.15% for P1 and P3, respectively processed with copper sulfate. The activator had no perceptible effect on copper and nickel concentrations in the tailings.

Table 5-2: Selected Chemical Characteristics of Tailings Samples

Fraction	Sulfide Activator	Parcel	pH	Total S	Cu	Ni	CO_2
			Unity	%	%	%	%
Whole	None	P2	8.3	0.2	0.053	0.039	0.2
+100	None	P2	9	0.15	0.046	0.028	<0.2
-100+200	None	P2	9.2	0.17	0.03	0.031	<0.2
-200	None	P2	9	0.24	0.03	0.031	0.2
Whole	None	P1	8.3	0.23	0.025	0.033	0.2
Whole	Copper sulfate	P1	8.3	0.1	0.022	0.032	<0.2
+100	Copper sulfate	P1	9.1	0.11	0.03	0.021	<0.2
-100+200	Copper sulfate	P1	9.3	0.1	0.018	0.027	<0.2
-200	Copper sulfate	P1	8.8	0.09	0.011	0.027	0.2
Whole	Copper sulfate	P3	8.4	0.15	0.042	0.037	<0.2
+100	Copper sulfate	P3	9.2	0.11	0.039	0.023	<0.2
-100+200	Copper sulfate	P3	9.3	0.14	0.025	0.029	<0.2
-200	Copper sulfate	P3	9	0.14	0.014	0.032	0.2

The results show no consistent differences between particle sizes. For Parcel 2 processed without using copper sulfate, the finest fraction had higher sulfur than the two coarser fractions and the bulk, but for P1, the fine fraction had the lowest sulfur concentration but the difference between fractions was small. For P3, the differences between fractions were again small. It appears that use of copper sulfate not only lowered overall sulfur content but may also have resulted in more effective removal of sulfur from the finest size fractions.

As shown in Table 5-2, carbonate was reported as undetectable (<0.2%) or at the detection limit (0.2%). These low values confirmed the optical finding that calcite was effectively absent, or possibly present at trace levels. This is consistent with the magmatic origin of the Duluth Complex.

Neutralization potential results are not shown due to the complications of interpreting NP determined on samples containing reactive silicate and low carbonate content in the context of low sulfide content (Paktunc 1999).

5.2 Description of Leachate Chemistry from Dissolution Testwork

5.2.1 PolyMet Tailings

Graphs illustrating results from testwork are provided in Appendix C. Trends for pH, sulfate, alkalinity, nickel, cobalt and copper in humidity cells and MDNR reactors are shown in Figures 5-1 and 5-2, respectively.

All tests were continuing at the time of preparation of this report. The difference in duration of individual tests reflects different start-up dates. Tests on tailings size fractions were started after bulk tailings samples and the PolyMet/LTVSMC interaction test after that.

ASTM Humidity Cells

All tests showed a general decline in leachate pH lasting about 1 year followed by stabilizing pH after about a year of testing for the bulk tailings. Leachate pHs appeared to stabilize above pH 7, but with some variations. The P1 tailings produced using copper sulfate showed the highest pH (near 7.2 to 7.5). This sample had the lowest sulfur concentration of any of the bulk samples (0.1%). P3 showed a decrease in pH to 6.8 before increasing to between 6.9 and 7.4. This sample had a higher sulfur concentration (0.15%). The other two samples produced without using copper sulfate showed generally lower pHs. The lowest pH (6.4) was shown by P2 (tailings prepared using copper sulfate) though pH appeared to recover.

Individual size fractions initially produced leachates with a narrow range in pHs (7.6 to 8.2). After about 30 weeks, the range in pHs increased as the coarser fractions showed declining pHs to below pH 7 while the -270 mesh tailings showed a lesser decline to pHs between 7.2 and 8. More recent leachate pHs for the coarse tailings samples were stabilizing.

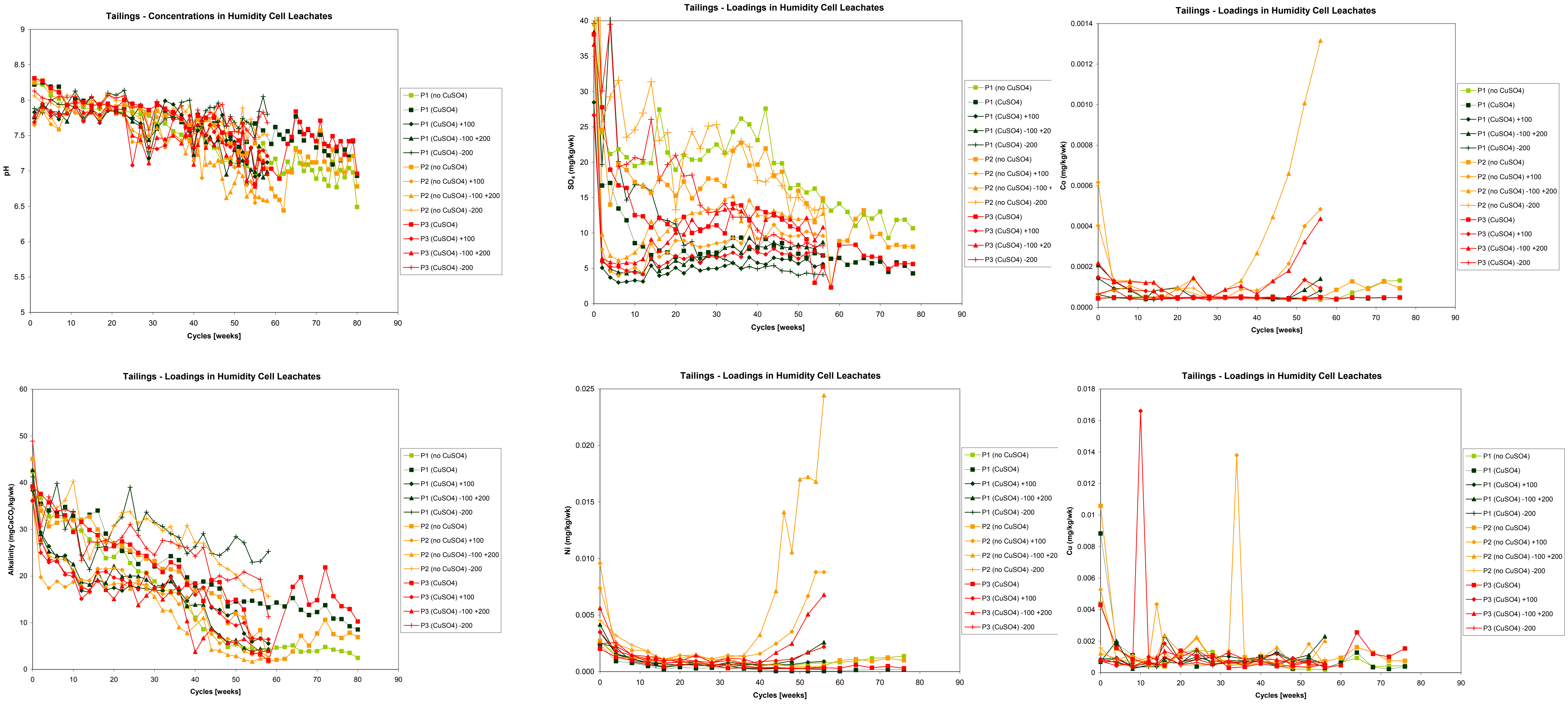


Figure 5-1: Trends in pH, Sulfate, Alkalinity, Nickel, Cobalt and Copper in Tailings Humidity Cells

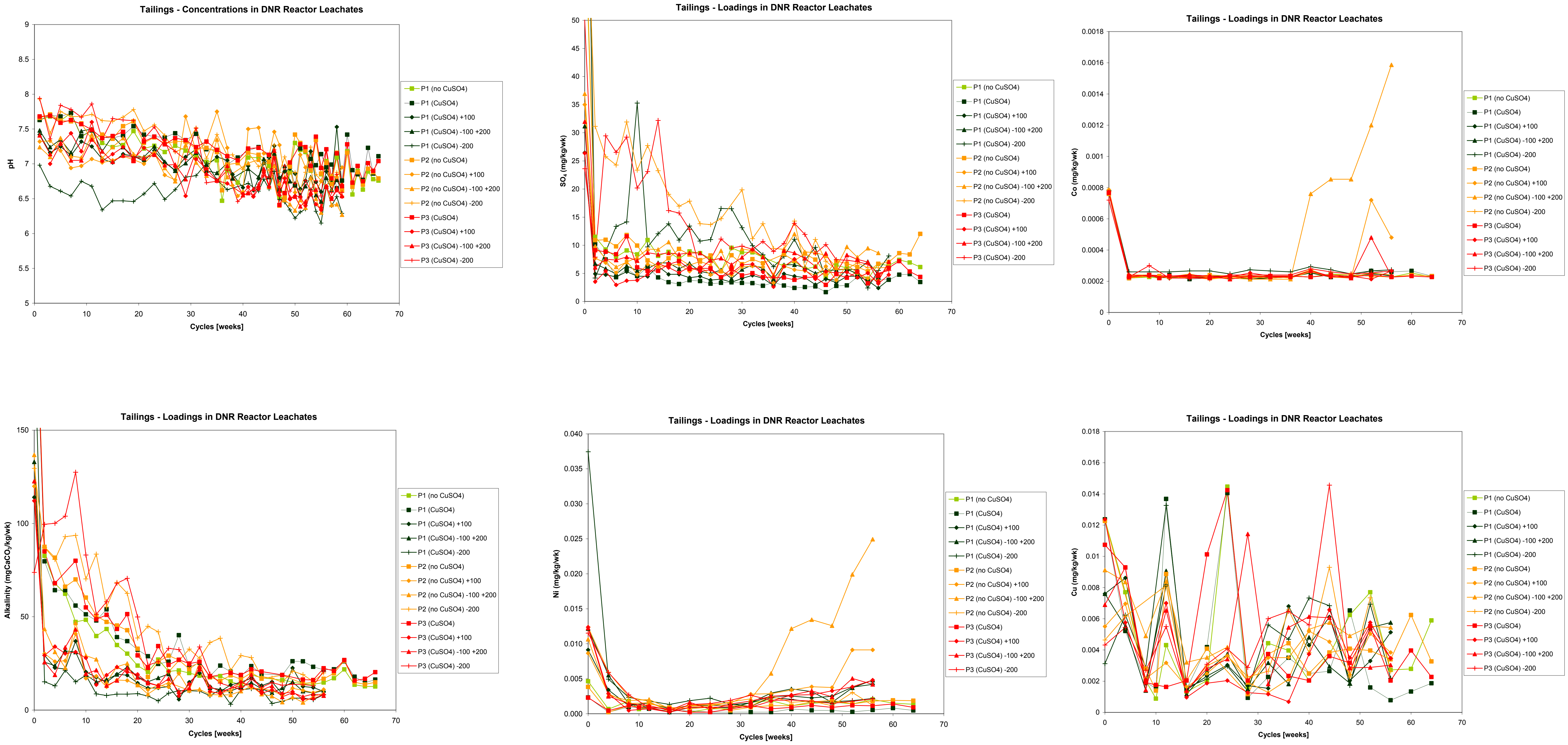


Figure 5-2: Trends in pH, Sulfate, Alkalinity, Nickel, Cobalt and Copper in MDNR Reactor Tests

Major ions in leachates were sulfate, bicarbonate and calcium. Sulfate concentrations decreased very sharply at first, then reached a subdued peak and then in the case of whole tailings showed a decreasing trend. Alkalinity in contrast showed a decreasing trend, with greatest alkalinity leaching from the -200 mesh fractions, followed by the bulk fractions. Alkalinity leaching from all tailings samples appeared to stabilize after about a year. Calcium leaching followed trends close to sulfate (except that the initial decrease was absent). Calcium leaching appears to stabilize after about a year, whereas magnesium, sodium and potassium leaching followed the decreasing alkalinity trend stabilizing after about a year.

Leaching of copper generally occurred at concentrations of less than 5 µg/L. Isolated spikes were observed reflecting occasional detections by ICP-ES. Because the trends were not confirmed by subsequent low level ICP-MS analyses, the results are due to analytical uncertainty. Nickel leaching initially occurred at low levels mostly below 10 µg/L. Around week 40, nickel concentrations began increasing for all the coarser tailings samples concurrent with declining pH. Similar affects were apparent for cobalt but at lower concentrations.

Whole tailings samples prepared without using copper sulfate are showing slightly increasing nickel and cobalt release trends. Lowest nickel and cobalt leaching is being shown by the P1 and P3 whole tailings prepared with the use of copper sulfate and all three -200 mesh samples.

Manganese leaching showed the same trends as nickel and cobalt.

Low level mercury analyses were conducted on 13 leachates collected in June 2006. Results are provided in Appendix C.4. A statistical summary of the data is shown in Table 5-3. The reporting limit for the analyses was 2 ng/L. At 3.1 ng/L, the median was slightly above the reporting limit. The travel blank contained 2.4 ng/L mercury. The results indicated that mercury may have leached from the samples or have been contributed by the laboratory atmosphere. The latter might occur because the samples are exposed to the atmosphere during testing although the effect cannot be confirmed.

Table 5-3: Summary of Low Level Mercury Analyses for ASTM Humidity Cell Leachates (ng/L)

Statistic	Result
n	13
Minimum	Not detected
P_5	2.5
Mean	3.2
Median	3.1
P_{95}	4.0
Maximum	4.2

MDNR Reactors

Leachates from MDNR reactors showed a similar pH trend to the ASTM tests except that pHs were lower and mostly between 6.2 and 7.5 later in the test period (Figure 5-2). Lowest pH (6.3) was indicated by the the P1 -200 mesh sample (prepared using copper sulfate).

Major ions in leachates were bicarbonate, sulfate and calcium. Alkalinity decreased at first though after a year, alkalinity leaching stabilized along with sulfate and other major ions (calcium, magnesium, sodium and potassium). Silica leaching stabilized early in testing. The whole tailings and -200 mesh fractions initially leached higher levels of all ions though the gap between whole tailings and the -200 mesh fraction and the coarser size fraction narrowed as the test proceeded. The exception was the P1 -200 mesh sample which initially consistently lower leaching of major ions compared to the other -200 mesh samples.

Copper leaching was low and erratic with no evidence of trends. Coarse fraction P2 samples (-100+200 and +100 mesh) both showed increasing nickel, cobalt and manganese leaching which matched the same trend shown in the humidity cell. There was also evidence of low level increases in nickel leaching for other coarse size fraction samples though not for the whole tailings.

5.2.2 LTVSMC Tailings

Samples of coarse and fine LTVSMC tailings were leached in a configuration that allowed changes in concentrations along the flow path to be evaluated. Charts of concentrations are shown in Appendix C.3.

Leachates from both samples showed an initial slight increase in pH which then stabilized near 8. There was no indication of pH changes along the flow path. Oxidation-reduction potential readings gradually increased for both samples and showed that reducing conditions had not developed in the columns. Leachate chemistry was initially dominated by sodium and sulfate but then shifted to bicarbonate, calcium and magnesium. Sulfate concentrations were lower than alkalinity but sulfate was present in the tens of milligrams per liter.

Concentrations of major parameters increased along the flow path. Lowest concentrations were seen in the first port and highest in the last of the three ports. Many parameters showed a flushing effect. Highest concentrations were seen early in the test but these slowly dissipated as the test proceeded. This effect was shown for sulfate and fluoride. Despite the textural differences, results for the samples were very similar.

Leaching of copper occurred at low concentrations for both samples and there was no apparent indication of increasing concentrations along the flow path or of a flushing effect. Nickel concentrations were also low but it appeared that concentrations increased along the flow path and there was some initial flushing. The fine tailings sample showed decreasing nickel concentrations and a lack of flow path accumulation toward the latter stages of the test, whereas the coarse sample showed nickel concentrations increasing between port 1 and 2 but not between port 2 and 3. The effect for the coarse tailings sample diminished as the test progressed.

Manganese leaching showed unusual trends. For the fine tailings sample, concentrations initially increased and showed accumulation along the flow path. At the peak, higher concentrations (0.1 mg/L) were apparent in sampling port 1, and then concentrations decreased very rapidly to below 0.01 mg/L. Ports 1 and 2 then showed stable manganese concentrations near 0.01 mg/L. Port 3 showed further decrease in manganese to below 0.001 mg/L. The more recent samples showed that manganese decreased along the flow path with the greatest decrease at the base of the column. These changes correlated with slowly increasing ORP from 88 mV to over 350 mV.

The coarse sample showed relatively stable manganese concentrations for about 16 weeks then concentrations in Port 3 decreased from 0.04 mg/L to 0.002 mg/L while concentrations in port 1 remained near 0.05 mg/L. Concentrations in port 2 decreased as port 3 concentrations also decreased but to a lesser degree. Like the fine tailings, later results showed decreasing manganese concentrations along the flow path from 0.04 to 0.005 mg/L in the most recent sample set.

5.2.3 PolyMet and LTVSMC Tailings Interaction

PolyMet P1 Tailings

The P1 NorthMet leachates were characterized by pH above 7 and relatively stable leachate chemistry including alkalinity 33 mg $CaCO_3$/L, sulfate between 16 and 20 mg/L and calcium 14 to 15 mg/L. Copper and nickel leaching were below 0.005 mg/L. Neither parameter showed indication of increasing trends.

Concentrations of all major and many trace ions increased as the leachate from the NorthMet tailings entered the LTVSMC tailings and concentrations increased along the flow path through the LTVSMC tailings. Of the trace elements, only nickel leached from the NorthMet tailings at greater concentrations than the LTVSMC tailings (Figure 5-3). However, nickel concentrations variably decreased as the NorthMet tailings leachates entered the LTVSMC tailings. For the fine taconite tailings composite, nickel concentrations decreased from 0.003 mg/L in the NorthMet tailings leachate at week 48 to 0.0003 mg/L in the first port in the taconite tailings indicating a concentration reduction of 90%. In the coarse taconite tailings composite test the effect was initially apparent but became weak toward the later stages of the test

Cobalt did not show the same effect as nickel. It was generally not detected in the PolyMet tailings leachates. In the early stages, cobalt flushed from the LTVSMC tailings but then diminished.

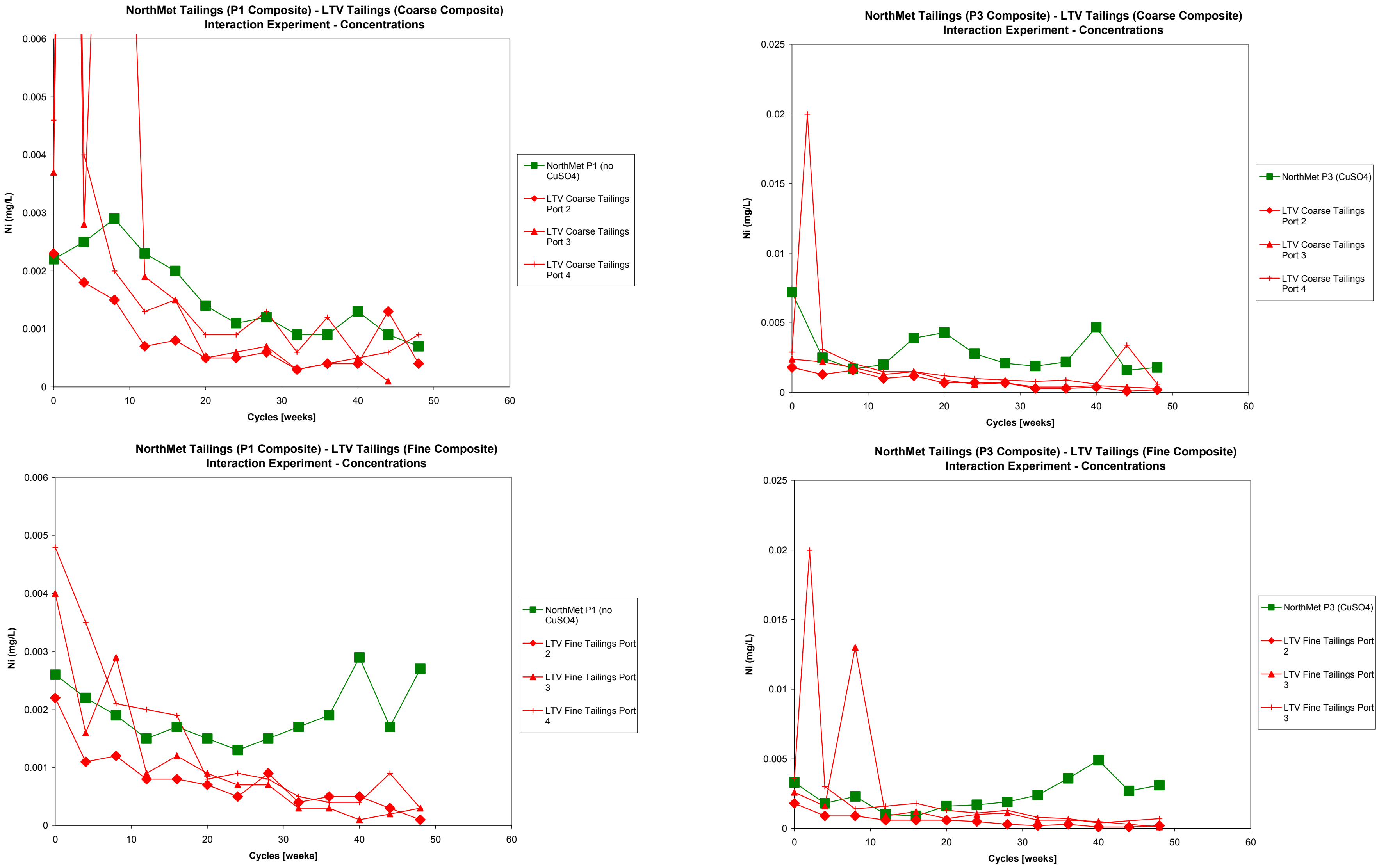


Figure 5-3: Nickel Leaching Trends for PolyMet and LTVSMC Tailings Interaction Experiment

Manganese leaching from Port 4 of the LTVSMC tailings followed similar trends to the control column. Initially, this showed that manganese increased as the PolyMet tailings water contacted the LTVSMC tailings. As the test progressed, manganese leaching from the PolyMet tailings stabilized and in the case of the fine LTVSMC tailings exceeded manganese leaching from the LTVSMC tailings. This implied that manganese leached from the PolyMet tailings was removed by contact with the PolyMet tailings.

PolyMet P3 Tailings

The P3 NorthMet leachates had similar major ion characteristics except that leachates had slightly lower alkalinity, sulfate and calcium concentrations. Copper leaching was comparable to P1 but nickel concentrations were slightly higher reaching a maximum of 0.005 mg/L.

Like the P1 columns, the LTVSMC tailings added load of major ions and many trace elements to the load released from the P3 tailings samples. Nickel concentrations were greater in the P3 leachate and was removed as the leachate contacted the LTVSMC taconite tailings. In the fine taconite tailings composition, nickel concentrations in the first port were 0.0007 mg/L in the latest leachate compared to 0.0031 mg/L leaving the P3 tailings representing a removal factor of 92%. In the coarse tailings, the inflow from the NorthMet tailings was 0.0018 mg/L compared to 0.0006 mg/L in the first taconite port, representing 33% removal.

Low level mercury analyses were conducted on 22 leachates collected in June 2006. Results are provided in Appendix C.4 and a statistical summary of the data is shown in Table 5-4. The reporting limit for the analyses was 2 ng/L. At 3.2 ng/L, the median was slightly above the reporting limit. The travel blank contained 2.4 ng/L mercury indicating minor contribution of mercury from the tailings.

There were no clear increasing or decreasing mercury concentration trends along the flow path through the LTVSMC tailings.

Table 5-4: Summary of Low Level Mercury Analyses for LTVSMC Contact Experiment Leachates (ng/L)

Statistic	Result
n	22
Minimum	2.3
P_5	2.6
Mean	3.2
Median	3.2
P_{95}	3.7
Maximum	5.4

6 Interpretation of Dissolution Testwork

6.1 General Interpretation of Leachate Chemistry

The primary requirement for interpretation of the tailings testwork was a long term prediction of the performance of the tailings solids in terms of potential for ARD and metal leaching. A similar requirement exists for the waste rock for which a much larger database exists. Review of dissolution testwork for waste rock in RS42 (SRK 2007b) indicated that a conceptual dissolution model would need to account for the observed leachate chemistry features shown in Table 6-1. Because kinetic tests on Babbitt Deposit tailings have operated for a maximum of 4 years compared to the 18 years of data for waste rock, and the sulfur content of tailings tested has been less than 0.4%, many of the features observed in the waste rock data have not been observed for tailings. Table 6-1 indicates which observations have been documented for tailings. These include:

- Absence of acidic conditions in any NorthMet or Babbitt Deposit tailings for samples containing less than 0.41% sulfur.
- Generally lower leachate pHs for MDNR reactor tests compared to ASTM humidity cells on the same material when pHs are above about 5.5.
- Increasing nickel and cobalt concentrations as pH decreases below 7 but not necessarily in the presence of increasing sulfate release.
- Decrease in nickel and cobalt release even as pH remains below 7 and continues to decrease.

Based on review of the waste rock data described in RS42 (SRK 2007b), the interpretations shown in Table 6-1 were developed.

Table 6-1: Interpretation of Dissolution Test Observations – Waste Rock and Tailings

OBSERVATION	Observed for Tailings	INTERPRETATION
General		
The variable long term delay in development of acidic conditions in the absence of carbonate mineral buffering capacity.		Silicate minerals provide buffering capacity through carbonic acid weathering and direct reaction of sulfuric acid with silicate minerals.
The absence of acidic conditions for samples containing sulfur concentrations less than 0.41%.	X	Bicarbonate alkalinity produced by carbonic acid weathering of silicates permanently offsets acidity from sulfide oxidation. Sulfide oxidation is strongly correlated with sulfur content.
Leachate pH Trends		
Initially strongly basic alkaline leachates (pH>8) followed by a steep decline in pH to below 8 within a few months of initiation of kinetic tests.		Reaction of fresh silicate mineral surfaces with water (“abrasion pH”).
The lack of long term pH decrease for samples that have not generated acidic leachate after 18 years of testing		Steady generation of bicarbonate alkalinity by weathering of silicates.
The generally slow decline in leachate pH in kinetic tests that eventually produce acidic leachate. The initial decline is not necessarily accompanied by increasing sulfate release.		Bicarbonate from silicate weathering is less than acidity from sulfide oxidation and excess acid must react directly with silicate minerals. Blinding of silicate minerals limits this process.
At times stepwise sharp decreases in pH under acidic conditions.		Consumption of weathering mineral buffers leachate acidity. When exhausted, the pH drops sharply until the next buffer is reached.
Steady (at times with steps) recovery of leachate pH following a short term pH minimum.	X	As sulfide oxidation decelerates due to sulfide mineral depletion, silicate minerals become more effective again and pH recovers.
Difference between test work procedures		
Generally lower leachate pHs for MDNR reactor tests compared to ASTM humidity cells on the same material when pHs are above about 5.5.	X	Higher liquid to solid ratios result in greater effect of deionized water when reacting with silicate minerals.
Increase in sulfate in some MDNR reactor tests when pH decreases early in test		Lower pH enhances bacterial activity and accelerates oxidation.
Generally lower leachate pHs for ASTM humidity cells compared to MDNR reactor tests on the same material when pHs are below 5.5.		Higher liquid to solid ratios dilute acidity produced by sulfide oxidation.
Metal Leaching Trends		
Increasing nickel and cobalt concentrations as pH decreases below 7 but not necessarily in the presence of increasing sulfate release.	X	Dissolution of secondary minerals formed above pH 7 as pH decreases.
Decrease in nickel and cobalt release even as pH remains below 7 and continues to decrease.	X	Depletion of secondary minerals formed above pH 7.
Coincident sulfate and nickel, cobalt and copper concentration peaks as pH drops below 5.		Metals released by oxidation of sulfides remain in solution due to lower pH.
Long term declining metal release as pH recovers.		Depletion of sulfide minerals.

6.2 Comparison between Different Test Methods

As described in Section 4.3.3, two different dissolution type tests were performed on tailings samples. The ASTM humidity cell was performed to ensure consistency with a standard method commonly in use. All samples were also tested using the MDNR's reactor test design because this procedure has been used in the past by the MDNR on both rock and tailing samples. Critical differences between the procedures include:

- The MDNR reactor contains a much smaller sample (75 g) compared to the ASTM humidity cell (1000 g).
- In order to obtain sufficient water for analysis, the MDNR reactor results in a five times higher water application rate of 2.7 mL/g compared to the ASTM reactor (0.5 mL/g).
- The sample in the ASTM cell is stirred during flushing whereas the sample in the MDNR reactor is leached without stirring.
- Water is held in contact with the sample for 1 hour in the ASTM humidity cell before draining. For the MDNR reactor, the water is allowed to drain immediately.

The difference in water application rates has an important effect on overall leachate chemistry. As observed in waste rock tests (Table 6-1), the MDNR reactors generally resulted in lower leachate pHs. Because carbonate minerals are typically absent or rare in Duluth Complex Rocks, leachate pH is controlled by weathering of silicates and alkalinity generation is relatively low and susceptible to the effects of dilution produced by using leaching water with a pH of about 5.5 due to dissolved carbon dioxide. Table 6-2 shows a sample calculation performed using Geochemist's Workbench in which the pH resulting from different water application rates was calculated assuming a constant silicate weathering rate. The difference between the application rate for the MDNR reactor and ASTM humidity cell is 0.7 pH units. This difference is a reasonable explanation for the difference observed in testwork. While this difference is not substantial it can have a significant effect on nickel leaching because nickel and cobalt solubility appears to increase as pH decreases below 7.

Table 6-2: Calculated Effect on pH of Leachate Ratio Using a Constant Silicate Weathering Rate as the Source of Alkalinity

Test Procedure	Water Application Rate mL/g/week	Equivalent Water Application Rate mm/year	Leachate pH
MDNR Reactor	2.7	2700	6.65
ASTM Humidity Cell	0.5	750	7.37

Figure 6-1 compares average sulfate release rates for the ASTM humidity cells and MDNR reactors for each fraction. The comparison for bulk tailings shows that oxidation rates are strongly correlated with sulfur concentration but that the correlation is different. The MDNR reactors showed consistently lower oxidation rates at a given sulfur concentration. Regression relationships for both test types pass close to the origin indicating that all sulfur is theoretically oxidizable. The coarser fractions show qualitatively that the humidity cells oxidized at a higher rate but the difference was less obvious. For the -200 mesh fractions, the difference between methods is not readily apparent with the exception of the highest sulfur sample for which the ASTM test showed a higher average oxidation rate than the MDNR Reactor.

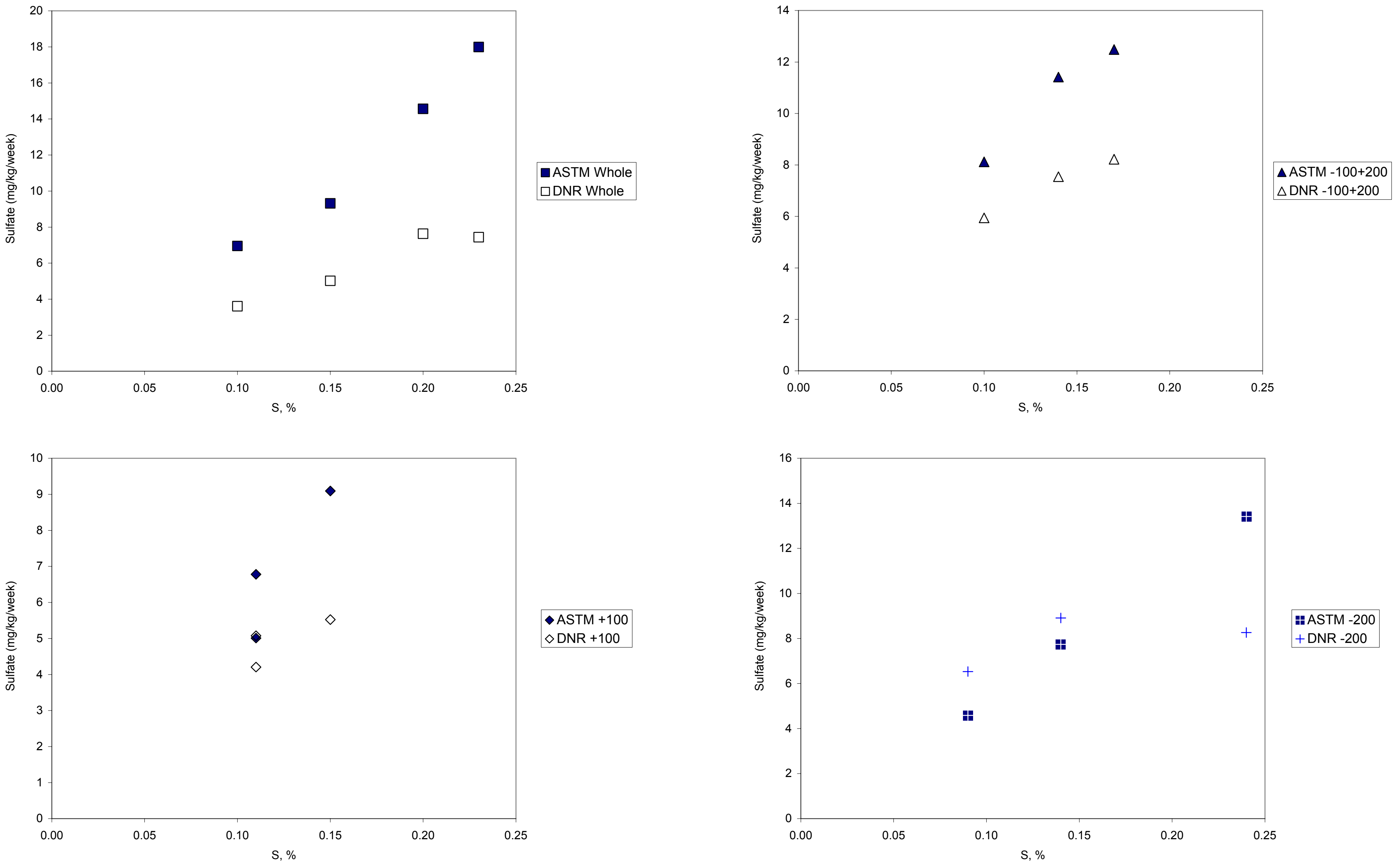
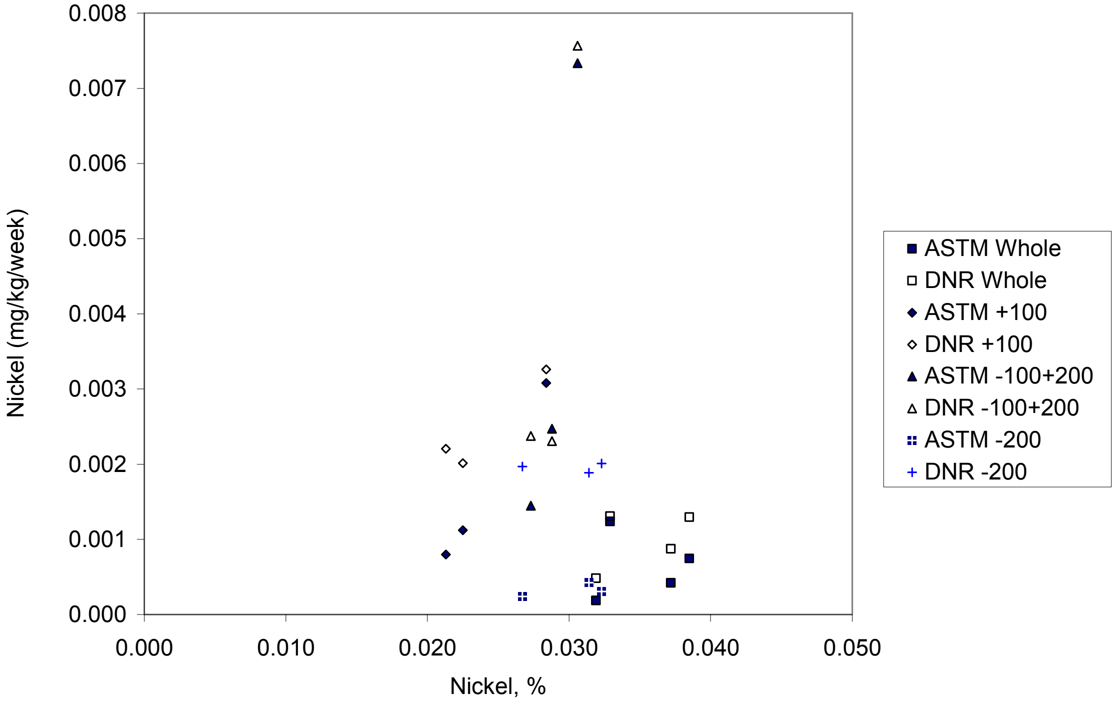


Figure 6-1: Comparison of Average Sulfate Rates as a Function of Sulfur Content for MDNR Reactors and ASTM Humidity cells for Each Size Fraction.



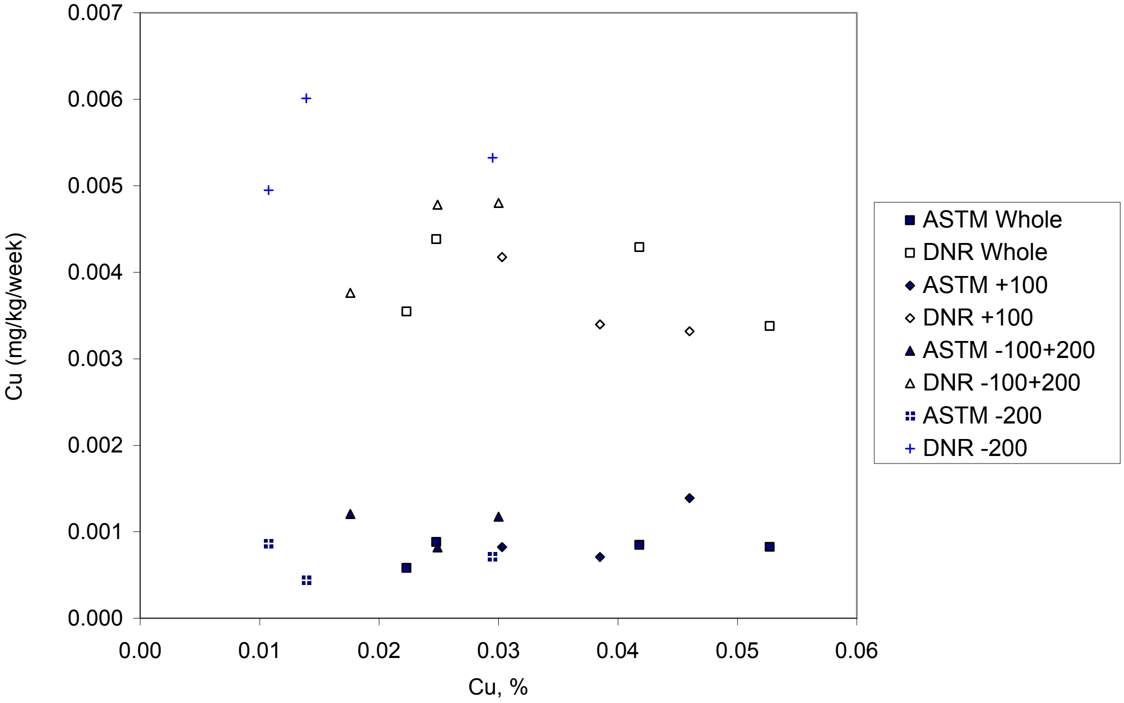


Figure 6-2: Comparison of Average Copper and Nickel Rates as a Function of Copper and Nickel Content for MDNR Reactors and ASTM Humidity cells for Each Size Fraction.

Figure 6-2 compares average copper and nickel release rates with copper and nickel content of the tailings. The average rates for nickel are affected by the increases in leaching that occurred as pH dropped below 7. Copper and to a lesser degree nickel leaching were greater for the MDNR reactors when compared to the ASTM humidity cells.

The difference in sulfate release indicates that some factor is causing oxidation to be enhanced in the humidity cells or that the leaching of sulfate is consistently more efficient for the humidity cells. The main differences that could affect oxidation and leaching is the act of stirring the humidity cell when the deionized water is first applied and the retention of leachate in the cell. Stirring and fluid retention are both expected to lead to more efficient recovery of oxidation products in the humidity cell.

The difference in metal release rates is probably due to the effect of the lower pHs in the MDNR reactors. Actual concentrations are low but the subtle difference in pH appears to have been sufficient to enhance the solubility of copper and nickel.

6.3 Trend Evaluation

6.3.1 ARD Potential

The geochemical processes operating in the tailings are expected to be similar to waste rock because the major mineralogy of the samples is the same as the waste rock. As presented in RS42 (SRK 2007b), the explanation for the lack of acidic conditions in long term (18 year) testwork on rock samples containing less than 0.41% is hypothesized to be due to long term generation of alkalinity by reaction of carbonic acid with silicate minerals (i.e. the conventional process of weathering of silicates as occurs during soil formation, e.g. Drever 1982). In this model, the entire mass of silicate minerals contributes to generation of alkalinity by weathering reactions on plagioclase such as:

$$CaAl_2Si_2O_8 + H_2O + 2H_2CO_3^o \rightarrow Ca^{2+} + Al_2Si_2O_5(OH)_4 + 2HCO_3^-$$

This reaction occurs regardless of whether sulfide minerals are present and effectively surrounds all tailings particles with bicarbonate alkalinity.

For waste rock, this process could be quantified by measuring alkalinity generation from rock containing very low concentrations of sulfide minerals. This rate was then compared to the balancing rate of acid generation.

The critical acid generation rate could be correlated to critical sulfur concentrations (SRK 2007) because acid generation rates have been shown to be well-correlated with sulfur content of the rock (RS42 SRK 2007b, Lapakko and Antonson 2006).

This particular approach could not be applied to tailings because weathering rates for silicate minerals in tailings could not be measured directly. All tailings samples contain some sulfide minerals albeit at low levels and the observed leachate chemistry is a result of oxidation of sulfides and reaction of the resulting acidity with dissolved alkalinity from silicate mineral weathering and direct reaction with silicate minerals. The alkalinity in leachates from the tests is therefore the net alkalinity remaining after reaction with acidity from sulfide minerals. The presence of alkalinity and pHs above 5.5 in both PolyMet's tests and the longer term MNDR tests on Babbitt Deposit tailings demonstrates that weathering of reactive silicates does occur according to the types of reactions shown above.

A different method was developed to understand the relationship between acid generation from sulfide oxidation, reaction of acidity with silicate minerals and alkalinity provided by weathering of silicate minerals. The following calculation steps were followed:

1. Latest weekly leachate analysis results for each sample were selected. The ASTM humidity cell tests were used because the procedure is believed to provide better recovery of weathering and oxidation products than the MDNR Reactors.

2. The observed leachate chemistry was used to estimate the amount of anorthite (from observed calcium), albite (from observed sodium), forsterite (from observed magnesium), fayalite (from the average composition of olivine, $Fo_{57}Fa_{43}$, indicated by microprobe work presented in RS42 (SRK 2007b) and pyrrhotite (from sulfate) dissolved in the leach cycle. This assumes that these parameters are not retained in any weathering products.

3. The calculated mineral quantities were used as inputs into Geochemist's Workbench to evaluate simulation of actual leachate chemistry. The minerals were assumed to be exposed to the atmosphere allowing excess oxygen and carbon dioxide to react with the minerals. Ferrihydrite and kaolinite were allowed to precipitate.

4. Geochemist's Workbench was found to over-predict the observed alkalinity concentration and the pH of the leachate compared to observed values in the leachate. Therefore, the quantities of reacting silicates were reduced to provide a closer fit to observed alkalinity and pH. The reduction varied from 5 to 45%.

5. The quantity of oxidizing pyrrhotite was then varied from below to above the observed sulfate release and the final pH was calculated using Geochemist's Workbench. The calculation is comparable to a titration in which acid (from pyrrhotite oxidation) is titrated into a source of alkalinity (from silicate weathering).

6. The oxidation rates used in the calculation were then converted to sulfur content using the relationship observed between oxidation rates and sulfide contents (Figure 6-1). Because the calculations were performed on oxidation rates observed after more than a year of testing, the sulfate rate was used to back-calculate the starting sulfur concentration in the sample.

7. The calculated residual pHs were then used to estimate the sulfur content at which the acidity generated would be sufficient to depress pH below that of carbonic acid (approximately 5.5).

Figure 6-3 shows "titration" curves generated for each sample. For each curve, the point used as the basis for development of the curve is shown. The form of the curve shows the transition from excess bicarbonate alkalinity resulting in pHs above 7, to excess acidity in which the pH is near 4 due to buffering by precipitation of alumino-silicates. Each curve represents a unique calculation for the particular sample.

For all particle sizes, the curves shift to the right as the sulfur content of the tailings sample under test increases. If neutralization were occurring only by reaction with dissolved alkalinity, it would be expected that the curves would be very similar or show no relationship to sulfur content. The position of the curves shows that more alkalinity is available at higher sulfur concentrations. This reflects direct reaction of acidity from pyrrhotite oxidation with silicate minerals by reactions of the type:

$$CaAl_2Si_2O_8 + H_2O + H_2SO_4^o \rightarrow Ca^{2+} + Al_2Si_2O_5(OH)_4 + SO_4^{2-}$$

These reactions occur most effectively at lower pHs and will increase in significance as sulfur content increases. This finding indicates that it is not appropriate to estimate critical sulfur contents at which acidity might be produced for each type of tailings based on individual samples, but must also consider the effect of acid consumption by direct reaction with the minerals in addition to dissolved alkalinity from carbonic acid.

Table 6-3 compares actual sulfur content compared to calculated sulfur content equivalent to pHs of 7 and 5.5. These two pHs were selected to provide an indication of the range of sulfur contents associated with the inflexion point on the curves. The table also shows the ratio of the predicted sulfur content to the initial sulfur content to indicate proximity of the actual value to the predicted value. Figure 6-4 shows actual sulfur content of the samples compared to the ratios.

From these calculations, the tendency for low pH conditions increases in a well-defined fashion as the sulfur content increases. For the bulk and coarser tailings samples, the ratio and initial sulfur content are correlated regardless of sample type, and the ratio is below 1 for samples with greater than or equal to 0.2%. This implies that coarse fraction tailings with more than 0.2% sulfur could theoretically generate acid. The -200 mesh tailings show a different correlation at a higher level indicating that sulfur content would need to be higher than for the bulk and coarse tailings before acidic conditions would be apparent.

The finding that 0.2% is a critical level that defines the potential for ARD in tailings is consistent with the MDNR's findings on waste rock that showed Duluth Complex rock from the Dunka Pit with 0.2% sulfur did not generate acid after 18 years of testing. The conclusion is also consistent with similar findings for waste rock presented in RS42.

Further consideration of the potential for acidic conditions to occur in the tailings in the context of the development of the weathering profile is provided in Section 7.2.4.

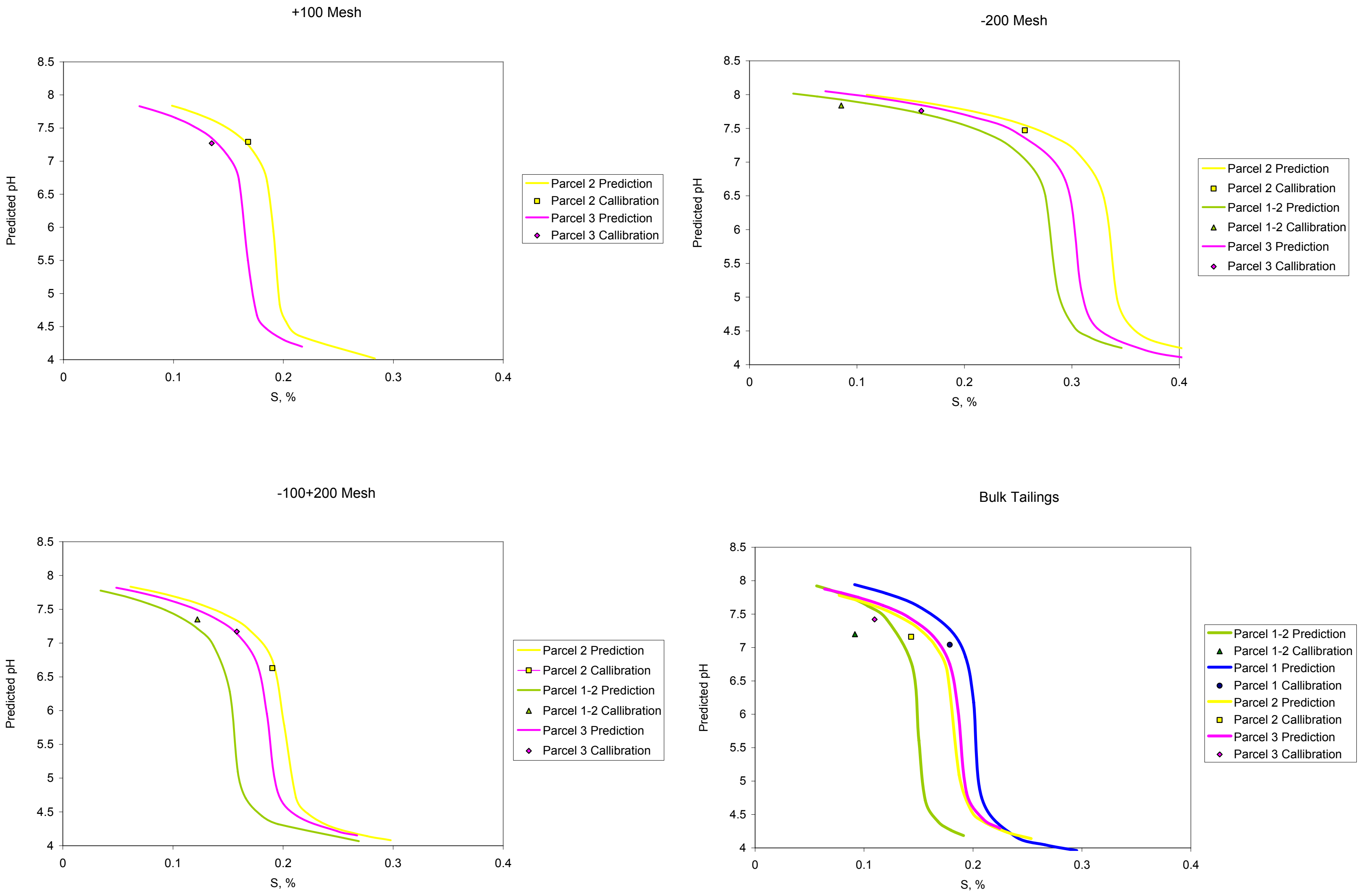


Figure 6-3: Titration Curves for Tailings Samples.

Table 6-3: Comparison of Initial Sulfur Content to Predicted Sulfur Content for pH 7 and 5.5

			S Content Equivalent to Indicated pHs from Titration Curves		Ratio of S Content for Indicated pH to Initial S Content	
Tailings Type	Ore Package	Initial S Content	5.5	7	5.5	7
		%	%	%		
Bulk	P1-2	0.1	0.15	0.14	1.5	1.4
Bulk	P1	0.23	0.21	0.19	0.9	0.8
Bulk	P2	0.2	0.19	0.17	1.0	0.8
Bulk	P3	0.15	0.19	0.18	1.3	1.2
+100	P2	0.15	0.20	0.18	1.3	1.2
+100	P3	0.11	0.17	0.15	1.5	1.4
-100+200	P1-2	0.1	0.16	0.14	1.6	1.4
-100+200	P2	0.17	0.22	0.19	1.3	1.1
-100+200	P3	0.14	0.19	0.18	1.4	1.3
-200	P1-2	0.09	0.29	0.26	3.2	2.9
-200	P2	0.24	0.34	0.33	1.4	1.4
-200	P3	0.14	0.31	0.29	2.2	2.1

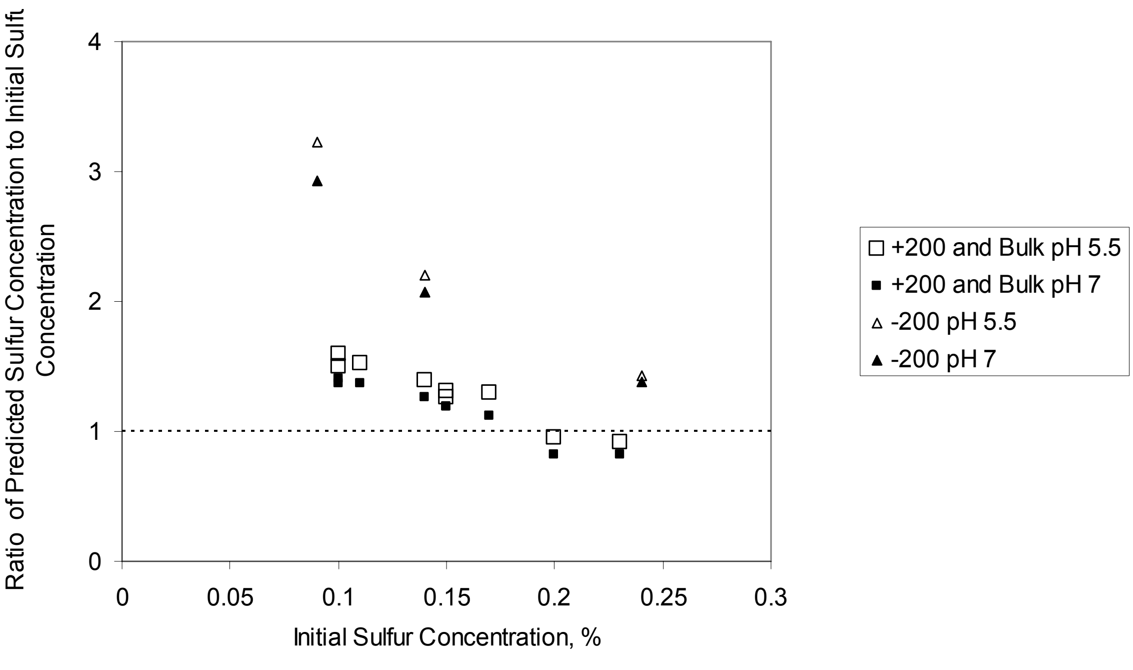


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Figure 6-4: Sulfur Content Compared to Ratio of Predicted Sulfur Content to Predicted Content to Initial Sulfur Content

6.3.2 Metal Leaching Potential

Metal leaching potential is clearly related to the pH of leachates. This is demonstrated by the effect of large pH changes in waste rock tests as discussed in RS42 (SRK 2007b), which results in orders-of-magnitude changes in metal concentrations in leachates as predicted from metal solubility. However, it also appears to be important for smaller shifts in pH as shown by the difference in copper and nickel leaching for the ASTM humidity cells and MDNR reactors, the effect of a decrease in pH below 7 for the MDNR's covered Babbitt tailings reactors (Figure 3-1) and the increase in nickel and cobalt leaching as pH decreases below 7 for NorthMet Project coarse tailings samples (Figure 5-1).

The following sections provide a discussion of metal leaching potential for nickel, copper and other parameters.

Release and Solubility of Nickel

Using microprobe data for the nickel composition of olivine and pyrrhotite for the NorthMet Deposit (described in RS42, SRK 2007b), the degree of nickel attenuation was approximated for the NorthMet tailing samples and the MDNR's Babbitt Deposit tailings using magnesium in leachates to indicate olivine leaching and sulfate to indicate pyrrhotite oxidation. Figure 6-5 shows the attenuation of nickel calculated by:

$$1 - \frac{\mathrm{Ni}_{\mathrm{leachate}}}{\mathrm{Ni}_{\mathrm{Olivine}} + \mathrm{Ni}_{\mathrm{pyrrhoite}}}$$

If nickel concentrations in leachate can be completely accounted for by leaching of nickel from olivine and pyrrhotite the attenuation factor would be zero. Positive values indicate attenuation of nickel, while high negative values indicate that more nickel is in the cell leachates than can be accounted for by dissolution of olivine and oxidation of pyrrhotite. A similar approach was used in RS42 (SRK 2007b) to assess nickel leaching from NorthMet Project waste rock.

Figure 6-5 broadly indicates the same trends shown for waste rock. At the start of the tests, nickel was being stored rather than released. The decrease in pH for coarse tailings and covered MDNR reactors resulted in release of nickel beyond the levels that could be accounted for by oxidation of pyrrhotite and dissolution of olivine. This showed that nickel stored in the early stages of the test (and probably also produced in storage prior to the test) was leached, but this was a short term effect. Once this stored load was removed, nickel leaching decreased and the net accumulation of nickel resumed though to a lesser degree than at higher pHs. This effect was not apparent for the bulk and -200 mesh NorthMet tailings and the Babbitt bulk tailings humidity cells due to the higher leachate pHs.

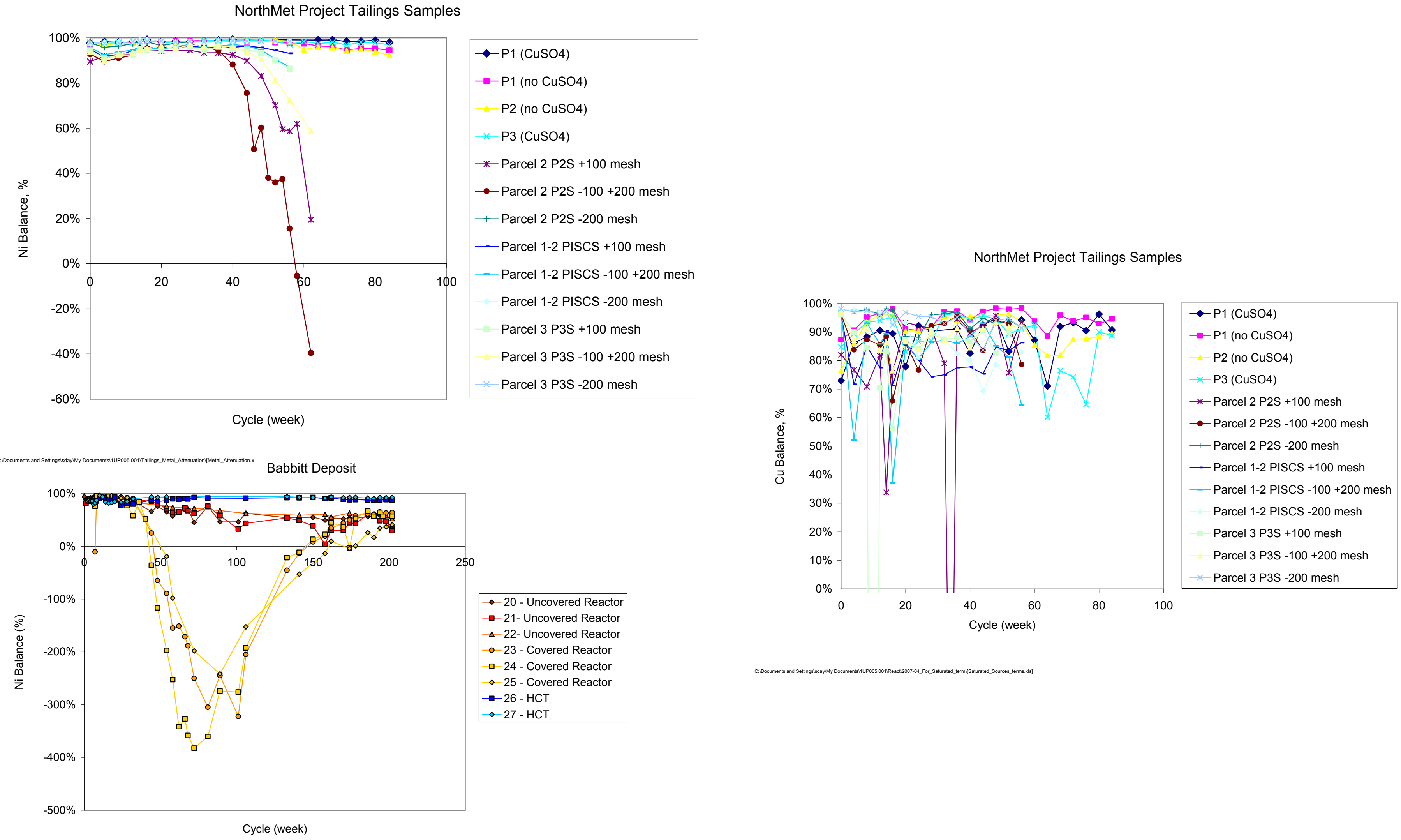

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Figure 6-5: Estimated Nickel Attenuation in NorthMet and MDNR Babbitt Tailings Kinetic Tests and Copper Attenuation in NorthMet Project Humidity Cells.

The form of stored nickel was evaluated by comparing nickel concentrations for all types of tests with respect to solubility limits calculated using thermodynamic data for two nickel silicates (nepouite and Ni-kerolite) known to form by weathering ultramafic rocks. The data were determined by Golightly (1981) and provided by Schmiermund (2006). The calculations were performed in Geochemist's Workbench and used to calculate nickel concentration as a function of pH for equations:

Nepouite: $3Ni^{2+} + 5H_2O + 2SiO_2 \rightarrow Ni_3Si_2O_5(OH)_4 + 6H^+$

Ni-Kerolite: $3Ni^{2+} + 4H_2O + 4SiO_2 \rightarrow Ni_3Si_4O_{10}(OH)_2 + 6H^+$

Figure 6-6 shows that highest nickel concentrations in ASTM humidity cells leachates exceeded the solubility of Ni-kerolite by about a factor of three when silica is provided by quartz. This corresponds to a silica concentration of about 5 mg/L which is the same level observed in much of the testwork. The outer edge of the highest nickel concentrations parallels the solubilities of the known minerals indicating that the actual nickel phase involved may be similar to these known nickel silicates (because the slope of the Ni(pH) relationship is the same) but that the thermodynamic data may need to be slightly adjusted to reflect actual solubility.

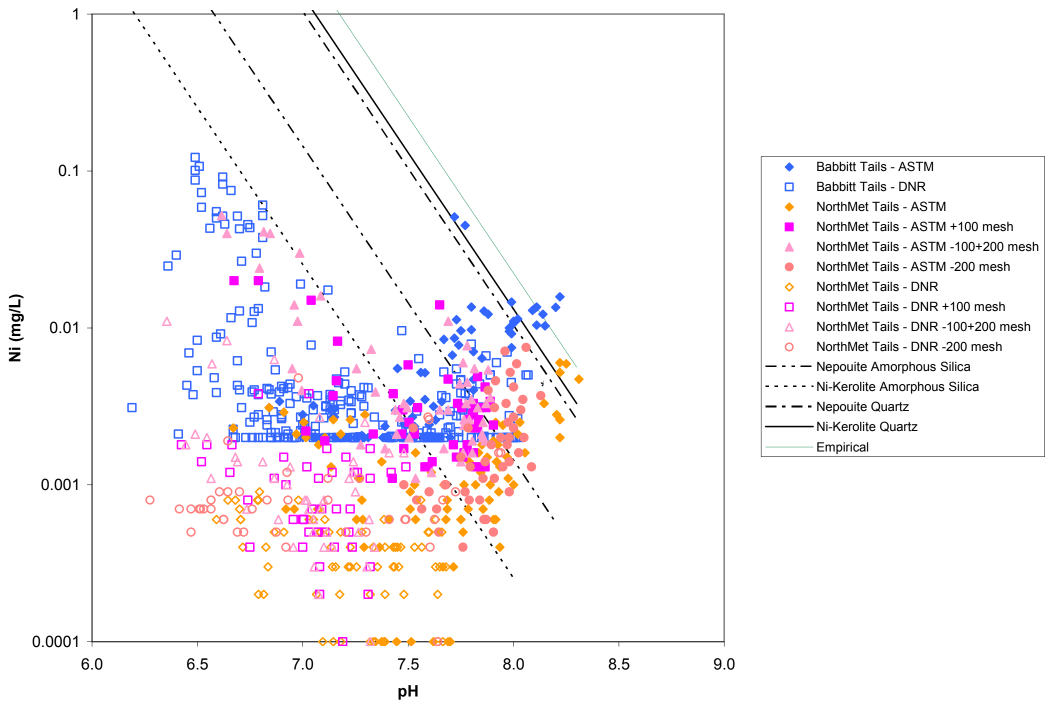

Figure 6-6: Nickel concentrations in kinetic test leachates compared to solubilities of two nickel silicates

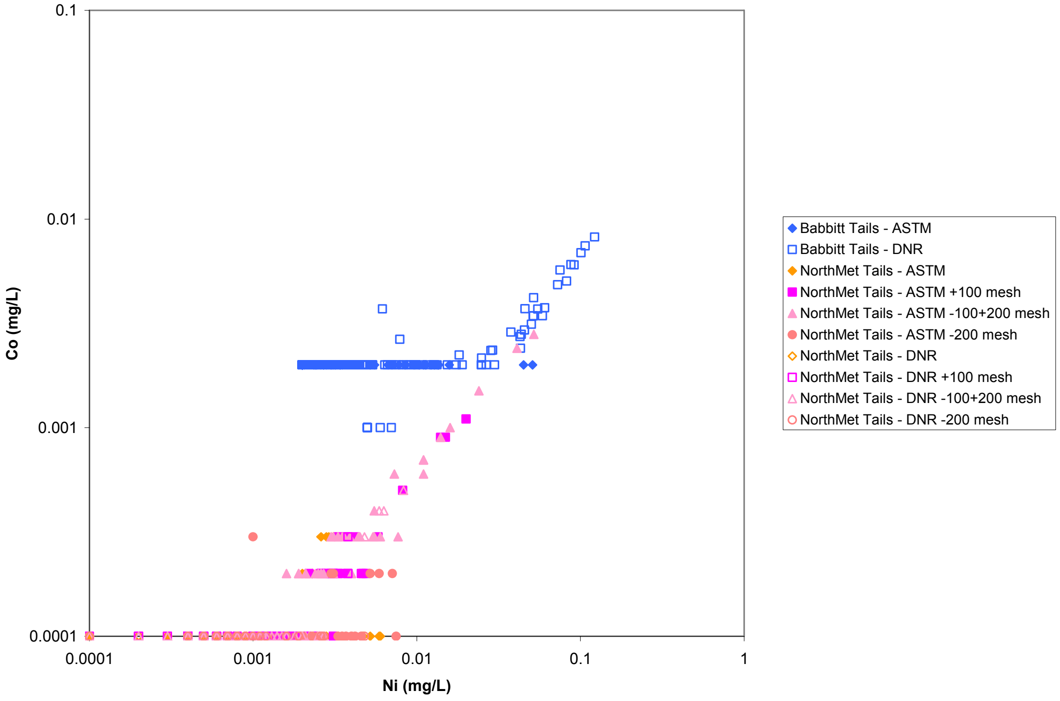

Figure 6-7: Comparison of Nickel and Cobalt Concentrations in Tailings Kinetic Test Leachates

Based on these findings, the increase in nickel release for the NorthMet coarse tailings and the Babbitt covered reactors reflects dissolution of a nickel silicate due to decrease in pH. The peak concentration of 0.12 mg/L is below the solubility of any known nickel minerals including silicates. The rapid but short term release of nickel therefore reflects removal of a finite stored amount of secondary nickel under test conditions.

These results indicate that:

- Exposures of coarser NorthMet tailings can be expected to leach nickel after a delay of several months due to depression of pH below 7.
- Assuming that nickel solubility is controlled by nickel silicates, solubility of nickel below pH 7 will be higher under field conditions than currently demonstrated by testwork. Using Geochemist's Workbench, nickel concentrations could be of the order 2.2 to 2.4 mg/L at pH 6.5, for example, if sufficient leachable secondary minerals are present.

The solubility of cobalt cannot be evaluated using the same methods because it occurs at low concentrations in the minerals and leachates. However, the correlation between nickel and cobalt is very well defined as pH decreases implying that cobalt would show the same behavior as nickel. and allows cobalt concentrations to be predicted from nickel (Figure 6-7). Based on this relationship, cobalt concentrations at pH 6.5 could be about 0.15 mg/L.

Copper Solubility

Neither the MDNR's data for the Babbitt tailings nor the NorthMet Project humidity cells or reactors showed an increase in copper release as pH decreased indicating that the form in which copper is stored in the samples during weathering was not as sensitive to pH as nickel. For the Babbitt tailings the effect may have been obscured by the detection limit of 0.002 mg/L used in the testwork but for the NorthMet Project tailings copper was detected in the leachates. A similar calculation to nickel was performed for NorthMet tailings to assess attenuation. Copper was assumed to originate from olivine and pyrrhotite leaching. Other forms may contribute to copper release (for example, residual chalcopyrite) therefore the calculation tends to underestimate the degree to which copper is attenuated. The calculation showed that copper was attenuated under the weathering conditions in the testwork. It appeared that less than 30% of copper produced by weathering was expressed in the leachates and therefore that at least 70% was stored. As pH decreased, this did not result in the same pattern as observed for nickel. The potential form of stored copper was therefore investigated further.

The solubility of the copper minerals malachite and tenorite which could reasonable be expected to form by weathering of the tailings were evaluated using Geochemist's Workbench. No thermodynamic data were available for copper silicates although by analogy to nickel, any of the numerous known copper silicates might be expected to form.

As shown in Figure 6.8, maximum copper concentrations in the kinetic test database were above the solubility of tenorite but below the solubility of malachite. The two highest copper concentrations in +100 mesh tailings fraction leachates were isolated results that were not part of the trend and are therefore unrelated to dissolution effects. The four highest copper concentrations for bulk tailings in ASTM-style tests were the first flush from the humidity cell. Concentrations dropped rapidly following the first flush indicating that that these results could reflect leaching of pore water from the process rather than oxidation products. Considering these factors, copper concentrations in all other leachates were near or below the solubility of tenorite indicating that this could be the secondary phase controlling copper release.

Based on the solubility of tenorite as a function of pH, the decrease in pH should have resulted in an increase in copper concentrations in kinetic test leachates much like that observed for nickel. However, no increase in copper release was apparent. For the MDNR's experiments, the detection limit may again be a factor but for the NorthMet tailings, copper concentrations were detectable at higher pHs. These findings imply that the secondary form of copper is not tenorite. If copper were co-precipitated with ferric oxides, copper release would not increase until pH dropped low enough to significantly dissolve these minerals. Typical pHs are below 5.

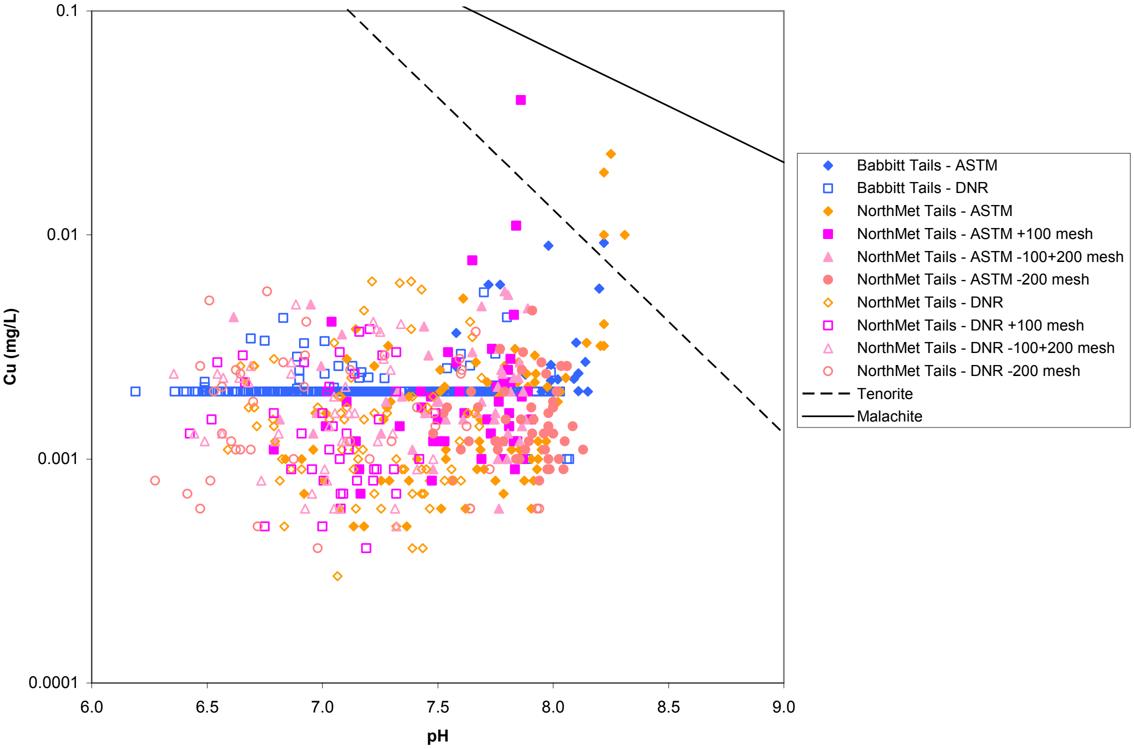

Figure 6-8: Copper concentrations in kinetic test leachates compared to solubilities of tenorite and malachite

Solubility of Major pH-Sensitive Elements

The majority of iron concentrations were below or near the detection limit of 0.01 mg/L with scattered concentrations up to 0.15 mg/L. These concentrations were all above the expected solubility of ferric hydroxide and the concentration expected to result from oxidation of pyrrhotite in the tailings. Iron released from pyrrhotite was therefore precipitated and the resulting sporadic detection of iron was probably due to the formation of iron flocs that passed through the 0.45 µm filter.

Maximum aluminum concentrations for any given pH were negatively correlated with pH but the concentrations were well above the solubility of alumino-silicates or hydroxides that would be expected to form from by weathering of silicates. Aluminum concentrations therefore probably reflect colloids formed by the breakdown of alumino-silicates rather than dissolved aluminum ions.

Solubility of Other Elements

Concentrations of other elements were evaluated with respect to pH but they were too low to be compared with the solubilities of known secondary minerals using the same methods described above for nickel and copper. Instead, the data distributions was reviewed to determine if any relationships existed and how these might relate to the solubilities of major secondary minerals.

The majority of elements showed no relationship to pH. Highest manganese concentrations for NorthMet tailings also showed a negative correlation with pH though at low concentrations. The negative correlation with pH was consistent with formation and dissolution of secondary minerals but concentrations were below their solubility.

In contrast, the highest arsenic, antimony and selenium concentrations at any given pH were positively correlated with pH. Because these elements occur as oxyanions, increasing solubility with higher pHs in natural range is expected. The trend is therefore consistent with this effect. Arsenic and antimony concentrations were well below the solubility of known arsenic and antimony minerals (for example, scorodite and antimony oxide) as is expected because arsenic and antimony content of the tailings is very low (average 2 mg/kg and 0.2 mg/kg, respectively) relative to iron as sulfide (3000 mg/kg). Therefore, the solubility of both elements from solution is expected to be controlled by the low solubility of ferric hydroxides at slightly basic pHs rather than discrete antimony and arsenic minerals.

6.4 Comparison of Results with MDNR Testwork Programs

Results from MDNR's testwork on tailings from the AMAX test shaft and tailings from Cominco's pilot plant processing of the Babbitt Deposit, and PolyMet's pilot plant should be compared cautiously due to potential differences in the ores and generation and management of the pilot tailings products. However, qualitatively, it is worth comparing order-of-magnitude ranges of rates for the various tests to determine if the results are similar though use of low detection limits by PolyMet provided better definition of metal leaching rates. Table 6-4 shows that all test types except the MDNR covered reactors for nickel leaching had comparable ranges. The rates indicated by the field test are probably affected to some degree by formation of secondary salts and are therefore lower than actual generation rates, but the calculated rates are of the same order as the laboratory tests indicating comparable behavior under field and laboratory conditions.

The MDNR covered reactors showed a markedly different nickel leaching trend as well as a higher sulfate rate (Figure 3-1). Both features may be related to the lower pH of leachate in this test which both allowed stored nickel to be released (Figure 6-5) and caused pyrrhotite oxidation to accelerate resulting in depletion of 55% of sulfur compared to 29% and 38% of sulfur in the humidity cells and uncovered reactors on the same tailings samples. The explanation of the different behavior of the same sample tested under the different conditions is believed to be the retention of moisture resulting from lack of evaporation between cycles. This effect is shown in Figure 6-9 by the consistently higher recovery of leachate from covered reactors. The higher recovery indicates retention of leachate which in turn allows residual carbonic acid to accumulate in the reactors between cycles compared to the uncovered reactors that evaporate the residual moisture allowing less retention of carbonic acid.

The overall effect is that lower pH conditions developed in the covered reactors due to the high liquid to solid application rate compared to the uncovered reactors. Because liquid application rate on an area basis (2700 mm/year, Table 6-2) far exceeds precipitation at the tailings pond (711 mm/year) the covered reactors are an artificial condition both in terms of water application and covering to reduce evaporation. Evaporation will conceivably be lower on the tailings during the winter months but under these conditions reaction rates in the tailings will be greatly curtailed by low temperatures and significant portions of the tailings will be frozen which will result in reduced or near zero infiltration.

The MDNR’s testwork performed on whole tailings samples was not directly comparable to the testing being performed on NorthMet Project tailings size fractions. The recent trends in nickel and cobalt release from the -100+200 mesh and +100 mesh tailings samples appear to be similar to the trends observed for the MDNR’s covered reactor test. The effect in the coarser size fractions is probably due to the lower surface area available for silicate weathering. The current lack of a similar effect for the -200 mesh samples is consistent with this conclusion because this fraction will have a much higher effective silicate mineral surface area to contribute alkalinity. The effect for the coarse fractions is therefore due to the physical characteristics of the samples rather than excessive water application in the case of the MDNR’s covered reactors.

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Table 6-4: Comparison of Rate Ranges for Babbitt Deposit and PolyMet Deposit Tailings Samples

	Humidity Cell (mg/kg/week)				MDNR Reactor (mg/kg/week)				MDNR Reactor (Covered) (mg/kg/week)				Average Rates for Field Test (mg/kg/week)			
Test Program	**pH**	**Cu**	**Ni**	**SO_4**	**pH**	**Cu**	**Ni**	**SO_4**	**pH**	**Cu**	**Ni**	**SO_4**	**pH**	**Cu**	**Ni**	**SO_4**
AMAX Babbitt Shaft	-	-	-	-	-	-	-	-	-	-	-	-	6.3 – 8.3	0.00015	0.0005	5.2
Cominco Babbitt	6.8 – 8.2	<0.001 – 0.003	<0.001 – 0.01	4 – 17	6.7 – 7.9	<0.004 – 0.01	<0.004 – 0.02	2 – 42	6.2 - 8.0	<0.004 – 0.01	<0.004 – 0.3	3 – 72	-	-	-	-
NorthMet (Whole Tailings)	6.4 – 8.3	0.0003 to 0.003	0.00004 – 0.001	2 – 28	6.5 – 7.8	0.0008 – 0.01	0.0002 – 0.002	2 – 12	-	-	-	-	-	-	-	-

Notes:

1. Isolated high values not part of a trend were excluded for the MDNR data.

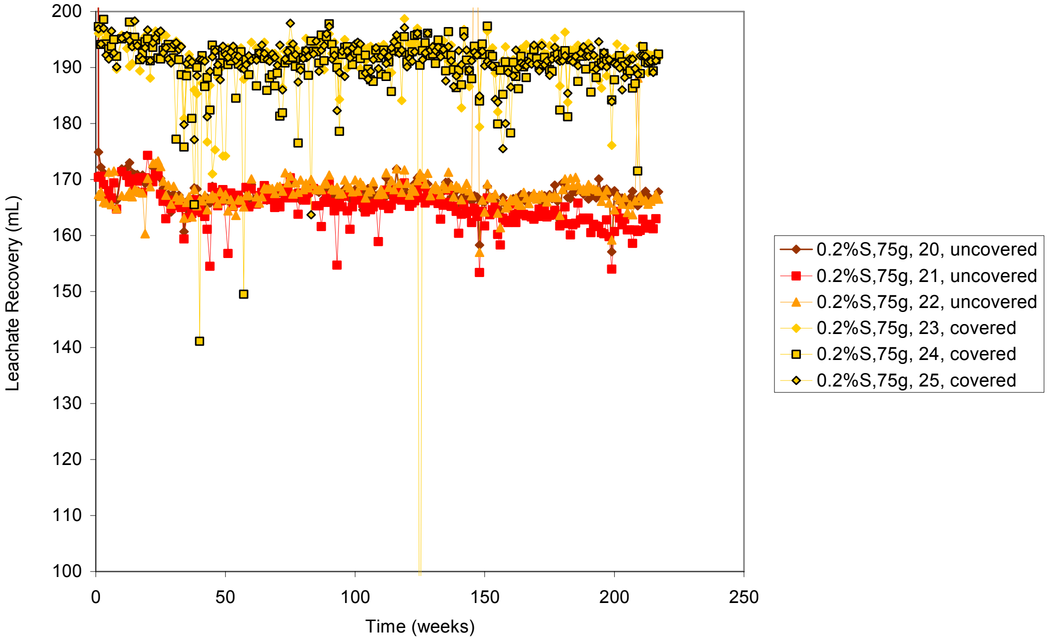

Figure 6-9: Leachate Recovery from MDNR Reactors Containing Babbitt Tailings

6.5 Interaction of PolyMet Tailings Leachate with LTVSMC Tailings

Table 6-5 shows saturation indices for leachates from the control column containing Coarse LTVSMC taconite tailings calculated using Geochemist's Workbench (Bethke 2005). Leachate chemistry for the fine tailings control was similar and therefore shows similar saturation indices. Saturation indices exceeding 0 for dolomite, strontianite, calcite and magnesite indicate that leachate chemistry is controlled by the dissolution of abundant carbonate. Ankerite and siderite would also be expected to be dissolving but iron concentrations were low and the leachates were not chemically reduced indicating that iron was present in ferric form. It is probable that the iron-bearing carbonates are dissolving but the iron is oxidized to ferric and immediately precipitated. The week 1 cycle shows that ferrihydrite ($Fe(OH)_3$) was over-saturated which is consistent with precipitation of this mineral.

Another major component of the taconite tailings is quartz. Silica concentrations are consistent with dissolution of some form of silica. Other minerals that were close to saturation in the early stages were barite and fluorite. Fluoride concentrations in particular probably indicate that a fluoride-bearing mineral is present and dissolving. Berndt et al (1999) suggested that fluoride may be present as fluorite or a sorbed phase. Gypsum is not a known component of the LTVSMC tailings, and sulfate concentrations were well below the saturation level for gypsum. Other gypsum-bearing minerals could be contributing to sulfate concentrations, or the results could reflect flushing of sorbed sulfate as overall sulfate concentrations in the column leachate decreased.

Table 6-5: Saturation Indices for Coarse LTVSMC Tailings (Control Column)

Mineral	Week 1	Week 6	Week 36
Hematite[1]	11.4	-	-
Dolomite	2.5	3.0	3.1
$Fe(OH)_3$[1]	0.8	-	-
Strontianite	0.6	1.0	1.0
Calcite	0.5	0.8	1.1
Magnesite	0.4	0.6	0.4
Quartz	0.3	0.4	0.2
Chalcedony	0.0	0.1	0.0
Barite	-0.1	-	-1.3
Fluorite	-0.3	-1.1	-1.9
Rhodochrosite	-0.4	-0.3	-1.1
Amorphous Silica	-1.0	-0.9	-1.1
Gypsum	-1.2	-2.3	-2.1

Notes:
1. Iron was not detected in these leachates

The main process that occurred as NorthMet tailings water entered the LTVSMC tailings is that concentrations increase as the soluble components of the taconite tailings add to the relatively dilute NorthMet tailings leachate. The only exception to this finding is nickel, which showed decreasing concentrations as the NorthMet tailings leachate enters the LTVSMC tailings. This effect was evaluated by calculating saturation indices for nickel minerals to see if there was evidence that nickel was forming a discrete phase. Results for this calculation of leachates produced at week 20 for the P3 NorthMet tailings entering the coarse taconite tailings are shown in Table 6-6 with particular emphasis on nickel minerals. The thermodynamic database was augmented using data for two additional nickel silicate minerals (nepouite and Ni-kerolite) provided by R. Schmiermund (personal communication).

Leachate leaving the NorthMet P3 tailings was dilute and undersaturated with respect to most of the minerals, which subsequently become saturated in contact with the taconite tailings. The exception is quartz, which was calculated to be saturated in both column leachates. Amorphous silica however was undersaturated for both column leachates. Silica concentrations increased from 10 to 15 mg/L by contact with the taconite tailings.

Nickel concentrations were well under-saturated with respect to all the nickel minerals in the database, which indicates it is very unlikely that these minerals are forming and resulting in the observed decrease in nickel concentration. A more likely explanation is that the dissolution of iron-bearing carbonates and the subsequent formation of ferrihydrite is removing nickel from solution by co-precipitation and adsorption. The elevated pHs of the column leachates provides good conditions for removal of metals by this process. If this is occurring, the LTVSMC tailings have a large capacity to attenuate nickel. Because the first sampling port in the taconite tailings did not show break through in 36 weeks of testing, it is not possible to calculate the attenuation capacity of the taconite tailings. A minimum attenuation capacity of 0.02 mg Ni/kg of taconite tailings was calculated for the duration of the P3 NorthMet tailings to coarse taconite tailings experiment.

Table 6-6: Saturation Indices for NorthMet P3 Tailings Leachate into Coarse LTVSMC Tailings (Final Leachate)

Mineral	P3 Tailings Week 20	Coarse Taconite Tailings Week 20
Dolomite	-1.14	3.30
Calcite	-0.84	1.24
Strontianite	-1.15	1.14
Magnesite	-1.93	0.43
Quartz	0.22	0.39
Rhodochrosite	-1.95	-0.45
Amorphous silica	-1.07	-0.90
Ni-Kerolite	-3.15	-1.29
Ni_2SiO_4	-2.70	-1.74
Nepouite	-3.28	-1.77
NiO	-4.74	-4.35
$Ni(OH)_2(s)$	-5.07	-4.68
$NiCO_3$	-6.36	-5.59

In summary, the contact experiment showed that leachate produced by the LTVSMC taconite tailings is dominated by alkalinity produced by the dissolution of carbonates. The NorthMet tailings had no perceivable effect on the major ion chemistry because the taconite minerals are considerably more soluble than the silicates in the NorthMet tailings. Only nickel leached more readily from the NorthMet tailings but was attenuated by contact with the taconite tailings probably due to sorption effects.

6.6 Conclusions

The following were concluded from testing performed by MDNR on Babbitt tailings and by PolyMet on NorthMet Project tailings:

- NorthMet tailings will consist of crushed Duluth Complex minerals, which are mainly plagioclase and olivine. Pyrrhotite is a minor component, which accounts for the sulfur content of the tailings. Carbonate minerals are virtually undetectable in the tailings, which is consistent with the magmatic origin of the deposit.

- Long term leachate chemistry can be explained by the oxidation of pyrrhotite and weathering of silicate minerals. The former produces sulfuric acid whereas the latter produces secondary silicate minerals and dissolved alkalinity.

- Because the weathering processes produced weak leachates, test protocol has a significant effect on leachate chemistry. The ratio of deionized water to sample solid affects pH because a high ratio introduces a greater amount of carbonic acid during the leach cycle. Lower pHs occur when the liquid to solid ratio is high.

- The effect of lower pHs is to increase the solubility of metals and in particular nickel. The testwork indicates that as pH decreases below 7, nickel stored in weathering products at higher pHs is leached resulting in a spike in nickel release lasting possibly 2 years.

- Based on this finding, metal leaching is best represented by the ASTM humidity cells and has been used as the input to subsequent predictions of operational tailings beach runoff and pore water aqueous chemistry at closure.

- Nickel leaching appears to be explainable by dissolution of nickel silicates.

- The overall finding is that NorthMet tailings generally containing less than 0.2% sulfur and produced using the copper sulfate process to enhance recovery of pyrrhotite will be very unlikely to generate acid. This finding is consistent with the MDNR's waste rock and tailings testing which has not shown generation of acidic leachate for rock or tailings containing less than 0.41% sulfur.

- Coarse tailings (+100, -100+200 mesh) appear to be susceptible to moderate pH decrease below 7 resulting in enhanced leaching of nickel and cobalt.

- The experiment to evaluate the interaction of NorthMet tailings leachate with the LTVSMC tailings showed that the LTVSMC tailings are more soluble and can be expected to produce alkaline leachate due to the presence of carbonates. The NorthMet tailings produced weaker leachates with lower levels of metals with the exception of nickel. Nickel leached from the NorthMet tailings was attenuated by contact with the taconite tailings.

6.7 Recommendations for Future Testing

Prediction of tailings water chemistry provided in Section 7 relies on scale-up of laboratory testwork on pilot plant tailings samples to tailings produced at full-scale weathering under field conditions.

Once the plant is in full production, a program of characterization of the performance of full-scale plant tailings using field test plots and laboratory tests should be designed to extend the application of ongoing test work to the operating tailings basin.

7 Water Chemistry Modeling

7.1 Introduction

Iterative modeling of the geochemical behavior of the tailings solids resulted in selection of an approach that overlaps the operational and closure periods. The original format of the outline agreed with the MDNR has been replaced with the following structure:

- Description of the detailed modeling used to predict the weathering and leaching behavior of tailings solids; and
- Description of the coupling of the result from this modeling with prediction of the chemistry of the process water in the tailings pond.

7.2 Leaching Behavior of Tailings Solids

7.2.1 Approach

Over time, the fine and coarse tailings will respond differently to the physical and geochemical processes that will control water quality. The coarser sandy tailings have a higher porosity and are more permeable. As a result, water will infiltrate and drain away more readily, and oxygen will diffuse more rapidly and deeper into these tailings. The finer silty tailings will be less permeable than the coarser tailings and, as a result, will more effectively retain moisture and reduce the rate of oxygen diffusion.

Sulfide minerals, when exposed to ambient conditions (air and water), will oxidize to form free acid (sulfuric acid) which will react with neutralizing minerals. Under neutral but oxidizing conditions, iron released by the oxidation of pyrrhotite would be expected to form iron oxy-hydroxides which will limit the solubility of iron. These oxy-hydroxides also have a potential to co-precipitate or sorb dissolved metals that may be released from sulfide oxidation. However, where conditions are not sufficiently oxidizing, it may be possible that iron could remain in solution as ferrous iron. The oxidation of galena (which is present in trace amounts in the PolyMet tailings, see Section 5.1.2) could result in the dissolution of lead; however, under conditions of elevated sulfate concentrations it is expected that anglesite would be formed and lead concentrations would remain low. Similarly, the oxidation of chalcopyrite could lead to the release of soluble copper; however its concentration would be limited at neutral pH conditions by the formation of secondary minerals.

Conservatively, however, for the parameters addressed in this report, solubility controls were generally disregarded and the mass release rates, as determined from the kinetic leach tests, were utilized directly in the oxidation release calculations. Conclusions on metal mobility provided in Section 6.3.2 provide a basis for evaluation predictions of tailings pore water chemistry.

Therefore, to determine the water quality of seepage from the tailings, the following steps were undertaken:

- First, the geochemical properties and kinetic test results were used to establish the rates at which the sulfide minerals oxidize and to estimate the associated metal and other solute release rates.

- Second, because the moisture content has a major impact on the rate at which oxygen may diffuse into the tailings, the average moisture content of the coarse and fine tailings were estimated using the physical properties of the tailings. The moisture content and physical properties were then used based on well-established correlations to establish the effective oxygen diffusion coefficients for the coarse and fine tailings respectively.

- Third, oxygen diffusion calculations were then undertaken to determine the rate of oxygen consumption (i.e. sulfide mineral oxidation rates) with depth. These were then used together with the estimated solute release rates to determine mass loadings to the porewater in the coarse and fine tailings respectively. This yielded porewater concentrations in the unsaturated fine and coarse tailings respectively.

- Fourth, infiltration rates to the coarse and fine tailings during deposition were estimated based on the depositional strategy and assumed beach conditions. These estimates were used in the updated RS13 (Draft 03) (Barr 2007c) to estimate transport rates of surface infiltration to the base of the LTVSMC tailings. The transport rates were then used to estimate the volume of seepage from each of the coarse and fine tailings beaches, and combined with the estimated porewater concentrations determined in the previous step to estimate solute concentrations in the seepage.

In the following sections, first the intrinsic oxidation rate of the tailings is established. The physical properties of the tailings are then used to determine potential controls on oxygen diffusion into the tailings. The outcomes from these assessments are then used to determine the inputs for the diffusion modeling which is used to estimate sulfide depletion rates.

7.2.2 Geochemical and Physical Test Results

Geochemical Properties and Oxidation Rates

The humidity cell test results provide some insight into the geochemical mechanisms that could prevail in the tailings and can be used to calculate the intrinsic oxidation rates.

The oxidation rates were estimated from the final 20 cycles of testing to represent a 'steady state' oxidation rate. The oxidation rates were calculated assuming the pyrrhotite is oxidized first according to the following reaction:

$$FeS(s) + 2\,O_2 \rightarrow FeSO_4\,(aq) \qquad \ldots(1)$$

The ferrous iron is then oxidized to ferric and precipitated as ferri-hydrate as follows:

$$2Fe^{2+} + \tfrac{1}{2} O_2 + 5H_2O \rightarrow 2Fe(OH)_3\,(s) + 4H^+ \qquad \ldots(2)$$

With the overall reaction as follows:

$$2\,FeS(s) + 9/2\,O_2 + 5H_2O \rightarrow 2Fe(OH)_3\,(s) + 2H_2SO_4 \qquad \ldots(3)$$

Overall oxidation rates, expressed as oxygen uptake rates, were calculated and are summarized in Table 7-1.

Table 7-1: Summary of Tailings Oxidation Rates

Test Type	Fraction	Humidity Cell Test Full ID	Acid Potential kg $CaCO_3$/t	S %	SO_4 (mg/kg/wk)	Oxidation Rates (mol O_2/kg/s)
MDNR Reactor	+100	Parcel 1-2 PISCS +100 mesh	3.4	0.11	4.44	1.72×10^{-10}
MDNR Reactor	+100	Parcel 3 P3S +100 mesh	3.4	0.11	5.24	2.03×10^{-10}
Humidity Cell	+100	Parcel 3 P3S +100 mesh	3.4	0.11	6.11	2.37×10^{-10}
Humidity Cell	+100	Parcel 1-2 PISCS +100 mesh	3.4	0.11	4.61	1.79×10^{-10}
Average			3.4	0.11	5.10	1.98×10^{-10}
MDNR Reactor	-100+200	Parcel 1-2 PISCS -100 +200 mesh	3.1	0.1	5.78	2.24×10^{-10}
MDNR Reactor	-100+200	Parcel 3 P3S -100 +200 mesh	4.4	0.14	7.90	3.06×10^{-10}
Humidity Cell	-100+200	Parcel 1-2 PISCS -100 +200 mesh	3.1	0.1	6.22	2.41×10^{-10}
Average			3.5	0.11	6.63	2.57×10^{-10}
MDNR Reactor	-200	Parcel 1-2 PISCS -200 mesh	2.8	0.09	8.39	3.25×10^{-10}
MDNR Reactor	-200	Parcel 3 P3S -200 mesh	4.4	0.14	10.1	3.91×10^{-10}
Humidity Cell	-200	Parcel 1-2 PISCS -200 mesh	2.8	0.09	5.84	2.26×10^{-10}
Humidity Cell	-200	Parcel 3 P3S -200 mesh	4.4	0.14	16.6	6.43×10^{-10}
Average			3.6	0.12	10.2	3.96×10^{-10}
MDNR Reactor	Whole	P1S	3.1	0.10	3.45	1.34×10^{-10}
MDNR Reactor	Whole	P3S Lapakko	4.7	0.15	5.08	1.97×10^{-10}
Humidity Cell	Whole	P1 (CuSO4)	3.1	0.10	7.45	2.89×10^{-10}
Humidity Cell	Whole	P3 (CuSO4)	4.7	0.15	10.5	4.06×10^{-10}
Average			3.9	0.13	6.62	2.56×10^{-10}

As shown in the table, although the oxidation rates fall within a relative narrow range, the results suggest that the fine tailings on average may oxidize more rapidly than the coarse tailings.

These oxidation rates were established for laboratory conditions where a relatively thin layer of tailings was assessed. Under these conditions, the oxidation rates would not be expected to be limited by oxygen availability. Under field conditions once the tailings have been deposited, the near surface tailings would react at the rates indicated. However, at greater depth the rate of oxidation would be limited by the rate at which oxygen diffuses into the tailings. The rate of diffusion would depend on a number of factors, including the porosity, permeability and precipitation which would dictate the degree of saturation of the tailings.

Diffusion Coefficient

The effective diffusion coefficient for oxygen into tailings was calculated from the equation presented by Elberling et al. (1993). The Elberling equation is:

$$D_e = \tau D_a \, [1 - S_w]^c + S_w D_w / K_H \qquad \ldots(4)$$

Where:

D_a is the free diffusion coefficient of oxygen in air (2.0_10_ 5 m^2/s, Cussler, 1997),

D_w is the free diffusion coefficient of oxygen in water (1.8_10_ 9 m^2/s, Cussler, 1997),

τ is a tortuosity factor (~0.3),

c is an empirical coefficient (~3.3),

S_w is the water saturation, and,

K_H is Henry's constant for oxygen.

The equation provides a bulk effective diffusion coefficient corresponding to parallel diffusion in the gas and liquid phases, with the right-hand term ($S_w D_w / K_H$) corresponding to the liquid phase. Differences between the tortuosity factors for the liquid and gas phases are accounted for by the parameter a.

Therefore, to estimate the effective diffusion coefficient it is necessary to determine the level of saturation of the tailings. During tailings deposition, the spigot points will be cycled around the perimeter embankment of the tailings deposition area. Each 'active area' (i.e. down-slope from the spigot point) will therefore for a short time receive excess water during the deposition period over the area that the deposition fan will develop. Thereafter, the rate of infiltration will be dictated by the site precipitation.

The average site precipitation is about 28.2 inches, with a net precipitation of about 8.2 inches. Depending on the final surface of the tailings once deposition ceases, the net infiltration to the tailings would be expected to vary, and the degree of saturation would change accordingly. There is likely to be seasonal variation in the tailings moisture content.

HYDRUS-2D modeling was undertaken to estimate the saturation profiles that may develop respectively in the coarse and fine tailings. The modeling conditions and summary results are provided in Appendix D.1. The results indicated that the coarse tailings are relatively free draining and the level of saturation would be expected to decrease rapidly to about 38% of saturation. The fine tailings however will remain relatively saturated at about 90% of saturation.

A summary of the tailings porosity, permeability and density is provided in Table 7.2. The table also shows the estimated effective diffusion coefficients, calculated from Equation 4.

Table 7-2: Summary of Average Coarse and Fine Tailings Properties

Zone	Units	Coarse Tailings	Fine Tailings
Porosity	unitless	0.480	0.500
Bulk Dens	kg/m^3	1.560	1.500
Permeability	m/s	1.20x10^{-5}	2.24x10^{-7}
Saturation	%	38%	89%
D_e	m^2/s	1.02x10^{-6}	3.54x10^{-9}

It should be noted that oxygen ingress to the tailings will also be affected by snow accumulation and by freezing conditions should sufficient moisture remain in the tailings prior to winter freeze-up.

In the next section, the rate of oxygen diffusion is assessed.

7.2.3 Oxygen Diffusion Modelling

The rate of oxygen transport into the tailings by diffusion is governed by Fick's law. Integrating the one-dimensional form of Fick's Law and incorporating a first order oxygen consuming reaction leads to the conservation equation:

$$\frac{dC}{dt} = \frac{dC}{dx}\left(D\,\frac{dC}{dx}\right) - rC \qquad \ldots(5)$$

Where:

C is the oxygen concentration

t is time

D is the effective diffusion coefficient

x is depth and r is the reaction rate constant.

A numerical solution for this equation was coded in Visual Basic in an Excel spreadsheet.

The average reaction rate constant for the tailings was calculated from the humidity cell tests as 3.38x10^{-8} s^{-1} for the coarse tailings, and 6.50x10^{-8} s^{-1} for the fine tailings.

Two correction factors were applied to the reaction rate constant. First, the average temperature in the tailings is expected to be well below room temperature at which the humidity cell tests were conducted. The temperature in the tailings are expected about 15 ^{o}C lower than the test conditions and, using the Arrhenius equation, it can be shown that the reaction constant will be lower by a factor of about 0.3 at the lower temperature. Second, for about 3 to 4 months of the year the tailings are expected to be frozen and/or covered by snow, which will severely restrict the diffusion of oxygen into the tailings. Effectively, this will reduce the annual average oxidation rate by a factor of about 0.75. Therefore, the effective reaction rate constant was obtained by multiplying the laboratory determined rate by 0.3 and 0.75 respectively, as shown in Table 7-3. It should however be noted that during spigoting the tailings beneath the deposition delta will be saturated which will further reduce oxygen ingress and thus oxidation of the tailings. Conservatively, this effect has been disregarded in the current evaluation.

Table 7-3: Summary of Assumed Effective Reaction Rate Constants

Zone	Calibration Reaction Rate Constant (s^{-1})	Temperature Correction	Frozen Conditions	Effective Reaction Rate Constant (s^{-1})
Coarse	3.38×10^{-8}	0.3	0.75	7.61×10^{-9}
Fines	6.50×10^{-8}	0.3	0.75	1.46×10^{-8}

An initial sulfide content of 0.11 % was assumed for the coarse tailings, and 0.12 % for the fine tailings.

Using these starting conditions, the oxygen concentration profiles with depth and the corresponding sulfide oxidation in the tailings with time were calculated. The results are summarized in Appendix D.1. Example plots of the oxygen concentration in the pore gases are shown in Figure 7.1 at years one, five and ten. The progress of the sulfide depletion front in the coarse tailings is in Figure 7.2. The corresponding plots for the fine tailings are provided in Figure 7.3 and Figure 7.4.

It is important to note that the depth of oxygen penetration into the coarse tailings essentially extends to 20 m (~65 ft) after one year; and after five years to the base of tailings column with a height of 30 m (i.e. ~100 ft) column indicating that the tailings would oxygenate very rapidly and would remain oxygenated. In the context of the construction sequence of 5 m (15 ft) lifts, it is apparent that the tailings would tend to oxidize through the entire column. This would also mean that iron would be oxidized to ferric and would therefore not be mobile provided neutral pH conditions prevail. In contrast to the coarse tailings, the depth of oxygenation of the fine tailings is limited to the near surface (note y-axis full-scale is 10 m) and the rate of oxidation will be limited by the flux of oxygen and no oxidation would be expected at depth.

The rate of depletion is significantly faster in the coarse tailings than in the fine tailings as shown in Figure 7.2 and Figure 7.4. Sulfide depletion would commence from the surface layer of the coarse tailings in about 55 years, and the sulfide in the coarse tailings could be depleted to a depth of 15 m (~ 45 ft) in about 160 years. Sulfide depletion in the near surface fine tailings is expected to commence after about 30 years because the fine tailings are more reactive than the coarse tailings. However, due the limitations on oxygen diffusion, the sulfide depletion would extend only to a depth of about 1 m (~3 ft) after 160 years (note the ‘steps’ in the plot are a consequence of the discritization of the tailings column in the numerical model). It is also apparent that the rate of depletion slows down over time. Therefore, because the coarse and fine tailings have similar sulfide mineral contents, it is apparent that the coarse tailings represent a significantly greater source of oxidation related solute release.

The oxidation rates obtained by this analysis were then used in conjunction with laboratory determined metal release ratios to estimate porewater quality within the oxidation zone as discussed subsequently.

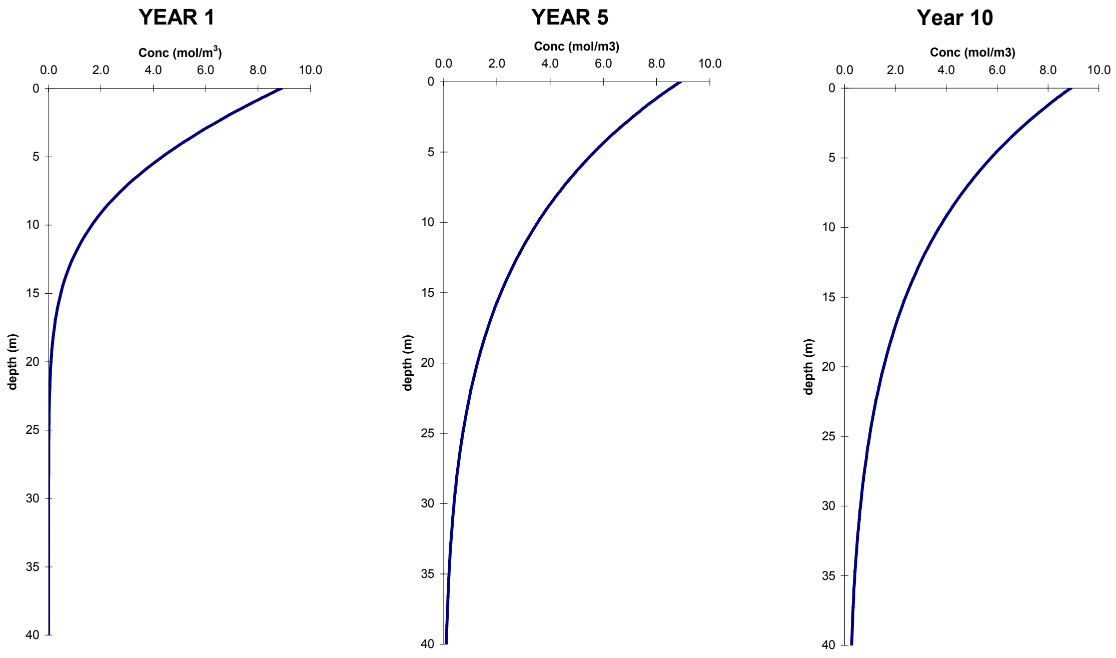

Figure 7-1: Oxygen Concentration Profiles in Coarse Tailings

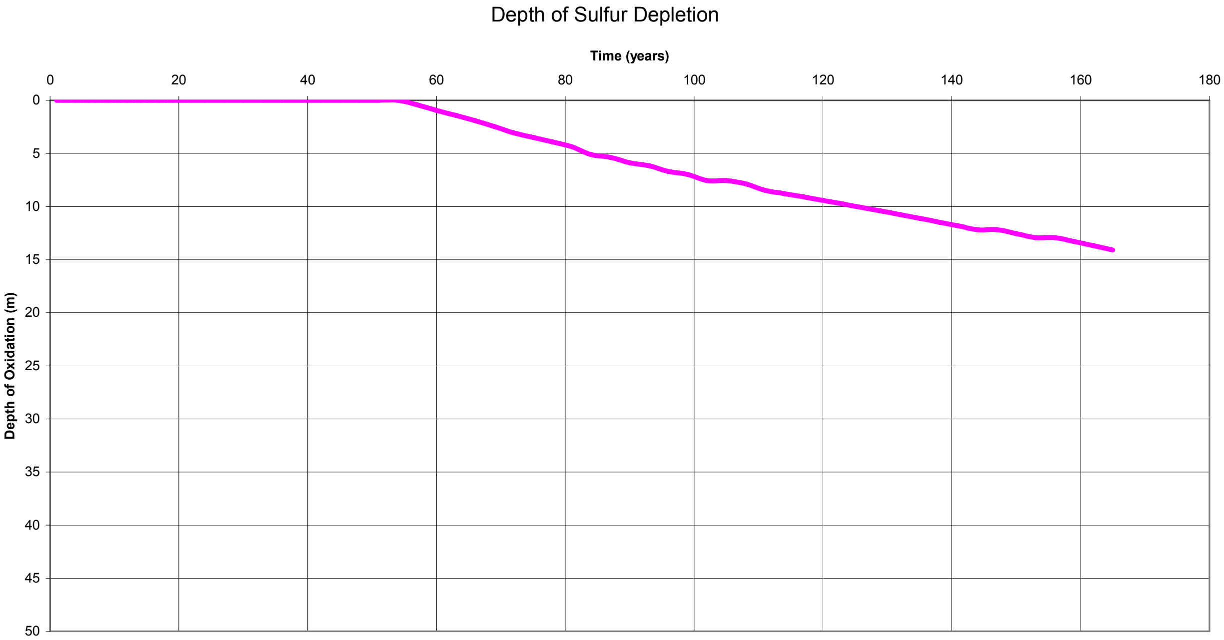

Figure 7-2: Sulfide Depletion in Coarse Tailings

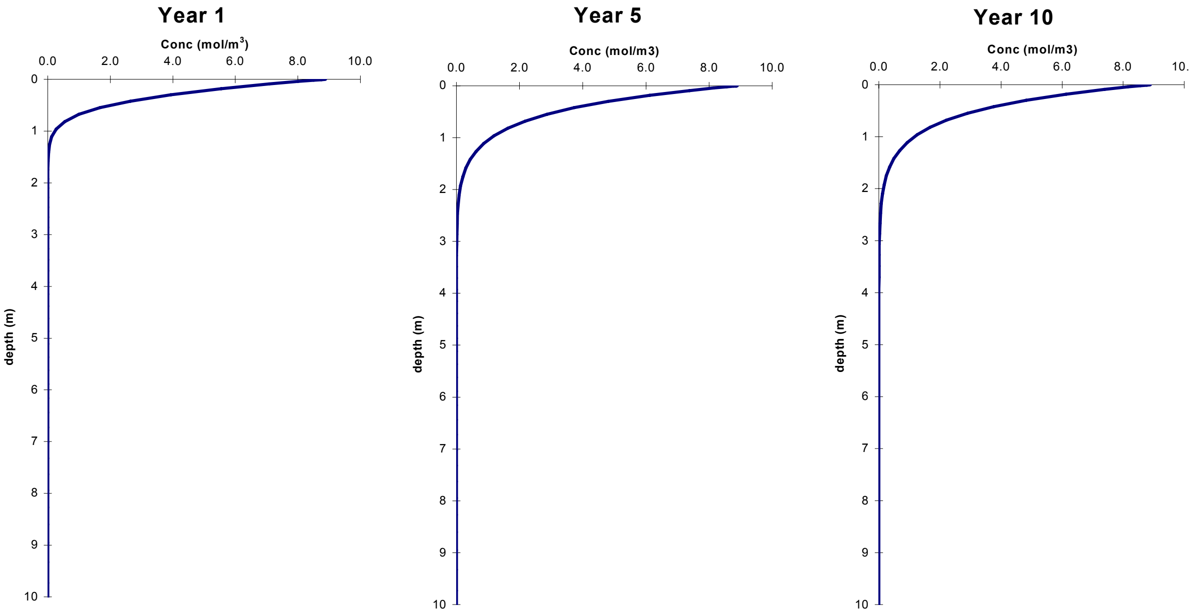

Figure 7-3: Oxygen Concentration Profiles in Fine Tailings

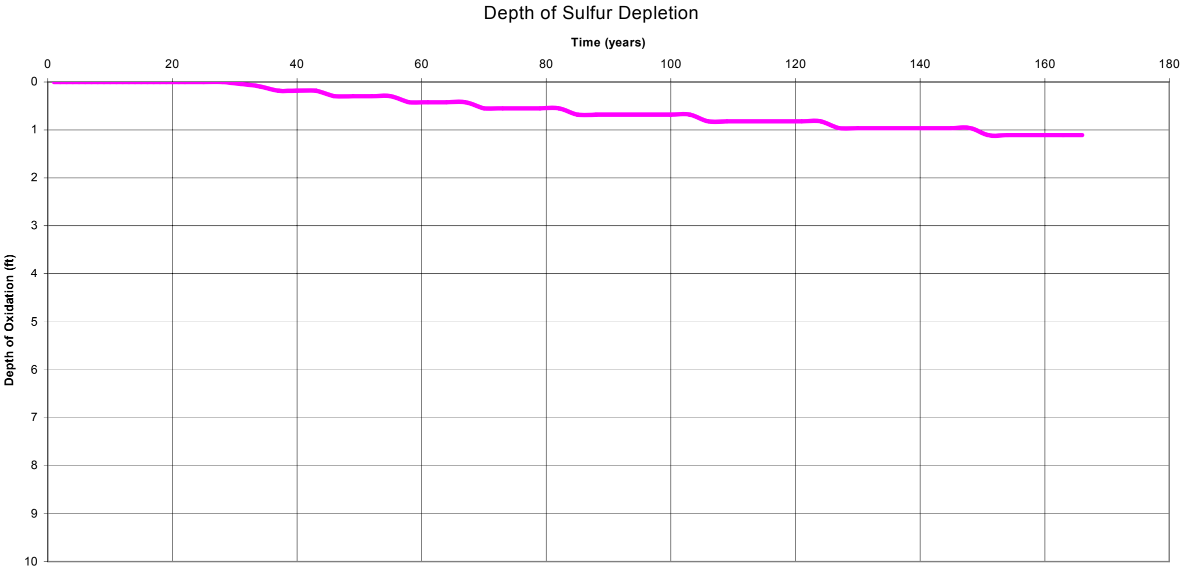

Figure 7-4: Sulfur Depletion in Fine Tailings

7.2.4 Acid Generation – Neutralization Consumption Balance Calculations

Alkalinity Release

This section provides further discussion of the availability of alkalinity to neutralize acid produced by sulfide oxidation as it relates to development of the tailings weathering profile.

The alkalinity release rates in excess of that consumed by the acid generated by oxidation were observed in the humidity cells. The results are summarized in Table 7.4. The table shows the average alkalinity concentration in the leachate from the final 20 cycles of testing. The leach rate represents the rate of loss of alkalinity in excess of that which is required for acid neutralization. For reference, the corresponding acidity equivalent alkalinity consumption rates, and the combined or total (i.e. consumption plus leached excess alkalinity) consumption rates are also shown. The alkalinity release rate from the coarse tailings appears to be lower than that from the fine tailings which is consistent with observed susceptibility of coarse tailings to pH depression.

Table 7-4: Summary of Estimated Steady State Alkalinity Release and Consumption Rates

Sample ID	Average Alkalinity Concentration (mg $CaCO_3$ eq/L)	Leach Rate Indicated by Test Work (mg $CaCO_3$ eq/kg/s)	Acidity Eq. Alkalinity Consumed Indicated by Sulfate Release (mg $CaCO_3$ eq/kg/s)	Total Alkalinity Consumed and Leached (mg $CaCO_3$ eq/kg/s)
P1S	30.8	$2.34x10^{-5}$	$1.14 x10^{-5}$	$3.48 x10^{-5}$
P3S	24.4	$1.90 x10^{-5}$	$1.28 x10^{-5}$	$3.18 x10^{-5}$
Average		$2.12 x10^{-5}$		
Parcel 1-2 PISCS +100 mesh	35.3	$2.72 x10^{-5}$	$9.47 x10^{-6}$	$3.67 x10^{-5}$
Parcel 3 P3S +100 mesh	36.2	$2.77 x10^{-5}$	$1.18 x10^{-5}$	$3.95 x10^{-5}$
Average		$2.74 x10^{-5}$		
Parcel 1-2 PISCS -100 +200 mesh	34.3	$2.67 x10^{-5}$	$1.35 x10^{-5}$	$4.02 x10^{-5}$
Parcel 3 P3S -100 +200 mesh	27.9	$1.98 x10^{-5}$	$2.15 x10^{-5}$	$4.13 x10^{-5}$
Average		$2.32 x10^{-5}$		
Parcel 1-2 PISCS -200 mesh	61.2	$4.74 x10^{-5}$	$9.85 x10^{-6}$	$5.72 x10^{-5}$
Parcel 3 P3S -200 mesh	59.2	$4.33 x10^{-5}$	$2.12 x10^{-5}$	$6.45 x10^{-5}$
Average		$4.54 x10^{-5}$		

Because the mineralogical assessment identified only traces of carbonate minerals, the alkalinity appears to be generated from weathering of silicate minerals (i.e. plagioclase) due to interaction with atmospheric carbon dioxide. Because the mineralogical assessment also indicated that quartz is not present or very rarely, it is concluded that the silica release is indicative of the weathering of the plagioclase. The presence of minor amounts of clay further supports this conclusion.

Because the humidity cell tests were conducted on well-aerated thin layers of tailings, the leach tests therefore are likely to indicate the maximum rate of alkalinity release that can be expected from the tailings. The calculation of the maximum alkalinity release that may occur under field conditions will however require an understanding of the depth of carbon dioxide penetration into the tailings by gaseous diffusion. It is, however, recognized that rain water will also be saturated with carbon dioxide which will further contribute to alkalinity release but that mechanism is not considered herein.

Calculation of the depth of diffusion requires an understanding of the rate at which carbon dioxide is consumed by the weathering reactions. The theoretical ratio will depend on the end-product (i.e. clay mineral) that is formed and it is probable that a range of clay minerals are present such that the actual release ratio is the end-product of a combination of ratios. Therefore, bicarbonate to silicate ratios were calculated from the later cycles of the humidity cell leachate concentrations as summarised in Table 7-5. The table shows first the molar ratio of the total release of alkalinity (including that consumed by oxidation reactions) to the silica present in the leachate. As shown in the table, the ratio in some cases (e.g. the coarse samples) is substantially higher than would ordinarily be expected from the weathering of silicate minerals. The very high ratios suggest that calcite or dolomite may in fact participate in the reactions. However, it is anticipated that these carbonates had been formed as a result of the initial high reactivity of the silicates, and therefore remain indicative of the overall potential for generating alkalinity. Nonetheless, the ratios were recalculated with the calcium equivalent bicarbonate concentration subtracted from the total prior to calculating the ratio. These results are shown in the second column.

As shown in the table, the 'whole samples' indicate a net release ratio of about 1.9 on average. The coarse and mid size tailings samples indicate higher ratios of about 7.0 and 5.5 respectively. Two of the fine tailings samples indicate a ratio similar to that of the whole samples (i.e. about 2.0). The third sample however returned a much higher ratio. The reason for this is not certain. Overall it appears that a ratio of about 2 is not unreasonable for weathering reactions unaffected by carbonates.

Table 7-5: Summary of Bicarbonate to Silicate Molar Concentration Ratios in Tailings Leachate

Test	Description	(Total HCO_3) : Si	(Total – Calcium eq HCO_3) : Si
14	P1S	7.26	2.60
15	P1 Solids	4.76	1.62
16	P2S	5.26	1.51
17	P3S	5.77	1.69
18	Parcel 2 P2S +100 mesh	19.28	7.53
21	Parcel 1-2 PISCS +100 mesh	18.04	7.31
24	Parcel 3 P3S +100 mesh	17.49	6.29
19	Parcel 2 P2S +200 mesh	13.20	5.01
22	Parcel 1-2 PISCS -100 +200 mesh	14.98	4.80
25	Parcel 3 P3S -100 +200 mesh	18.83	6.76
20	Parcel 2 P2S -200 mesh	9.01	1.89
23	Parcel 1-2 PISCS -200 mesh	30.49	16.00
26	Parcel 3 P3S -200 mesh	10.60	2.18

Using a bicarbonate to silicate release ratio of 2.0, the carbon dioxide consumption rates were estimated for the coarse and fine tailings, in much the same way as the oxygen consumption rates were calculated. The results are shown in Table 7-6.

These rates were then used in diffusion calculations as described for the oxygen transport modeling, to estimate the depth of carbon dioxide diffusion into the tailings, as shown in Figure 7-5. The results indicate that the depth to which carbon dioxide is expected to diffuse into the tailings is about 0.25 m (or 0.8 ft) in the fine tailings and about 0.8 m (2.6 ft) in the coarse tailings. Using these depths, and assuming a tailings bulk density of 1.2 and the rates of alkalinity release shown in Table 7-6, it can be shown that the approximate alkalinity release rate in the tailings deposit will be about 0.576 kg $CaCO_3$ eq/m^2/year from the fine tailings, and about 1.225 kg $CaCO_3$ eq/m^2/year from the coarse tailings.

Table 7-6: Summary of Carbon Dioxide Consumption Rates Estimated from Silicate Molar Release Ratios in Tailings Leachate

Test	Procedure	Size	Sample	Si Release in Tests (mol/kg/s)	CO_2 Consumption mol/kg/s
L21	DNR	+100	Parcel 1-2 PISCS +100 mesh	3.56×10^{-11}	7.11×10^{-11}
L24	DNR	+100	Parcel 3 P3S +100 mesh	3.87×10^{-11}	7.73×10^{-11}
T8	ASTM	+100	Parcel 1-2 PISCS +100 mesh	3.28×10^{-11}	7.40×10^{-11}
T11	ASTM	+100	Parcel 3 P3S +100 mesh	3.70×10^{-11}	6.57×10^{-11}
			Average	3.60×10^{-11}	7.20×10^{-11}
L23	DNR	-200	Parcel 1-2 PISCS -200 mesh	2.36×10^{-11}	4.72×10^{-11}
L26	DNR	-200	Parcel 3 P3S -200 mesh	9.99×10^{-11}	2.00×10^{-10}
T10	ASTM	-200	Parcel 1-2 PISCS -200 mesh	6.14×10^{-11}	1.23×10^{-10}
T13	ASTM	-200	Parcel 3 P3S -200 mesh	5.92×10^{-11}	1.18×10^{-10}
			Average	6.10×10^{-11}	1.22×10^{-10}

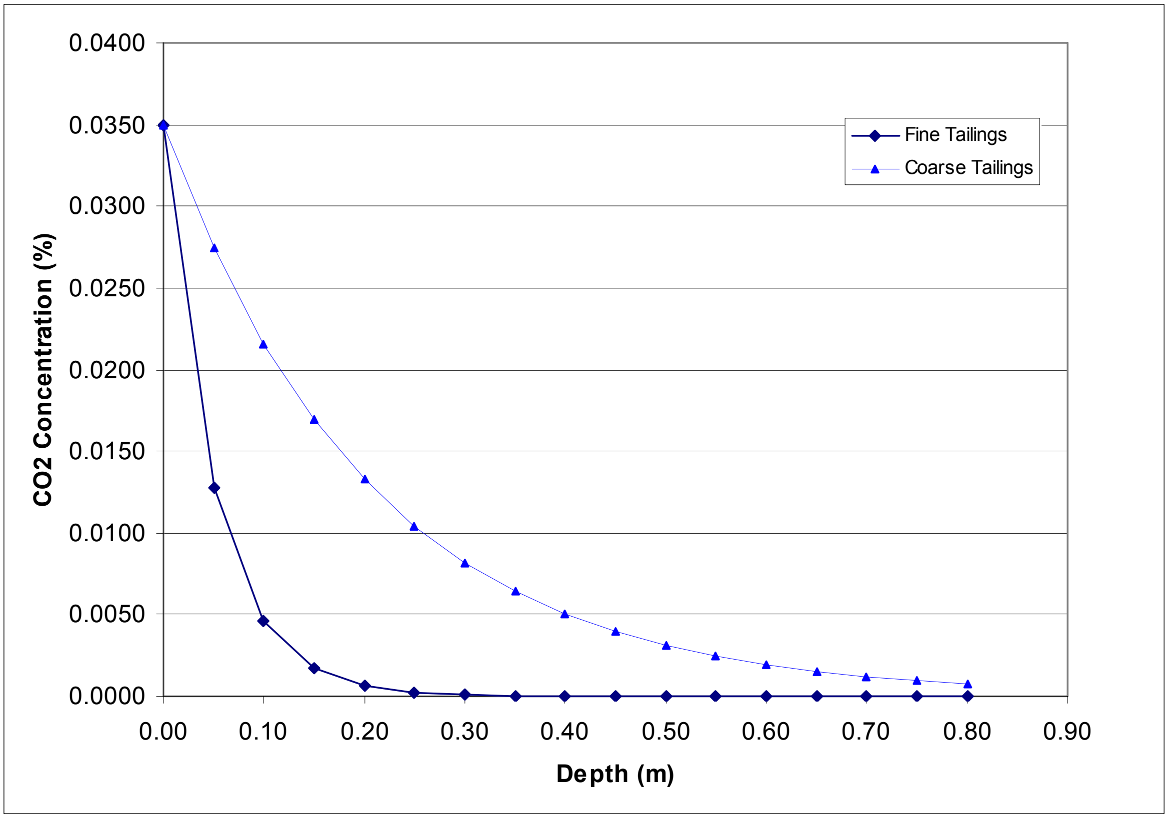

Figure 7-5: Calculated Carbon Dioxide Concentration Profiles in Fine and Coarse Tailings

The petrographic assessment indicated that the tailings contain about 65 % plagioclase on average. Assuming kaolinite is formed when plagioclase reacts with carbon dioxide the reaction proceeds as follows:

0.38 Plagioclase + 0.52 CO_2 *+ 0.78* H_2O *=> 0.26 Kaolinite + 0.235* Na^+ *+ 0.144* Ca^{2+} *+ 0.47* SiO_2 *+ 0.52* HCO_3^- *…(5)*

For this reaction the HCO_3^- : SiO_2 is about = 1.11, which is a much lower bicarbonate yield than measured in the laboratory and would therefore result in a conservative estimate of plagioclase depletion. At the above rates of alkalinity release and using the stoichiometry in equation 5, plagioclase will be depleted at a rate of about 17.9 mol/m^2/year from the zone to which carbon dioxide would diffuse (i.e. about 0.8 m or 2.6 ft) in the coarse tailings, and at a rate of about 8.4 mol/m^2/year from the corresponding zone (0.25 m or 0.8 ft) from the fine tailings. At a bulk tailings density of 1.2, and an average plagioclase content of 65%, it can be shown that the 0.8 m zone in the coarse tailings can sustain an alkalinity release at the estimated maximum rate for about 129 years. The carbon dioxide influenced zone in the fine tailings can sustain the maximum alkalinity release rate for about 89 years. It should however be noted that as the consumption rate of the carbon dioxide in the near surface decreases (as plagioclase is fully converted) the depth to which carbon dioxide will diffuse will increase and additional plagioclase will be available for reaction and alkalinity generation, albeit at a lower rate.

These generation rates are compared to the acid generation rates in the next section.

7.2.5 Overall Acidity - Alkalinity Release Balance

The estimated rates of acidity generated, expressed in $CaCO_3$ equivalents, calculated for the oxidation rate of the coarse tailings over time are summarized in Table 7-7, and the corresponding rates for the fine tailings are shown in Table 7-8.

Table 7-7: Estimated Acidity and Alkalinity Generation in Coarse Tailings

Time	Oxygen Flux into Tailings	Corresponding Rate of Acidity Generation	Rate of Alkalinity Generation
Years	mol/m^2year	$kgCaCO_3eq/m^2/year$	$kgCaCO_3eq/m^2/year$
1	12.35	0.659	1.225
10	6.84	0.365	1.225
15	6.07	0.324	1.225
30	3.97	0.211	1.225
60	2.67	0.143	1.225
90	2.11	0.113	1.225
125	1.64	0.087	1.225

Table 7-8: Estimated Acidity and Alkalinity Generation in Fine Tailings

Time	Oxygen Flux into Tailings	Corresponding Rate of Acidity Generation	Rate of Alkalinity Generation
Years	mol/m^2year	$kgCaCO3eq/m^2/year$	$kgCaCO3eq/m^2/year$
1	3.37	0.180	0.576
10	1.83	0.097	0.576
15	1.43	0.076	0.576
30	0.97	0.052	0.576
60	0.67	0.036	0.576
90	0.54	0.029	0.576
120	0.47	0.025	< 0.576*

Note: * While the plagioclase will in theory have been depleted from the near surface in the fine tailings, carbonate will progress deeper into the tailings and may reduce the rate of alkalinity release.

As discussed in the previous section, the maximum rate of alkalinity from the coarse tailings is expected to be sustained for about 129 years which is about the time it is estimated that all of the sulfur will be depleted from the coarse tailings to a depth of about 80 feet. It should however be noted that carbon dioxide will be released within the oxidation zone when bicarbonate alkalinity reacts with acidity as follows:

$$HCO_3^- + H^+ \Rightarrow H_2CO_3 \Rightarrow H_2O + CO_2 \qquad \ldots(6)$$

The carbon dioxide generated then becomes available to react again with plagioclase within the oxidation zone to release additional alkalinity. Therefore, excess alkalinity will be generated to neutralize the acidity and maintain neutral pH conditions even well after the estimated period of release from the near surface layer.

In the case of the fine tailings, the initial alkalinity release rates can be maintained from the near surface tailings (i.e. 0.8 ft) for about 89 years. At that time the rate of oxidation will have decreased to about 16 % of the initial rate, i.e. the alkalinity requirement to maintain neutral pH conditions will be considerably lower. The net rate of alkalinity is nonetheless anticipated to exceed the acid generation rate for two reasons. First, as the plagioclase is depleted from near surface, carbon dioxide diffusion will extend deeper into the tailings thus additional plagioclase will become available for reaction. Alkalinity release will continue albeit at a reduced rate. Second, as noted above, bicarbonate neutralization will release carbon dioxide within the oxidation zone and will result in the ‘regeneration’ of alkalinity from plagioclase present within the oxidation zone.

It is therefore concluded that the tailings will remain pH-neutral indefinitely.

7.2.6 Infiltration and Seepage Rates

Background

Tailings deposition will commence in Cell 2E of the LTVSMC tailings storage facility. The tailings will be spigoted from the perimeter of the cell so that a beach of coarser tailings will form immediately inside the perimeter and further away from the spigot location a beach of finer tailings will accumulate before the excess water flows into the supernatant pond. The embankment itself will be constructed from these coarse tailings. The coarse tailings beach is expected to be about 400 feet wide and the zone of finer tailings is expected to be about 300 feet wide.

Tailings deposition will continue in Cell 2E until the tailings reach the elevation of the tailings in Cell 1E. This is anticipated to occur at about Year 8. Thereafter, i.e. from Year 9 onwards, Cell 2E and Cell 1E will be operated as a single disposal facility. This will mean that tailings will be deposited along the outer embankments of both cells to raise the embankments simultaneously. The embankments will be raised in lifts of about 15 ft. However, only the exterior embankments along the north edge of Cell 2E and south and southeastern edge of Cell 1E will be constructed of coarse tailings (note – the reference to Cell 2E and 1E is only to indicate locations within the single large pond). As each embankment is completed, and construction of the next lift commences. The exterior embankments constructed of coarse tailings will be capped with a synthetic membrane to reduce oxidation and limit infiltration to the embankment.

To manage the phreatic surface within the coarse embankment a series of horizontal drains (finger drains) will be installed along the entire outer (north) embankment of Cell 2E. The drains will be spaced about 100 ft apart and will be located at the base of the LTVSMC tailings. For Cell 1E, horizontal drains will be required only along the perimeter where the tailings overlie bedrock. Figure 7-6 illustrates the configuration of Cell 2E and Cell 1E after they had been merged as a single pond. The red lines indicate the locations of the horizontal drains. As described in the following sections, water quality predictions were completed for seepage collected at each of the horizontal drain systems.

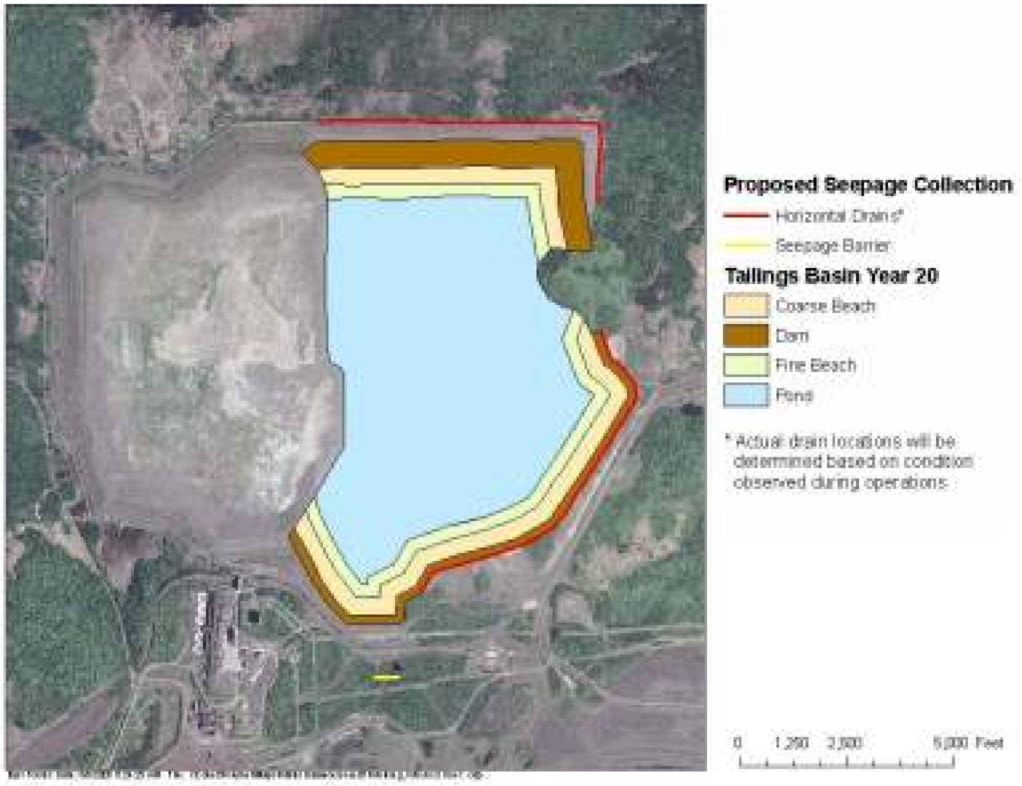

Figure 7-6: Plan View of Cell 2E and Cell 1E after Merging to a Single Pond. Source: Barr Engineering

As indicated previously, the coarse tailings are likely to be most susceptible to oxidation and the above operating strategy has been developed specifically to limit coarse tailings beach size and to restrict active oxidation during the operational period. After operations cease, the coarse tailings beach adjacent to the exterior embankments will be capped with a synthetic membrane to limit both infiltration and restrict oxidation of the coarser tailings.

The total rate of oxidation will therefore depend on the total beach area that is exposed. The estimated beach areas for each of coarse and fine beaches are shown in Tables 7-9 and 7-10, for Cells 2E and Cell 1E, respectively. These were used to estimate ingress of oxygen to the tailings.

Table 7-9: Estimated Beach Area Exposure During Tailings Deposition to Cell 2E

		Embankment	Beach			
Elevation	**Height**	**Coarse to Fine**	**Coarse to Fine**	**Fine to Slime**	**Pond**	**Total Area**
feet	**feet**	**square feet**	**square feet**	**square feet**	**square feet**	**square feet**
1570	0	0	0	0		
1585.0	15.0	430782	2999560	2249670	12649574	18329586
1600.0	30.0	886149	3072000	2304000	13485480	19747629
1615.0	45.0	1349373	3104320	2328240	14857688	21639621
1630.0	60.0	1815117	3105600	2329200	15757140	23007057
1645.0	75.0	2304341	3081300	2310975	16610208	24306824
1660.0	90.0	2867682	3064280	2298210	16886345	25116517
1675.0	105.0	3608470	3068400	2301300	17629980	26608150
1690.0	120.0	3938030	3068400	2301300	18708730	28016460
1705.0	135.0	4438078	3068400	2301300	19504186	29311963
1720.0	150.0	4951640	3068400	2301300	20321140	30642480
1726.1	156.1	5157741	3068400	2301300	20648997	31176437

Table 7-10: Estimated Beach Areas for Cell 1E from Year 9 Onwards

		Embankment	Beach			Total Area
Elevation	**Height**	**Coarse to Fine**	**Coarse to Fine**	**Fine to Slime**	**Pond**	
feet	**feet**	**square feet**	**square feet**	**square feet**	**square feet**	**square feet**
1683.5	9	366785	5287600	3965700	24805941	34426025
1690	15	932186	5270320	3952740	24235652	34390897
1704.8	29.8	1660056	5173360	3880020	23327334	34040770
1720	45	2442068	5486800	4115100	21754282	33798249
1726.1	51.1	2522212	5198640	3898980	21863048	33482880

Active Disposal Infiltration

During the operational period, tailings will be discharged from a single movable point spigot. It is anticipated that a delta will be formed at an angle of about 70^o that will extend about 700 ft from the discharge point. As noted before, the coarser tailings will tend to accumulate within the first 400 ft, and the finer tailings will be deposited beyond that range.

HYDRUS-2D modeling was undertaken to assess the rate of infiltration that may occur at the anticipated water discharge rate associated with the tailings slurry. The results indicated that for the duration of discharge, sufficient water will be available to result in an infiltration rate equal to the saturated hydraulic conductivity. Therefore, based on the assumed dimensions of the delta and the saturated hydraulic conductivity (K_{sat}) of $2x10^{-4}$ cm/s for the coarse tailings and $2.2 \text{ x } 10^{-5}$ cm/s for the fine tailings, the net infiltration to the tailings beaches were calculated as shown in Table 7-11 for the coarse tailings beach and in Table 7-12 for the fine tailings beach. Note that the estimates are averaged for the entire beach area, and encompass both cells.

Table 7-11: Estimated Infiltration Rates to Coarse Tailings Beaches During Active Tailings Deposition

Elevation ft	Area ft^2	Flow m^3/year	Spigot Inches/year	Precipitation Inches/year	Total Inches/year
1570					
1585	2999560	215,818	30.5	8	38.5
1600	3072000	215,818	29.8	8	37.8
1615	3104320	215,818	29.5	8	37.5
1630	3105600	215,818	29.4	8	37.4
1645	3081300	215,818	29.7	8	37.7
1660	3064280	215,818	29.8	8	37.8
1675	3068400	215,818	29.8	8	37.8
1690	8338720	215,818	11.0	8	19.0
1705	8241760	215,818	11.1	8	19.1
1720	8555200	215,818	10.7	8	18.7
1726.1	8267040	215,818	11.1	8	19.1

Table 7-12: Estimated Infiltration Rates to Fine Tailings Beaches During Active Tailings Deposition

Elevation ft	Area ft^2	Flow m^3/year	Spigot Inches/year	Precipitation Inches/year	Total Inches/year
1570					
1585	2249670	49,854	9.4	8	17.4
1600	2304000	49,854	9.2	8	17.2
1615	2328240	49,854	9.1	8	17.1
1630	2329200	49,854	9.1	8	17.1
1645	2310975	49,854	9.1	8	17.1
1660	2298210	49,854	9.2	8	17.2
1675	2301300	49,854	9.2	8	17.2
1690	6267000	49,854	3.4	8	11.4
1705	6254040	49,854	3.4	8	11.4
1720	6181320	49,854	3.4	8	11.4
1726.1	6416400	49,854	3.3	8	11.3

These infiltration rates were used in the unsaturated flow modeling together with particle tracking to determine the net transport rate of seepage from the tailings storage facility (RS13, Barr 2007c). The output from that modeling provided an estimate of the coarse tailings pore water, fine tailings pore water and pond water that would be expected to report to the horizontal drains and seepage from the tailings storage facility. The application of the results from the unsaturated flow modeling is discussed in the next section.

7.2.7 Seepage Transport Rates

The transport rate modeling was undertaken for infiltration occurring in Year 1, Year 8, Year 9, Year 14 and Year 20. Typically, output from the transport modeling indicated a percentage of flow from each of the sources (coarse tailings, fine tailings, pond) that reported to the horizontal drain and the seepage recovery barrier in the case of Cell 1E. The flow modeling also provided overall water balances for the tailings basin.

The results from the flow modeling are reported in RS13 (Barr, 2007c). However, the following briefly describes the use of the flow modeling results to estimate the seepage water quality.

Figure 7-7 illustrates the results from the flow modeling for Year 1 infiltration to the coarse tailings that report to the horizontal drain system of Cell 2E over time. The solid line represents a curve that was fitted to the data (diamond shapes). Similar plots for the fine tailings and the embankment are shown in Figure 7-8 and Figure 7-9.

The formulation for the curve that was fitted to the data was then used to estimate the annual flow intercepted by the horizontal drains. The results are shown in Figure 7-10. The figure shows the results for each source for Year 1 and those for Year 9.

The Year 1 flows were assumed to repeat for Year 2 to Year 8 because the infiltration rates remain constant over this period. For example, infiltration in Year 1 from the coarse tailings first appears in the horizontal drains in Year 4. Therefore, the infiltration from Year 2 would first appear in the horizontal drains in Year 5, that in Year 3 in Year 6 and so on. The combined flow from the coarse tailings would be the sum of these flows up and including Year 8. In years subsequent to Year 8, the infiltration rates change and the flow profiles for Year 9 were adopted for infiltration occurring from Year 9 to Year 20, when operations cease and infiltration rates decrease further. The sums of these combined flows over time are illustrated in Figure 7-11. These flow rates together with the source concentrations derived in Section 7.2.8 were used to estimate the seepage water quality from each of the cells.

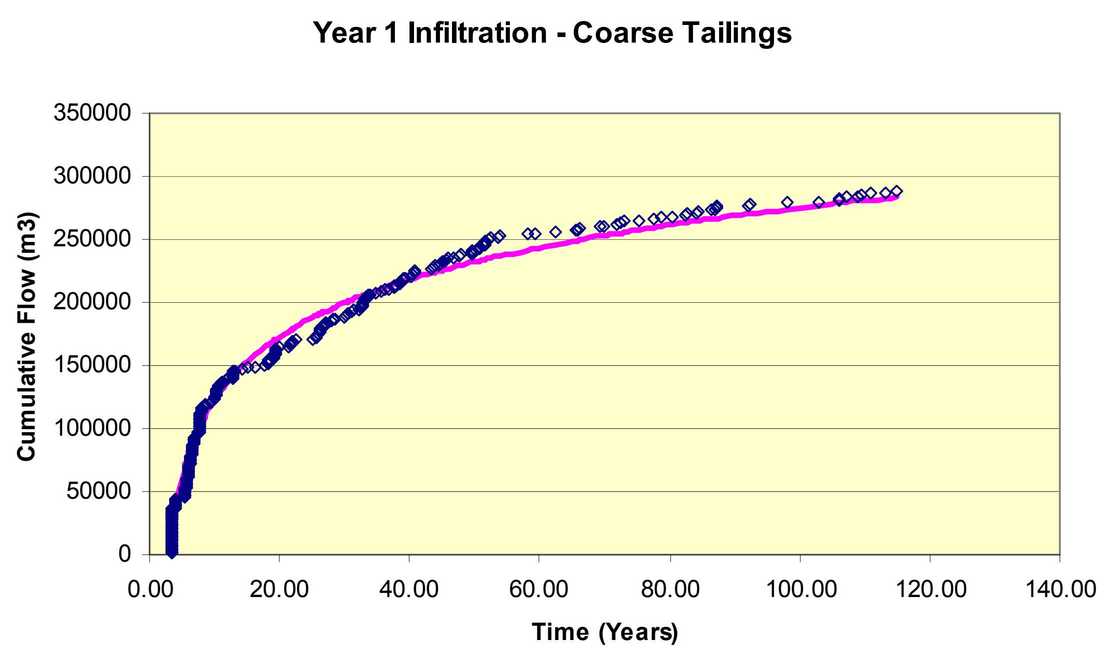

Figure 7-7: Cumulative Seepage from Year 1 Infiltration to Cell 2E Coarse Tailings Beach

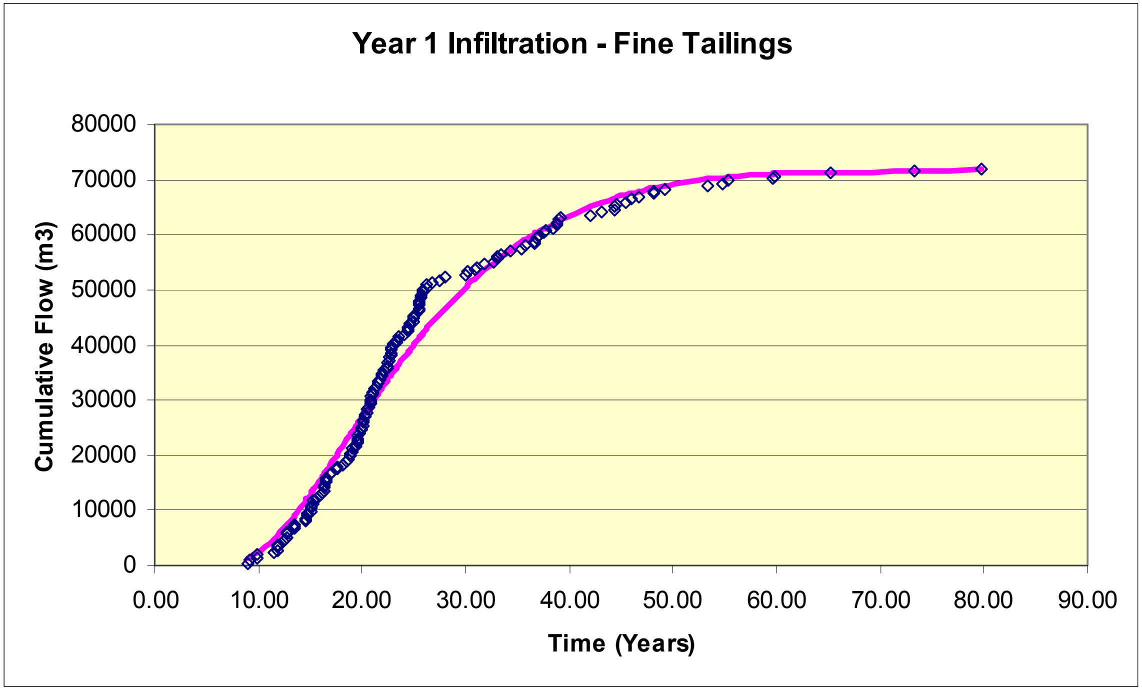

Figure 7-8: Cumulative Seepage from Year 1 Infiltration to Cell 2E Fine Tailings Beach

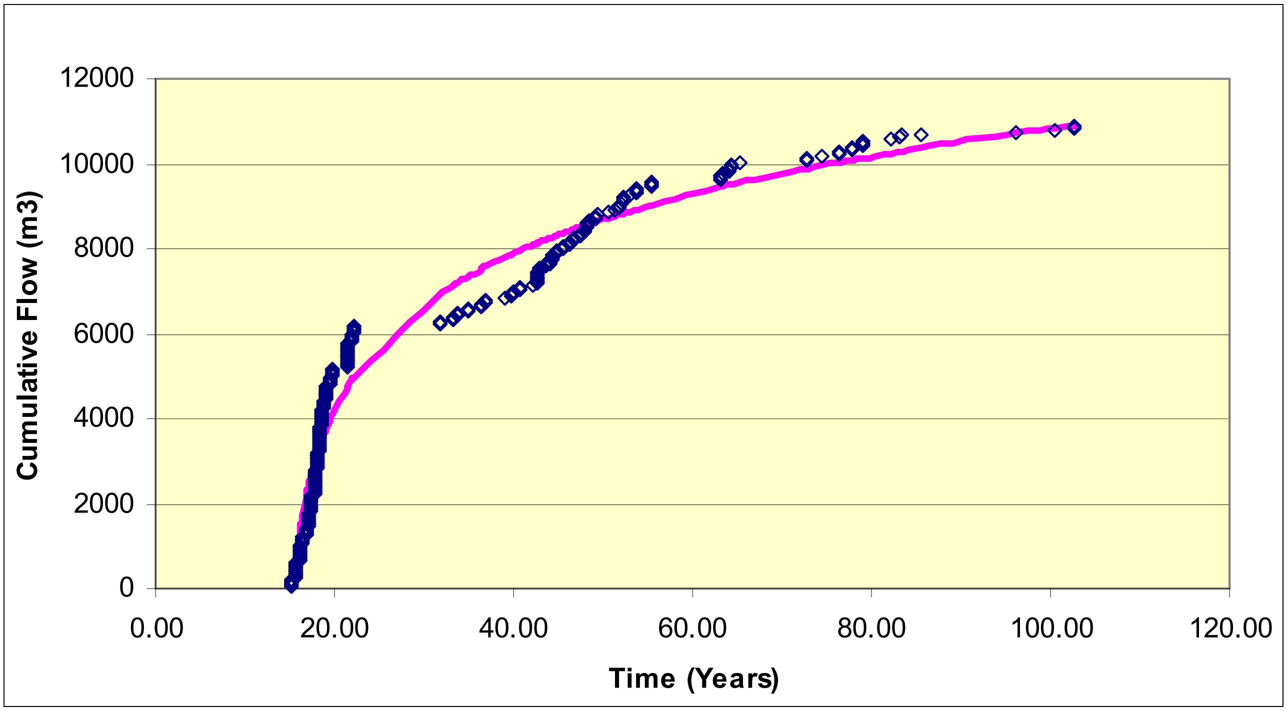

Figure 7-9: Cumulative Seepage from Year 1 Infiltration to Cell 2E Embankment

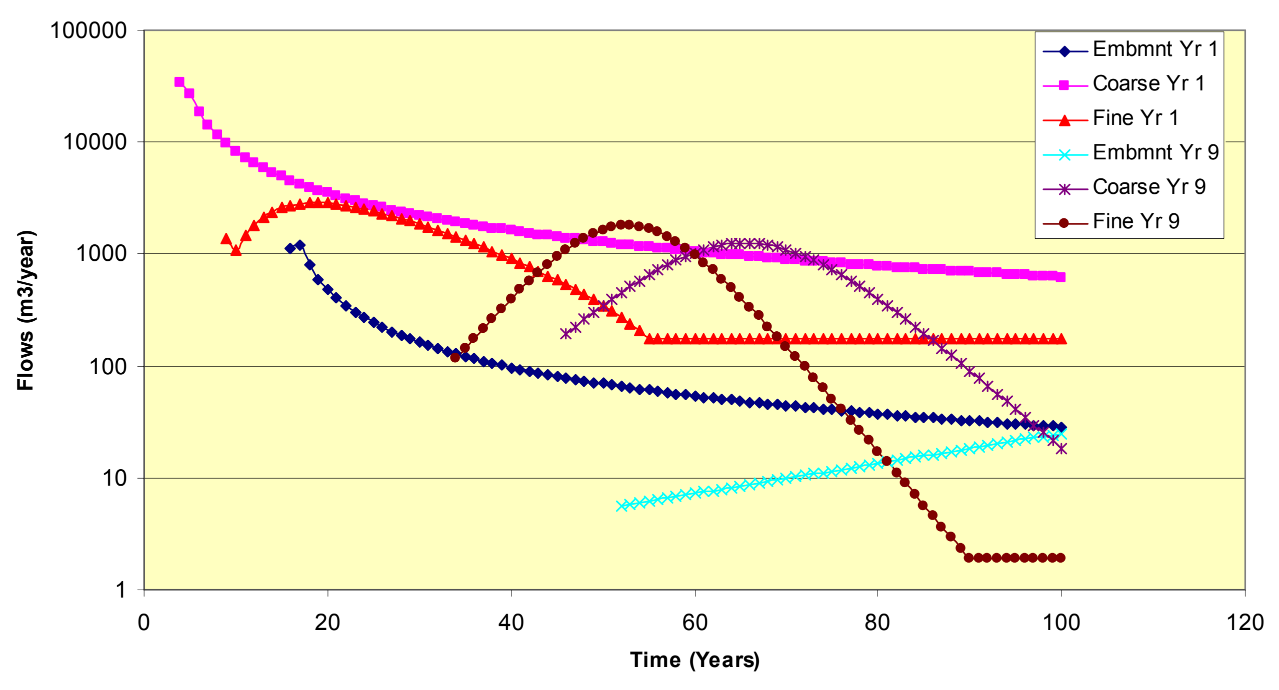

Figure 7-10: Flows from Infiltration in Year 1 and in Year 9

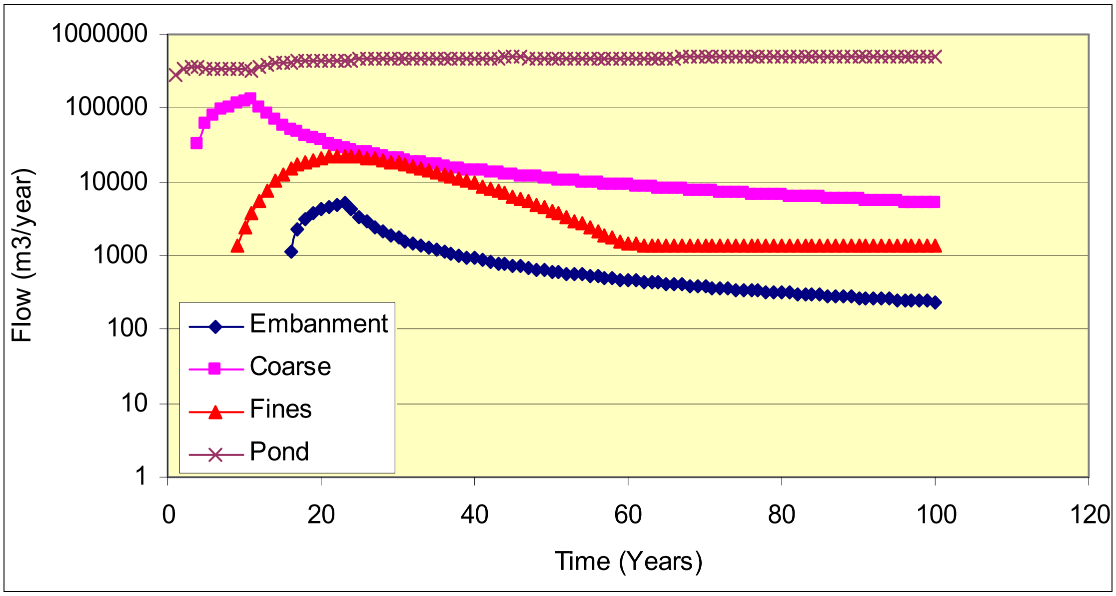

Figure 7-11: Combined Drainage Flows from Infiltration Commencing Year 9 to Year 20

7.2.8 Solute Concentrations in Seepage Water

Oxidation Release Rates and Source Concentrations

To estimate potential metal concentrations in seepage from the tailings, the molar ratios of key elements relative to sulfate were calculated. The results are shown in Table 7.13. Except for antimony, the average of the large scale ASTM humidity cell tests was used to estimate metal release rates. In the case of antimony, the results from the smaller scale MDNR cells were used. As described in Section 4.3.3, the materials used to construct the humidity cells were found to leach antimony but the same was not the case for the MDNR reactor tests.

Table 7-13: Molar Metal to Sulfate Release Ratios Calculated from Humidity Cell Test Results

Ratio	Coarse Tailings	Fine Tailings
Sb/SO_4	$4.0x10^{-5}$	$4.0\ x10^{-5}$
As/SO_4	$2.0\ x10^{-4}$	$4.2\ x10^{-4}$
Cu/SO_4	$1.5\ x10^{-4}$	$1.4\ x10^{-4}$
Ni/SO_4	$6.6\ x10^{-4}$	$6.5\ x10^{-5}$
Zn/SO_4	$1.2\ x10^{-3}$	$6.4\ x10^{-4}$
Co/SO_4	$3.9\ x10^{-5}$	$1.3\ x10^{-5}$
Ca/SO_4	$1.8\ x10^{-1}$	$4.1\ x10^{-2}$
Mg/SO_4	$3.8\ x10^{-1}$	$4.5\ x10^{-1}$
Na/SO_4	$1.1\ x10^{-1}$	$2.3\ x10^{-1}$
K/SO_4	$3.3\ x10^{-1}$	$2.8\ x10^{-1}$
Ag/SO_4	$2.99\ x10^{-6}$	$2.7\ x10^{-6}$
B/SO_4	$5.97\ x10^{-4}$	$8.5\ x10^{-4}$
Be/SO_4	$1.43\ x10^{-4}$	$1.3\ x10^{-4}$
Cd/SO_4	$2.30\ x10^{-6}$	$2.1\ x10^{-6}$
Pb/SO_4	$1.56\ x10^{-6}$	$1.4\ x10^{-6}$
Se/SO_4	$1.63\ x10^{-5}$	$1.5\ x10^{-5}$
Tl/SO_4	$6.31\ x10^{-7}$	$5.8\ x10^{-7}$

As discussed earlier, oxidation rates were estimated from oxygen flux rates into the tailings assuming that all of the oxygen is consumed by sulfide mineral oxidation reactions. By converting the oxidation rates into sulfate generation rates, and then multiplying the ratios presented in Table 7-13, the overall oxidation related metal release within the oxidation zone can be calculated at various times into the future. These release rates were then divided by the infiltration volumes to determine the pore water concentrations for each of the embankment, coarse, and fine tailings areas.

The infiltrating water quality will vary over time. For example, during tailings deposition, the water infiltrating the beaches and embankments will predominantly consist of process water. Post operations, the infiltrating water will reflect unaffected meteoric precipitation. Therefore, to calculate the pore water concentrations, the infiltrating water was assumed to be constant at the estimated process water concentrations shown in Table 7-14. Concentrations were assumed to remain constant for the modeling period. Once deposition ceases, the infiltrating water was assumed to have no dissolved solutes.

Table 7-14: Summary of Assumed Process Water Concentrations

Parameter	Units	Concentration
SO4	mg/L	200
Sb	mg/L	0.015
As	mg/L	0.037
Cu	mg/L	0.012
Ni	mg/L	0.027
Zn	mg/L	0.091
Co	mg/L	0.003
Ca	mg/L	106
Mg	mg/L	26
Na	mg/L	52
K	mg/L	11
Ag	mg/L	0.0012
B	mg/L	0.23
Be	mg/L	0.00054
Cd	mg/L	0.00082
Pb	mg/L	0.0040
Se	mg/L	0.0018
Tl	mg/L	0.0022

Note: Concentrations are based on average for process pond modeling because the process adds low metal loads to the process water as it is re-cycled. Sulfate was calculated from the addition of copper sulfate reagent.

Detailed results of the estimated pore water concentrations are provided in Appendix D.3. The results for Cell 2E beaches are summarized in Table 7-15 and the corresponding summary for Cell 1E beaches are presented in Table 7-16. Calculated pore water concentrations for sulfate, cobalt and nickel are elevated but consistent with the conclusions on metal solubility provided in Section 6.3.2. The sulfate concentrations are consistent with the solubility of gypsum in the presence of magnesium and sodium.

Table 7-15: Summary of Cell 2E Source Concentrations

Time	Embankment Porewater				Coarse Beach Porewater				Fine Tailings Porewater			
	SO_4	Cu	Ni	Co	SO_4	Cu	Ni	Co	SO_4	Cu	Ni	Co
Year	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
1	823	0.075	0.280	0.018	332	0.025	0.081	0.006	230	0.014	0.028	0.003
2	667	0.059	0.217	0.014	332	0.025	0.081	0.006	238	0.015	0.029	0.003
3	741	0.067	0.247	0.016	332	0.025	0.081	0.006	241	0.015	0.029	0.003
4	894	0.082	0.309	0.019	332	0.025	0.081	0.006	229	0.014	0.028	0.003
5	1090	0.102	0.388	0.024	334	0.025	0.082	0.006	230	0.014	0.028	0.003
6	1214	0.115	0.438	0.027	340	0.026	0.084	0.006	238	0.015	0.029	0.003
7	1273	0.121	0.462	0.029	353	0.027	0.089	0.006	241	0.015	0.029	0.003
8	1360	0.130	0.498	0.031	385	0.030	0.102	0.007	229	0.014	0.028	0.003
9	1549	0.149	0.574	0.035	725	0.065	0.240	0.015	245	0.016	0.029	0.003
10	1755	0.170	0.658	0.040	1,040	0.097	0.368	0.023	256	0.017	0.029	0.003
11	1780	0.172	0.668	0.041	1,755	0.170	0.658	0.040	262	0.017	0.030	0.003
12	1791	0.173	0.672	0.041	2,401	0.236	0.919	0.056	243	0.016	0.029	0.003
13	1841	0.179	0.693	0.042	2,554	0.251	0.982	0.060	245	0.016	0.029	0.003
14	1786	0.173	0.670	0.041	2,610	0.257	1.004	0.061	256	0.017	0.029	0.003
15	1809	0.175	0.679	0.041	2,609	0.257	1.004	0.061	262	0.017	0.030	0.003
16	1854	0.180	0.698	0.043	2,557	0.251	0.983	0.060	243	0.016	0.029	0.003
17	1862	0.181	0.701	0.043	2,440	0.240	0.936	0.057	245	0.016	0.029	0.003
18	1903	0.185	0.718	0.044	2,261	0.221	0.863	0.052	256	0.017	0.029	0.003
19	1922	0.187	0.726	0.044	1,982	0.193	0.750	0.046	262	0.017	0.030	0.003
20	1943	0.189	0.734	0.045	1,556	0.150	0.577	0.035	243	0.016	0.029	0.003
21	1965	0.191	0.743	0.045	1,559	0.150	0.578	0.035	245	0.016	0.029	0.003
22	1967	0.191	0.743	0.045	3,434	0.341	1.339	0.081	280	0.019	0.030	0.003
24	1967	0.191	0.744	0.045	3,414	0.339	1.331	0.080	288	0.020	0.031	0.003
27	1968	0.192	0.744	0.045	3,446	0.342	1.343	0.081	262	0.017	0.030	0.003
30	1968	0.192	0.744	0.045	3,483	0.346	1.359	0.082	200	0.012	0.027	0.003
33	1968	0.192	0.744	0.045	3,532	0.351	1.378	0.083	200	0.012	0.027	0.003
36	1968	0.192	0.744	0.045	3,596	0.357	1.404	0.085	200	0.012	0.027	0.003
39	1969	0.192	0.744	0.045	3,571	0.355	1.394	0.084	200	0.012	0.027	0.003
42	1969	0.192	0.744	0.045	3,843	0.382	1.504	0.091	200	0.012	0.027	0.003
45	1969	0.192	0.744	0.045	4,031	0.401	1.580	0.095	200	0.012	0.027	0.003
48	1969	0.192	0.744	0.045	4,371	0.436	1.718	0.103	313	0.022	0.032	0.003
51	1969	0.192	0.744	0.045	4,864	0.486	1.918	0.115	202	0.012	0.027	0.003
54	1969	0.192	0.744	0.045	5,582	0.559	2.210	0.133	201	0.012	0.027	0.003
57	1969	0.192	0.744	0.045	5,582	0.559	2.210	0.133	202	0.012	0.027	0.003
60	1969	0.192	0.744	0.045	5,583	0.559	2.210	0.133	202	0.012	0.027	0.003
63	1969	0.192	0.744	0.045	5,583	0.559	2.210	0.133	202	0.012	0.027	0.003
66	1769	0.180	0.717	0.043	5,383	0.548	2.183	0.130	2	0.000	0.000	0.000
69	1756	0.179	0.712	0.042	5,383	0.548	2.183	0.130	113	0.011	0.004	0.001
72	1719	0.175	0.697	0.042	5,383	0.548	2.183	0.130	2	0.000	0.000	0.000
75	1654	0.168	0.671	0.040	5,383	0.548	2.183	0.130	1	0.000	0.000	0.000
78	1552	0.158	0.629	0.038	5,384	0.548	2.183	0.130	2	0.000	0.000	0.000
81	1429	0.145	0.580	0.035	5,385	0.548	2.183	0.130	2	0.000	0.000	0.000
84	1282	0.130	0.520	0.031	5,386	0.548	2.184	0.130	2	0.000	0.000	0.000
87	1108	0.113	0.449	0.027	5,390	0.548	2.186	0.130	2	0.000	0.000	0.000
90	930	0.095	0.377	0.023	5,396	0.549	2.188	0.131	113	0.011	0.004	0.001
93	767	0.078	0.311	0.019	5,406	0.550	2.192	0.131	2	0.000	0.000	0.000
96	628	0.064	0.255	0.015	5,423	0.552	2.199	0.131	1	0.000	0.000	0.000
99	515	0.052	0.209	0.012	5,287	0.538	2.144	0.128	2	0.000	0.000	0.000

Table 7-16: Summary of Cell 1E Source Concentrations

Time	Embankment Porewater				Coarse Beach Porewater				Fine Tailings Porewater			
	SO_4	Cu	Ni	Co	SO_4	Cu	Ni	Co	SO_4	Cu	Ni	Co
(year)	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L	mg/L
9	823	0.075	0.280	0.018	462	0.0383	0.1336	0.0089	279	0.0190	0.0303	0.0032
10	502	0.042	0.150	0.010	515	0.0437	0.1548	0.0102	202	0.0118	0.0272	0.0026
11	906	0.083	0.313	0.020	749	0.0674	0.2496	0.0158	201	0.0117	0.0272	0.0026
12	1136	0.107	0.407	0.025	1407	0.1345	0.5167	0.0318	202	0.0118	0.0272	0.0026
13	1298	0.123	0.472	0.029	2020	0.1969	0.7654	0.0466	202	0.0118	0.0272	0.0026
14	1488	0.143	0.549	0.034	2164	0.2114	0.8234	0.0501	202	0.0118	0.0272	0.0026
15	1421	0.136	0.522	0.032	2232	0.2184	0.8513	0.0517	202	0.0118	0.0272	0.0026
16	1481	0.142	0.546	0.034	2271	0.2224	0.8669	0.0527	279	0.0190	0.0303	0.0032
17	1618	0.156	0.602	0.037	2295	0.2248	0.8765	0.0532	202	0.0118	0.0272	0.0026
18	1744	0.169	0.653	0.040	2172	0.2123	0.8269	0.0503	201	0.0117	0.0272	0.0026
19	1903	0.185	0.718	0.044	1989	0.1937	0.7526	0.0458	202	0.0118	0.0272	0.0026
20	1924	0.187	0.726	0.044	1707	0.1649	0.6381	0.0390	202	0.0118	0.0272	0.0026
21	1943	0.189	0.734	0.045	1279	0.1214	0.4647	0.0287	202	0.0118	0.0272	0.0026
22	1963	0.191	0.742	0.045	2767	0.2728	1.0679	0.0647	202	0.0118	0.0273	0.0026
24	1965	0.191	0.743	0.045	2769	0.2731	1.0690	0.0647	313	0.0221	0.0317	0.0034
27	1966	0.191	0.743	0.045	2771	0.2733	1.0697	0.0648	202	0.0118	0.0273	0.0026
30	1967	0.191	0.744	0.045	2772	0.2734	1.0703	0.0648	201	0.0117	0.0272	0.0026
33	1968	0.191	0.744	0.045	2773	0.2735	1.0707	0.0648	202	0.0118	0.0273	0.0026
36	1768	0.180	0.717	0.043	2574	0.2619	1.0438	0.0623	202	0.0002	0.0001	0.0000
39	1768	0.180	0.717	0.043	2575	0.2620	1.0441	0.0623	202	0.0002	0.0001	0.0000
42	1768	0.180	0.717	0.043	2575	0.2620	1.0442	0.0623	202	0.0002	0.0001	0.0000
45	1768	0.180	0.717	0.043	2576	0.2621	1.0444	0.0623	113	0.0105	0.0045	0.0009
48	1769	0.180	0.717	0.043	2762	0.2810	1.1200	0.0668	113	0.0002	0.0001	0.0000
51	1769	0.180	0.717	0.043	3101	0.3156	1.2576	0.0750	204	0.0001	0.0000	0.0000
54	1769	0.180	0.717	0.043	3594	0.3657	1.4574	0.0870	253	0.0002	0.0001	0.0000
57	1769	0.180	0.717	0.043	4312	0.4388	1.7485	0.1043	313	0.0082	0.0035	0.0007
60	1769	0.180	0.717	0.043	4312	0.4388	1.7486	0.1043	399	0.0372	0.0158	0.0031
63	1769	0.180	0.717	0.043	4313	0.4388	1.7487	0.1043	406	0.0378	0.0161	0.0032
66	1769	0.180	0.717	0.043	4313	0.4388	1.7488	0.1043	407	0.0379	0.0161	0.0032
69	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
72	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
75	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
78	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
81	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
84	1769	0.180	0.717	0.043	4313	0.4389	1.7488	0.1043	407	0.0379	0.0161	0.0032
87	1769	0.180	0.717	0.043	4313	0.4389	1.7489	0.1044	384	0.0357	0.0152	0.0030
90	1770	0.180	0.718	0.043	4313	0.4389	1.7490	0.1044	360	0.0335	0.0143	0.0028
93	1712	0.174	0.694	0.041	4315	0.4391	1.7497	0.1044	315	0.0293	0.0125	0.0025
96	1606	0.163	0.651	0.039	4319	0.4395	1.7515	0.1045	316	0.0294	0.0125	0.0025
99	1491	0.152	0.605	0.036	4328	0.4404	1.7549	0.1047	319	0.0297	0.0127	0.0025

Predicted Concentrations in Horizontal Drains and at Cell 1E Seepage Recovery Barrier

Using the pore water concentrations presented in the preceding section and the seepage flow rates, the seepage water quality was estimated for the water collected in the horizontal drains and at the Cell 1E Seepage Recovery Barrier (Figure 7-6). As discussed, the seepage water comprises seepage from the dam embankment, the coarse tailings beach, the fine tailings beach and the pond. Because the horizontal drains for Cell 2E are located within the LTVSMC tailings, the initial seepage will also contain LTVSMC pore water. For the purpose of this assessment it was assumed that the 'balance of seepage', i.e. total seepage less the seepage from the different sources will be LTVSMC pore water for the first seven years. Thereafter it was assumed that most of the porewater will have been displaced and that the pore water would reflect pond water quality. The estimated solute concentrations in the LTVSMC pore water and the pond water were as shown in Table 7-17. The estimated concentrations of key parameters in water collected in the horizontal drains and at the Cell 1E Seepage Recovery Barrier are summarized the following sections. Detailed results are provided in Appendix D.4.

Table 7-17: Summary of LTVSMC Tailings Pore Water and Pond Water Concentrations

Parameter	Units	LTVSMC Porewater	Pond Water
SO_4	mg/L	183	234
Sb	mg/L	0.0030	0.015
As	mg/L	0.0021	0.037
Cu	mg/L	0.0024	0.012
Ni	mg/L	0.0022	0.027
Zn	mg/L	0.010	0.091
Co	mg/L	0.0013	0.0026
Ca	mg/L	69	106
Mg	mg/L	81	26
Na	mg/L	97	52
K	mg/L	15	11
Ag	mg/L	0.0010	0.0012
B	mg/L	0.23	0.23
Be	mg/L	0.0002	0.0005
Cd	mg/L	0.0002	0.0008
Pb	mg/L	0.0071	0.0040
Se	mg/L	0.0020	0.0018
Tl	mg/L	0.0020	0.0022

Cell 2E – Horizontal Drains

Time profiles for the estimated sulfate, copper and nickel, and cobalt concentrations in seepage expected to be collected in the Cell 2E horizontal drains are shown in Figure 7-12. As shown, the concentration profiles indicate and initial peak concentration at about Year 12. A secondary peak is predicted to occur between about Year 60 and Year 80. To understand the development of these concentration profiles it is necessary to review the total volume of water from each source that will report to the horizontal drains. Figure 7-13 shows the combined flows from each of the sources for Year 1-8 and for the period Year 9 and above. The total represents the combined flows from all sources. Figure 7-14 illustrates the LTVSMC tailings pore water (Year 1 to 7) and the pond water flows, and the total volume of seepage collected in the horizontal drains. As shown in these plots, the initial peak in the concentrations occurs when the flow from the coarse tailings from the Year 1 to 8 period reaches a maximum. The secondary peak coincides with the maximum flows from the fine tailings beach from the period above Year 9. At that time, the embankment flows are also approaching its maximum. The source concentrations of the embankments are elevated and even at low flows have a significant impact on the water quality.

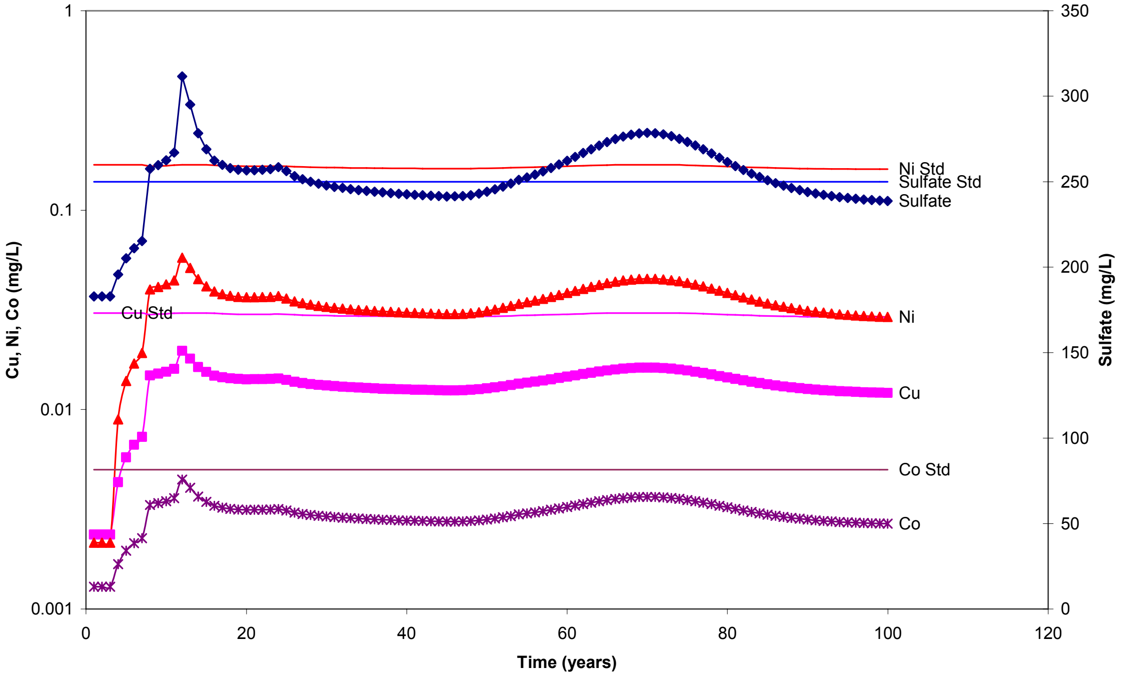

Figure 7-12: Estimated Sulfate, Cobalt, Copper and Nickel Concentrations in Seepage Collected in the Cell 2E Horizontal Drains

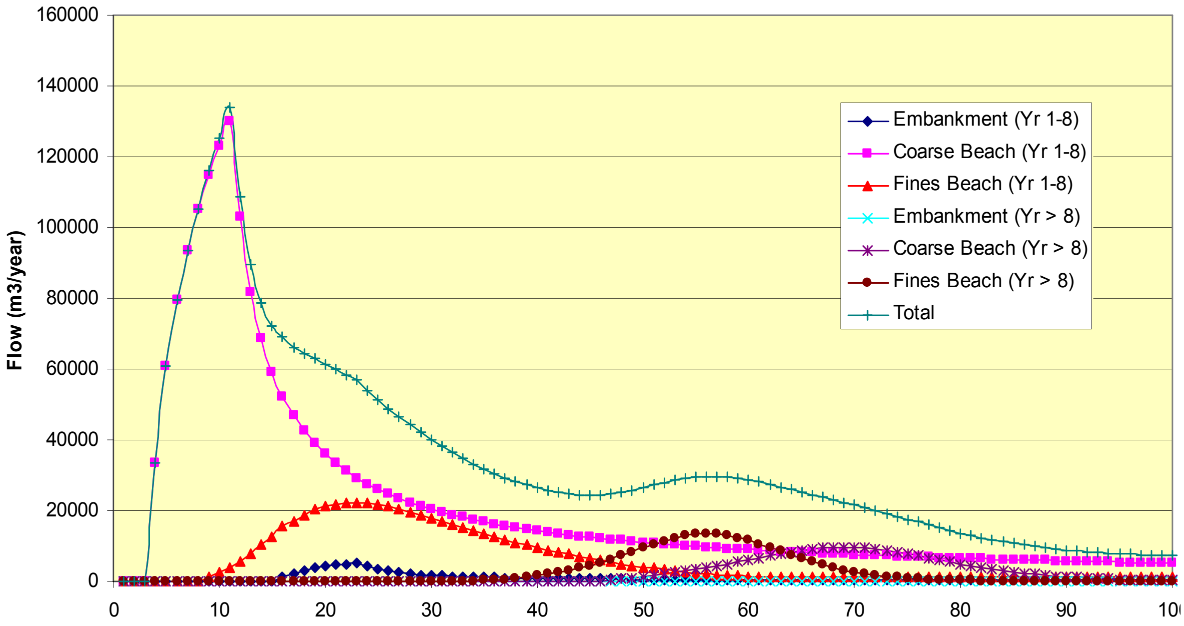

Figure 7-13: Estimated Flows Contributing to Seepage in the Cell 2E Horizontal Drains

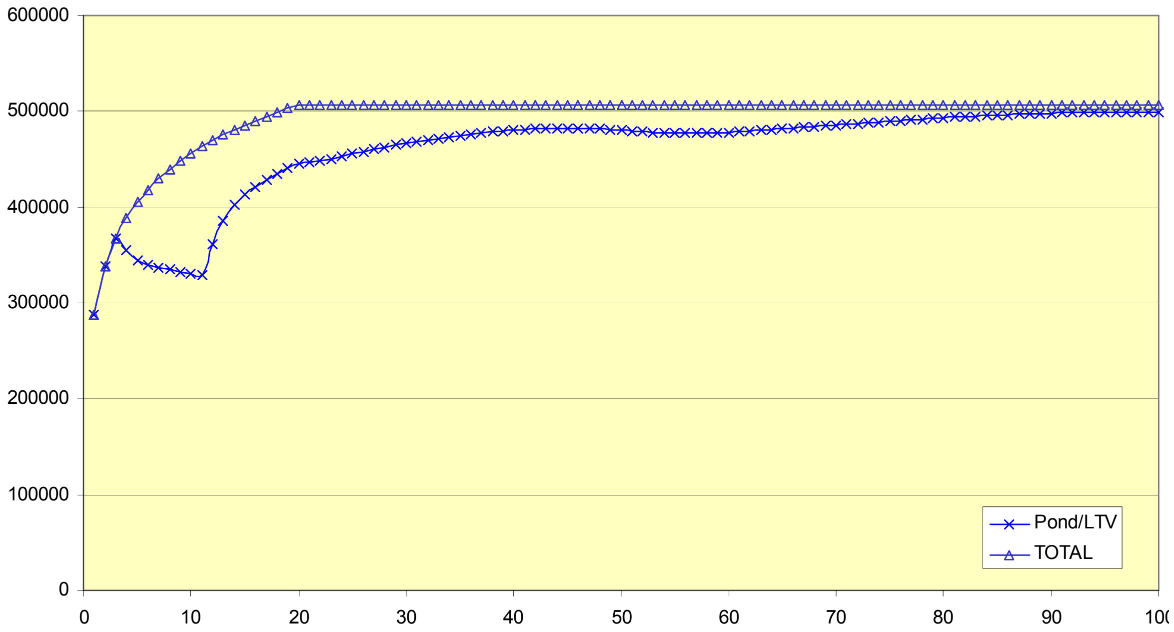

Figure 7-14: Estimated LTVSMC Porewater and Pond Water Flows Contributing to Seepage in the Cell 2E Horizontal Drains. Axis units are same as Figure 7-14.

Cell 1E Seepage to Horizontal Drains

Time profiles for the estimated sulfate, copper and nickel, and cobalt concentrations in seepage expected to be collected in the Cell 1E horizontal drains are shown in Figure 7-16. As shown, the concentration profiles indicate concentrations are predicted to increase rapidly from about Year 16 onwards. Peak concentrations are expected to occur at about Year 26 after which concentrations are expected to decrease again, to reach a plateau after about Year 35. These peak concentrations are caused by seepage originating from the coarse tailings beach.

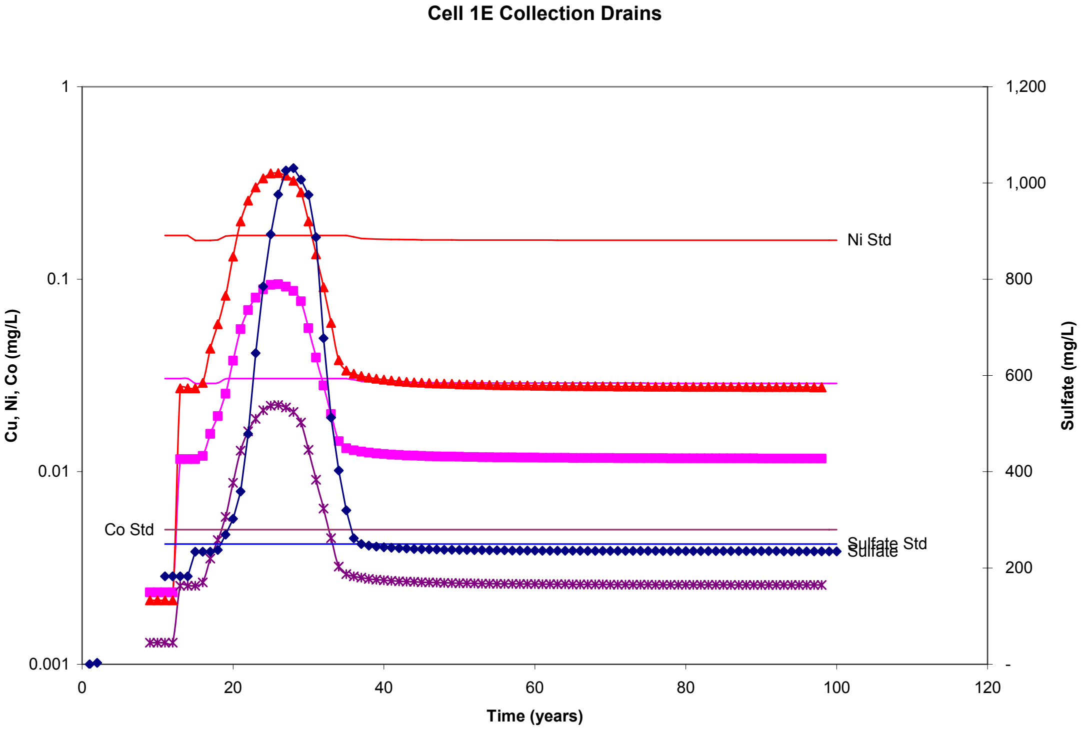

Figure 7-15: Estimated Sulfate, Cobalt, Copper and Nickel Concentrations in Seepage to Cell 1E Horizontal Drains

Cell 1E Seepage to Recovery Barrier

Time profiles for the estimated sulfate, copper and nickel, and cobalt concentrations in seepage expected to be collected in the Cell 1E seepage recovery barrier are shown in Figure 7-17. As with the horizontal drains collection system, the concentration profiles indicate concentrations are predicted to increase rapidly from about Year 16 onwards. However, maximum concentrations are substantially lower than those estimated for the Cell 1E horizontal drains due to significantly higher pond seepage contributions. Peak concentrations are expected to occur at about Year 26 after which concentrations are expected to decrease again, to reach a plateau after about Year 35. As with the horizontal drains, peak concentrations are caused by seepage originating from the coarse tailings beach.

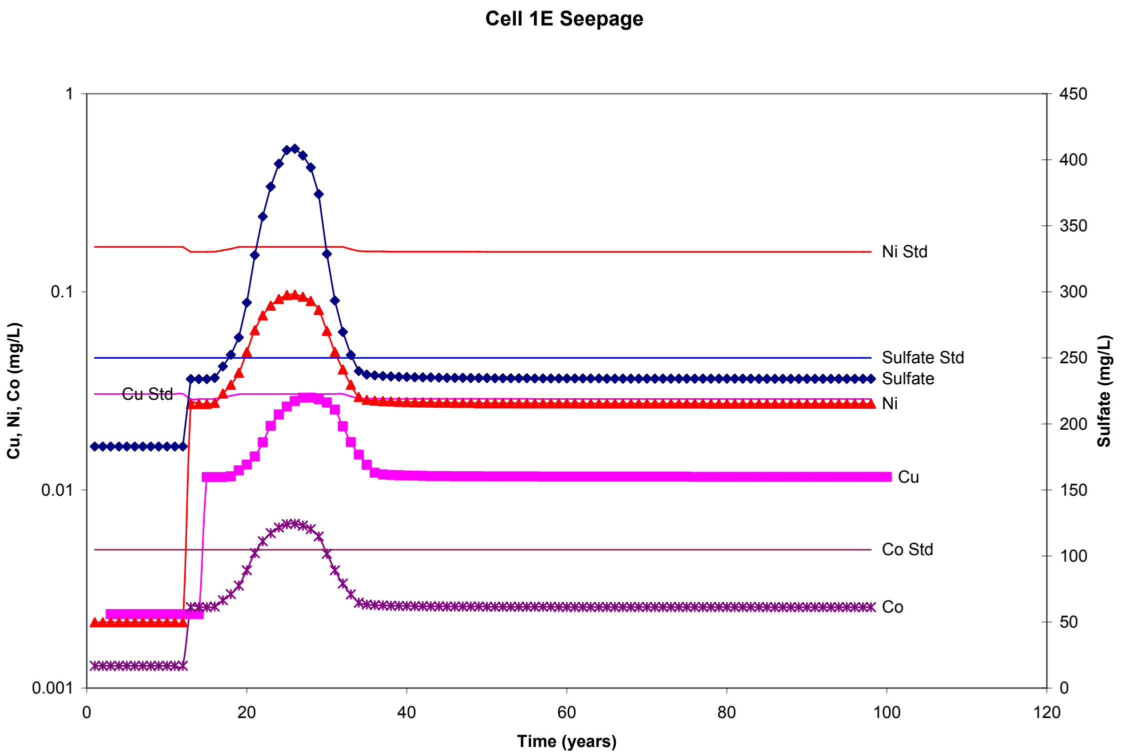

Figure 7-16: Estimated Sulfate Concentrations in Recovery Barrier Seepage from Cell 1E

7.3 Process Pond Model

7.3.1 Explanation of Modeling Approach

The water chemistry model couples water balance and chemical inputs to the operating tailings basin as described in RS13 (Barr 2007c). The model is calculated on a monthly time step, with the main output being the calculated chemical concentrations in the tailings basin at the end of each month. All calculations are done in Excel spreadsheets.

The tailings basin is subdivided into three separate cells (or basins): 2W, 1E and 2E. Only Cells 1E and 2E receive tailings and process water during operations. The model's flow components for Cells 1E and 2E are shown in Figure 7-18. The model simulates the effects of depositing tailings in only one cell (2E) for the first eight years (single pond operation) with Cell 1E used as a clear water basin to clarify flows prior to being returned to the process plant. After eight years, Cells 1E and 2E will merge and be operated as single pond.

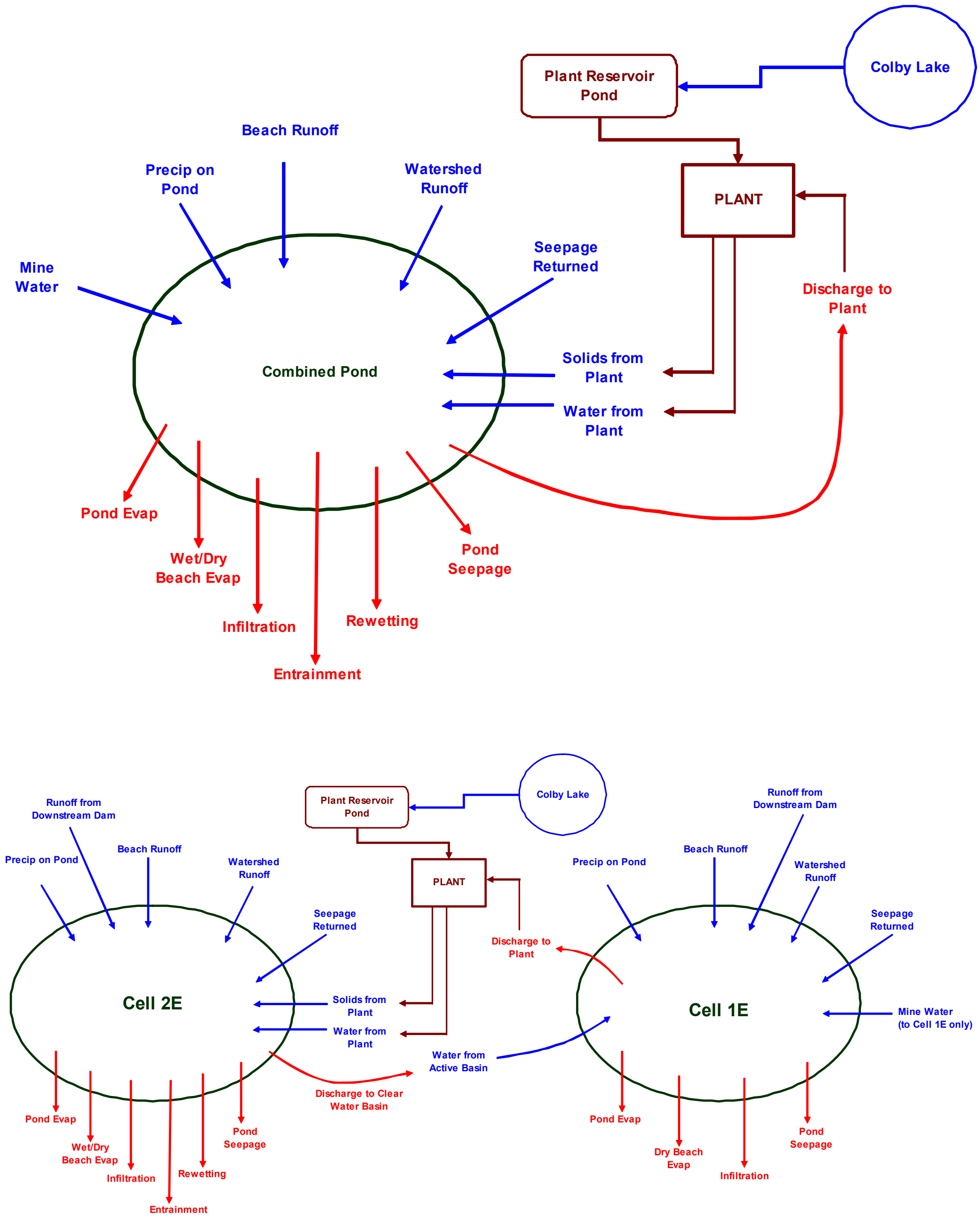

Figure 7-17: Water and Load Balance Components for Combined and Two Pond Operations

The overall flow balance is constrained by the required tailings beach and the associated water volume to maintain the beach. Each month, the net inflow (or outflow) to the basin is calculated such that the desired water volume (and beach) is maintained:

$$Net\,Monthly\,Inflow = \sum Inflows - \sum Outflows = Desired\,Volume\,Change$$

The variable that is changed to maintain the desired volume in each basin is either the reclaim to the flotation plant or the overflow to the inactive basin (Years 1 to 8).

The coupled load balance is represented as follows:

1. Load at the start of the month:

$$Load\,at\,Start\,of\,Month\,(L_1) = Concentration\,\,at\,Start\,of\,Month \times Volume\,\,in\,Pond\,at\,Start\,of\,Month$$

2. Load added to pond for each inflow:

$$Total\,Load\,added\,to\,Pond\,(L_2) = \sum \left[Inflows \times Concentration \right]$$

3. New concentration in pond assuming no outflows other than evaporation and rewetting:

$$Concentration_{NEW} = \frac{Load\,at\,Start\,of\,Month\,(L_1) + Load\,\,Added\,to\,Pond\,(L_2)}{Volume\,in\,Pond\,at\,Start\,of\,Month\,(V_1) + \sum Inflows\,(V_2)}$$

4. Load removed from pond at newly calculated concentration:

$$Load\,\,\mathrm{Re}moved\,\,from\,Pond\,(L_3) = \sum \left[Outflows \times Concentration_{NEW} \right]$$

5. Concentration at end of month is then the same as above-calculated concentration:

$$Concentration_{END} = \frac{Load\,at\,Start\,of\,Month\,(L_1) + Load\,\,Added\,(L_2) - Load\,\mathrm{Re}moved\,(L_3)}{Volume\,\,in\,Pond\,at\,Start\,of\,Month\,(V_1) + \sum Inflows\,(V_2) - \sum Outflows\,(V_3)}$$

The calculation of concentration assumes the ponds are perfectly mixed and that there is no load in the ponds at the beginning of the model. The model does not currently consider chemical attenuation effects, which could include precipitation of solids due to build-up of load in the pond and sorption effects that could serve to remove trace metal components. The model is therefore conservative from this standpoint.

The water and load balance in the flotation plant is calculated separately. The water inputs include reclaim from the inactive basin and make-up water from Colby Lake. Water from Colby Lake is adjusted in the model to maintain the required inflow to the flotation plant (see below). The balance does not consider the small change in flow and load losses when operating in Concentrate Mode.

The total inflows to and from the plant are set to the same values for the entire operations period, as provided in RS13 (Barr 2006):

$$\text{Inflow} = 1971\ \text{m}^3/\text{hr}$$
$$\text{Outflow} = 1986\ \text{m}^3/\text{hr}$$

The plant water balance is represented by:

$$\sum Inflows = \sum Outflows$$

The slightly higher water outflow from the plant is balanced by adding a small volume of water to the inputs so that the inflow is equal to the outflow. No load is associated with this inflow.

The load to the plant is calculated by combining the water inflows and associated chemical concentrations, along with the loads due to ore and reagents:

$$Total\ Load\ Added\ to\ Plant = \sum \left[Inflows \times Concentration \right] + Ore\ Load + \mathrm{Re}agent\ Load$$

The concentration of the plant water at the end of the month is calculated as follows (where the outflow is the value listed above):

$$Concentration_{END} = \frac{Load\ Added\ to\ Plant}{Outflow}$$

This concentration is then used to calculate the load added to the tailings pond from the plant for the following month.

All calculated metal concentrations are indicated as equivalent to “filtered” values. However, some of the parameters for watershed runoff and seepage return are totals as filtered values were not available. Unfiltered or “total” metal concentrations will be higher in the pond waters due to the presence of suspended matter.

7.3.2 Inputs to Water Quality Model

Solids and Water Balances

The solids and water balance has been calculated separately and are provided in RS13 (Barr 2007c). This calculation considers the operation of the pond, climatic effects and hydrogeological conditions in the vicinity of the pond. The load balance spreadsheet uses the flow and water balance information in RS13 (Barr 2007c) as an input.

Inputs to Loading Balance

The following sections describe the inputs to the load balance. Inputs were selected to be conservative so that calculated concentrations in the pond are reasonable worst case.

- Tailings Discharge

For the first month of the model, the tailings discharge load exiting from the flotation plant is calculated by multiplying the outflow from the plant by the concentrations derived from the pilot plant. In subsequent months, the tailings discharge chemistry is calculated from the load added as water passes through the flotation plant, as described in the previous section. The total load to the flotation plant is:

Load Withdrawn from Tailings Pond

+ Load Leached from Ore

+ Load Added by Reagents

+ Load in Colby Lake water

The concentration of the tailings discharge water at the end of the month is calculated by taking this total load and dividing it by the outflow from the plant during the month. This concentration is then equal to the beginning of month concentration for the following month. The load from the tailings discharge to the tailings pond is calculated by multiplying the beginning of month concentration of the plant water and the flow from the plant during the month.

  - Ore Leaching

The contribution from ore as it is processed is expected to include dissolution of oxidation products and direct leaching of ore in the process by reaction of the sulfide minerals with the process waters. The latter factor cannot be readily quantified. The pilot plant testing (RS32, Barr 2006a) was performed on a core composite that had been exposed in some cases for several years, therefore, the pilot plant water chemistry data reflected the combination of both dissolution of oxidation products and reaction during processing. The approach taken to include the effect of ore leaching was therefore to calculate leached load based on weathering prior to arrival at the flotation plant (as described below) and compare this to the load contributed by ore leaching in the pilot plant. The calculation was performed using sulfate because this is expected to be chemically conserved in the process.

Because the calculated effect of leaching of oxidation products was more than the measured contribution from ore leaching in the pilot plant, the calculation proceeded using the calculated leaching effect.

The load leached from the ore was calculated using humidity cell results for the three ore samples (RS42, SRK 2007b). This load was calculated using the following:

Load = Maximum Average Rate of Leaching (mg/tonne/month) x

Temperature Factor (unitless) x

Ore Production (tonnes/month) x

Particle Size Factor (unitless) x

Exposure Period (months) x

(1 - Leaching Factor) (unitless)

The maximum average leaching rate was calculated based on the period of testing equivalent to the exposure factor. Tabulated rates used in the calculation are provided in Table 7-18. Conservatively, the input used to the calculations was the maximum of the three averages.

The temperature factor accounts for the lower overall average temperatures at the site compared to laboratory temperatures, and the approximate reduction in oxidation rates indicated by the Arrhenius Equation. The factor used was 0.3.

Table 7-18: Ore Weathering Rates

Ore Composite	Units	P1	P2	P3	Maximum
Acidity	mg/kg/week	1.2	1.2	1.3	1.3
Alkalinity	mg $CaCO_3$/kg/week	5.5	5	8.5	8.5
Hardness	mg $CaCO_3$/kg/week	26	19	23	26
F	mg/kg/week	0.062	0.024	0.026	0.062
Cl	mg/kg/week	0.11	0.1	0.11	0.11
SO_4	mg/kg/week	24	16	17	24
Al	mg/kg/week	0.019	0.013	0.025	0.025
Sb	mg/kg/week	0.0027	0.0027	0.0024	0.0027
As	mg/kg/week	0.0017	0.00091	0.00074	0.0017
Ba	mg/kg/week	0.0051	0.0037	0.0053	0.0053
Be	mg/kg/week	0.000095	0.000095	0.0001	0.0001
B	mg/kg/week	0.0065	0.0091	0.014	0.014
Cd	mg/kg/week	0.000019	0.000019	0.000021	0.000021
Ca	mg/kg/week	8.2	5.1	6.4	8.2
Cr	mg/kg/week	0.000095	0.000095	0.0001	0.0001
Co	mg/kg/week	0.00029	0.00022	0.00045	0.00045
Cu	mg/kg/week	0.002	0.0017	0.0017	0.002
Fe	mg/kg/week	0.0053	0.0067	0.0055	0.0067
Pb	mg/kg/week	0.000024	0.000024	0.000026	0.000026
Mg	mg/kg/week	1.6	1.5	1.5	1.6
Mn	mg/kg/week	0.0069	0.0042	0.0064	0.0069
Mo	mg/kg/week	0.000024	0.000024	0.000026	0.000026
Ni	mg/kg/week	0.0044	0.0042	0.011	0.011
Se	mg/kg/week	0.000095	0.000095	0.0001	0.0001
Ag	mg/kg/week	0.000024	0.000024	0.000026	0.000026
Zn	mg/kg/week	0.0006	0.00048	0.00051	0.0006

Ore production is indicated by the mine plan described in RS18 (PolyMet 2006e).

The particle size factor accounts for the difference in particle size of ore prior to crushing in the plant compared to the standard particle size of crushed ore in the humidity cell test. The factor used was 0.2. This indicates the average weathering and oxidation rate of ore at the site can be represented by a rate that is 20% of the laboratory measured rate.

The exposure period is the time the ore is exposed to weathering prior to being processed. This period starts when the ore is first exposed by removal of adjacent rock. This period was set as 6 months and was estimated by PolyMet based on the mine plan. This reflects the expected maximum time that ore will be exposed in the walls prior to being blasted and trucked to the rail transfer hopper. Time spent in the rail transfer hopper is relatively short.

The leaching factor accounts for rinsing of soluble load that will occur as rock is exposed to infiltration in the pit walls and rail transfer hopper over a 6 month time period. The factor was set as 0.5. This indicates that 50% of load will be leached and report to the pit or rail transfer hopper water collection system whereas the balance will remain to contribute to the tailings pond water. These loads are included in the water quality predictions provided elsewhere for these sources RS31 – Pit Water Quality (SRK 2007c), RS42 – Waste Rock Water Quality (SRK 2007b).

The effect of dissolution of explosives residues was based on the explosives recipe provided in the Mine Plan (RS18, PolyMet 2006). The overall mixture of emulsion, oxidizer and ANFO (ammonium nitrate and fuel oil) will contain 67% ammonium nitrate. Explosive use will be 0.33 lbs/ton, or 3720 lbs/blast hole. PolyMet have estimated that explosives losses will occur mainly from spillage at the point of loading the blast holes, and that the estimated spillage is 2 lbs/hole, or 0.05% of total explosives use. For safety reasons, PolyMet is committed to re-firing or explosives recovery for blast holes that do not detonate and therefore losses from this source were assumed to be negligible.

Contribution from explosives residues was calculated by assuming that all residues will be leached from the rock as it passes through the processing plant. In reality, some portion of the residues will be leached in the ore stockpile.

- Reagent Contribution

The only reagent that is expected to contribute to metal and sulfate concentrations is copper sulfate. The process will involve addition of 55 g/t copper sulfate pentahydrate ($CuSO_4.5H_2O$). Because the purpose of addition of copper sulfate is to activate pyrrhotite and improve flotation by reaction of copper with the pyrrhotite surfaces, only the sulfate portion was added to the load contributed by the flotation plant. The Pilot Plant test confirmed that this was an appropriate assumption. The pilot plant showed that copper load was removed from the process waters as they were re-cycled through the plant (RS29T, Barr 2007b).

- Colby Lake Water

The load added by Colby Lake is included based on the flow and concentrations. Concentrations used in the calculation are shown in Table 7-19. Data were not available for some parameters. If data were found for watershed runoff, these were applied to Colby Lake. In the absence of watershed runoff data, the seepage data were used. Few analytical results were available for nitrogen forms and low level mercury data were not available. Concentrations of nitrogen forms were entered as 0.1 mg/L.

Table 7-19: Averages for Colby Lake, Watershed Runoff and Seepage Pumpback Water Chemistry

Parameter	Unit	Watershed Runoff	Colby Lake
Alkalinity	mg/L as CaCO3	290	36
Cl	mg/L	3.3	6.1
F	mg/L	0.84	0.26
Hardness	mg/L as CaCO3	340	91
SO4	mg/L	33	53
Al	mg/L	-	0.31
Sb	mg/L	-	-
As	mg/L	-	0.0014
Ba	mg/L	-	-
Be	mg/L	-	-
B	mg/L	0.14	-
Cd	mg/L	-	0.000054
Ca	mg/L	40	23
Cr	mg/L	-	-
Co	mg/L	0.0013	0.00051
Cu	mg/L	0.0022	0.0048
Fe	mg/L	0.1	0.84
Pb	mg/L	-	0.00049
Mg	mg/L	52	8.3
Mn	mg/L	0.9	-
Hg	mg/L	0.0002	0.0002
Ni	mg/L	0.0026	0.0028
K	mg/L	3.3	1.7
Se	mg/L	-	0.0009
Ag	mg/L	-	-
Na	mg/L	11	6.3
Tl	mg/L	-	-
Zn	mg/L	-	0.0069
TDS	mg/L	440	130

Notes:

“-“ indicates insufficient data or not analyzed. In calculations, concentrations were assumed to be zero.

- Precipitation

Precipitation incident on the tailings basin will fall on open water or bare tailings. Water falling on open water is assumed to be pure H_2O.

Water falling on exposed tailing beaches can be expected to dissolve soluble products of weathering and oxidation. Tailings particle sizes are expected to vary from coarse near the dams to fine near the pond due to particle size segregation as the tailings flow from the discharge point. Conservatively, the weathering rate applied to the beaches was calculated based on the maximum rates observed in testwork on the three tailings size fractions. The contribution of tailings weathering is a function of the exposed area of tailings. To estimate this affect for the short term when tailings will only briefly be exposed and wet due to placement, laboratory-measured humidity cell rates were expressed as $mg/m^2/month$, where m^2 reflects the aerial exposure of tailings and the load contribution was calculated using the area of exposed tailings as calculated in the water balance.

The area-based rates used in the calculation are shown in Table 7-20. These rates are based on the first six months of the testing and do not include the effects of accelerated nickel and cobalt leaching because there is an operational commitment to ensure that tailings are not exposed for more than six months. Because the rates are based on laboratory experiments, the six month period is conservative because weathering rates will be lower under site conditions.

- Watershed Runoff from Adjacent Areas

  The chemistry of water entering the pond as runoff from adjacent areas was based on data for sampling location WS009 reported in RS64 (Barr 2006d, Table 4) (Table 7-19). The input values used were averages because these are measured rather than predicted values. As shown, data were not available for a number of parameters. If data were available for Colby Lake, those values were used. If no data were available for Colby Lake, the values shown for groundwater were used in the prediction. Few analytical results were available for nitrogen forms and low level mercury data were not available. Concentrations of nitrogen forms were entered as 0.1 mg/L.

- Seepage Return

  The calculation of the chemistry of seepage returned to the impoundment from the horizontal drains is provided in Section 7.2.8.

- Make-up Water

Make-up water will originate from the Waste Water Treatment Facility (WWTF). The derivation of this water chemistry is provided in RS29T (Barr 2007b). Concentrations are provided in Table 7-21.

Table 7-20: Tailings Weathering Rates

		Maximum Average Rates		
Parameter	Unit	Coarse Tailings	Fine Tailings	Maximum Rate Used in Calculations
Alkalinity	mg as $CaCO_3/m^2$/month	2400	2500	2500
Cl	mg/m^2/month	26	25	26
F	mg/m^2/month	2.9	3.0	3.0
Hardness	mg as $CaCO_3/m^2$/month	3100	3500	3500
SO_4	mg/m^2/month	1000	1600	1600
Al	mg/m^2/month	7.1	7.5	7.5
Sb	mg/m^2/month	0.28	0.25	0.28
As	mg/m^2/month	2	0.096	2
Ba	mg/m^2/month	0.12	0.14	0.14
Be	mg/m^2/month	0.012	0.012	0.012
B	mg/m^2/month	2.1	1.8	2.1
Cd	mg/m^2/month	0.0024	0.0024	0.0024
Ca	mg/m^2/month	940	1100	1100
Cr	mg/m^2/month	0.016	0.018	0.018
Co	mg/m^2/month	0.009	0.011	0.011
Cu	mg/m^2/month	0.23	0.17	0.23
Fe	mg/m^2/month	1.2	2.0	2.0
Pb	mg/m^2/month	0.012	0.0094	0.012
Mg	mg/m^2/month	210	190	210
Mn	mg/m^2/month	0.71	0.8	0.8
Hg	mg/m^2/month	0.0013	0.0012	0.0013
Mo	mg/m^2/month	0.066	0.053	0.066
Ni	mg/m^2/month	0.16	0.15	0.16
K	mg/m^2/month	230	240	240
Se	mg/m^2/month	0.014	0.013	0.014
Ag	mg/m^2/month	0.003	0.003	0.003
Na	mg/m^2/month	75	67	75
Tl	mg/m^2/month	0.0016	0.0012	0.0016
Zn	mg/m^2/month	0.11	0.11	0.11

Table 7-21: Make-Up Water Chemistry from Waste Water Treatment Facility

Parameter	units	Year 1	Year 5	Year 10	Year 15	Year 20
Flow	gpm	674	1313	1378	875	1159
Hardness	mg/L	97	255	468	895	443
F	mg/L	0.29	0.39	0.86	1.83	1.60
Cl	mg/L	1.60	4.61	4.77	3.09	2.27
SO$_4$	mg/L	121	243	258	338	240
Al	mg/L	0.010	0.036	0.08	0.14	0.067
As	mg/L	0.004	0.008	0.008	0.020	0.012
Ba	mg/L	0.023	0.037	0.039	0.068	0.045
Be	mg/L	0.00029	0.00033	0.00047	0.00060	0.00041
B	mg/L	0.07	0.14	0.15	0.23	0.17
Cd	mg/L	0.0011	0.0010	0.0017	0.0023	0.0011
Ca	mg/L	150	150	150	150	150
Cr	mg/L	0.00062	0.0009	0.0010	0.0011	0.0011
Co	mg/L	0.00045	0.00121	0.0048	0.0092	0.0045
Cu	mg/L	0.00052	0.00113	0.0163	0.043	0.040
Fe	mg/L	0.046	0.086	0.080	0.034	0.027
Pb	mg/L	0.0015	0.0062	0.0069	0.013	0.008
Mg	mg/L	0.52	1.58	4.15	7.41	3.46
Mn	mg/L	0.0022	0.0051	0.0079	0.014	0.0086
Hg	mg/L	$5.0\mathrm{x}10^{-6}$	$5.5\ \mathrm{x}10^{-6}$	$6.4\ \mathrm{x}10^{-6}$	$1.1\ \mathrm{x}10^{-5}$	$7.7\ \mathrm{x}10^{-6}$
Mo	mg/L	0.0020	0.0036	0.0038	0.0036	0.0043
Ni	mg/L	0.0065	0.0126	0.039	0.076	0.042
P	mg/L	0.0072	0.012	0.012	0.025	0.014
K	mg/L	3.77	6.54	6.24	12.6	7.7
Se	mg/L	0.0012	0.0017	0.0018	0.0020	0.0020
Si	mg/L	0.59	0.84	0.59	1.45	0.92
Ag	mg/L	0.00043	0.00072	0.00076	0.00071	0.00086
Na	mg/L	14.8	58.3	44.0	117	72
Tl	mg/L	0.00070	0.0012	0.0013	0.00094	0.0014
Zn	mg/L	0.036	0.13	0.21	0.32	0.16
NO$_3$	mg/L	0.051	0.13	0.13	0.023	0.012
NH$_4$	mg/L	0.051	0.13	0.13	0.023	0.012

Loading Balance Outputs

The majority of water outputs (return to flotation plant, entrainment in tailings interstices, infiltration and loss through seepage) are assigned the calculated chemistry of the pond. The exceptions are evaporation (no load assigned) and beach wetting (assigned flotation plant water chemistry).

7.3.3 Results

Water Chemistry Prediction as a Function of Time

The water balance is described in RS13 (Barr 2007c). Flows to both cells are shown in Figure 7-19. The process plant provides the majority of water to both ponds and provides a constant loading resulting mainly from leaching of ore as it is processed but also Colby Lake water. The next largest sources of water are the treated water from the mine area and direct precipitation. The volume of water from the mine site reflects both increases in the footprint of disturbed area at the mine site (initial flow increases), and decreases in flow due to completion of mining in the East Pit, use of West Pit water to fill the East Pit and decrease in requirement for treatment due to reclamation. Seepage pumpback and precipitation on the tailings beaches are lesser sources of flow.

Predicted concentrations for sulfate, hardness, copper and nickel are shown in Figure 7-19. Listings for all parameters for which water quality standards are provided in Appendix D.5. The water quality standards are applicable in the receiving waters. During permitting, water quality discharge limits are developed to maintain the standards. Because the point of compliance is typically at a facility boundary, allowance can be made for mixing zones and site specific standards can be developed, a conservative assumption is that the water discharge limits will be no less than the water quality standard. PolyMet is not proposing a discharge but the water quality standards are used as water quality objectives for the project.

The predicted trend is for concentrations to sharply increase. The initial increase results from assuming that initial pond waters are very dilute. As concentrations increase, loss of water from the system (primarily by entrainment in the tailings pores) also removes load which balances the load added to the pond. The long term trends are different for each parameter and reflect different inputs as described in the following sections.

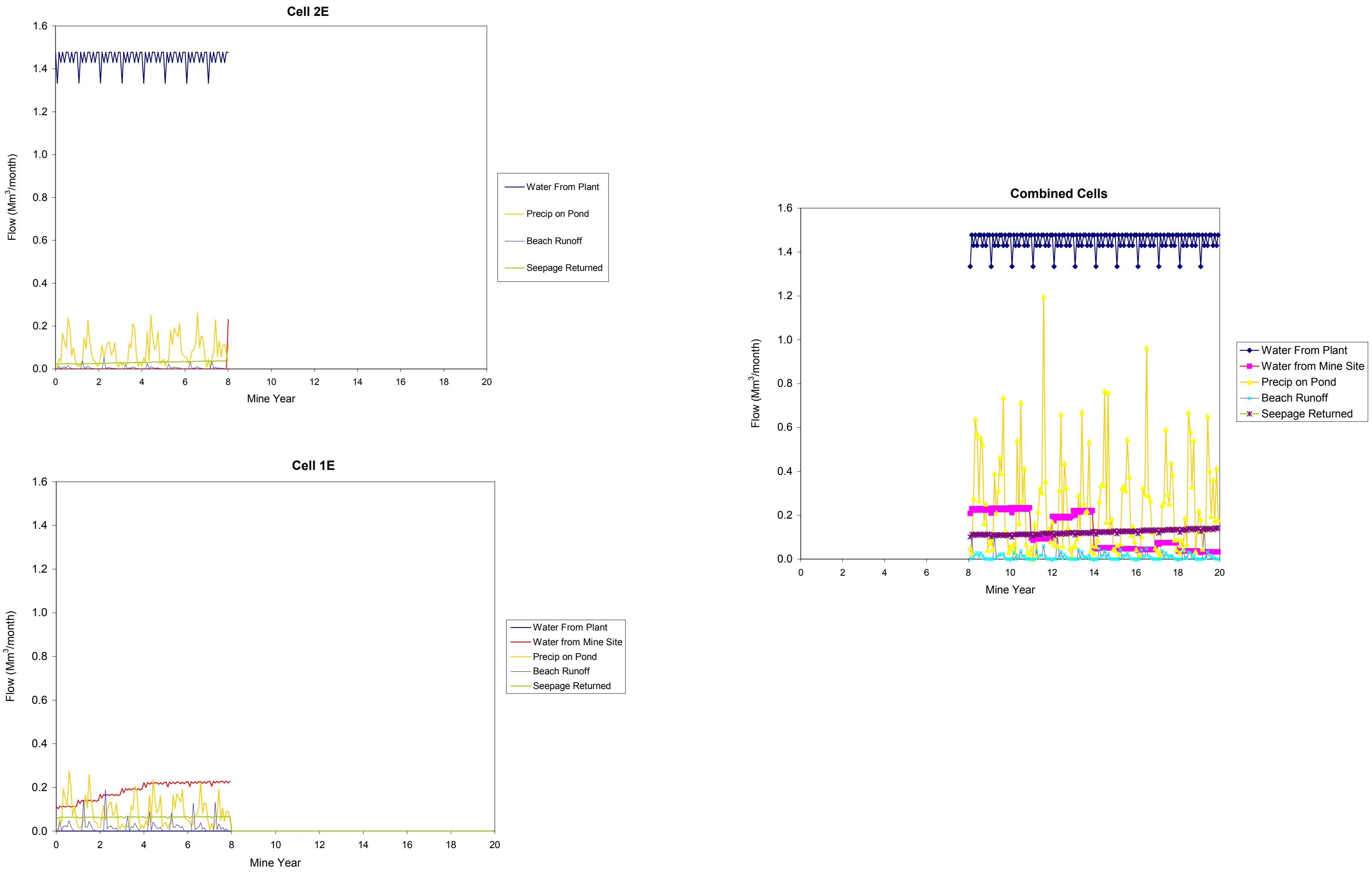

Figure 7-18: Flow Sources to Tailings Cells.

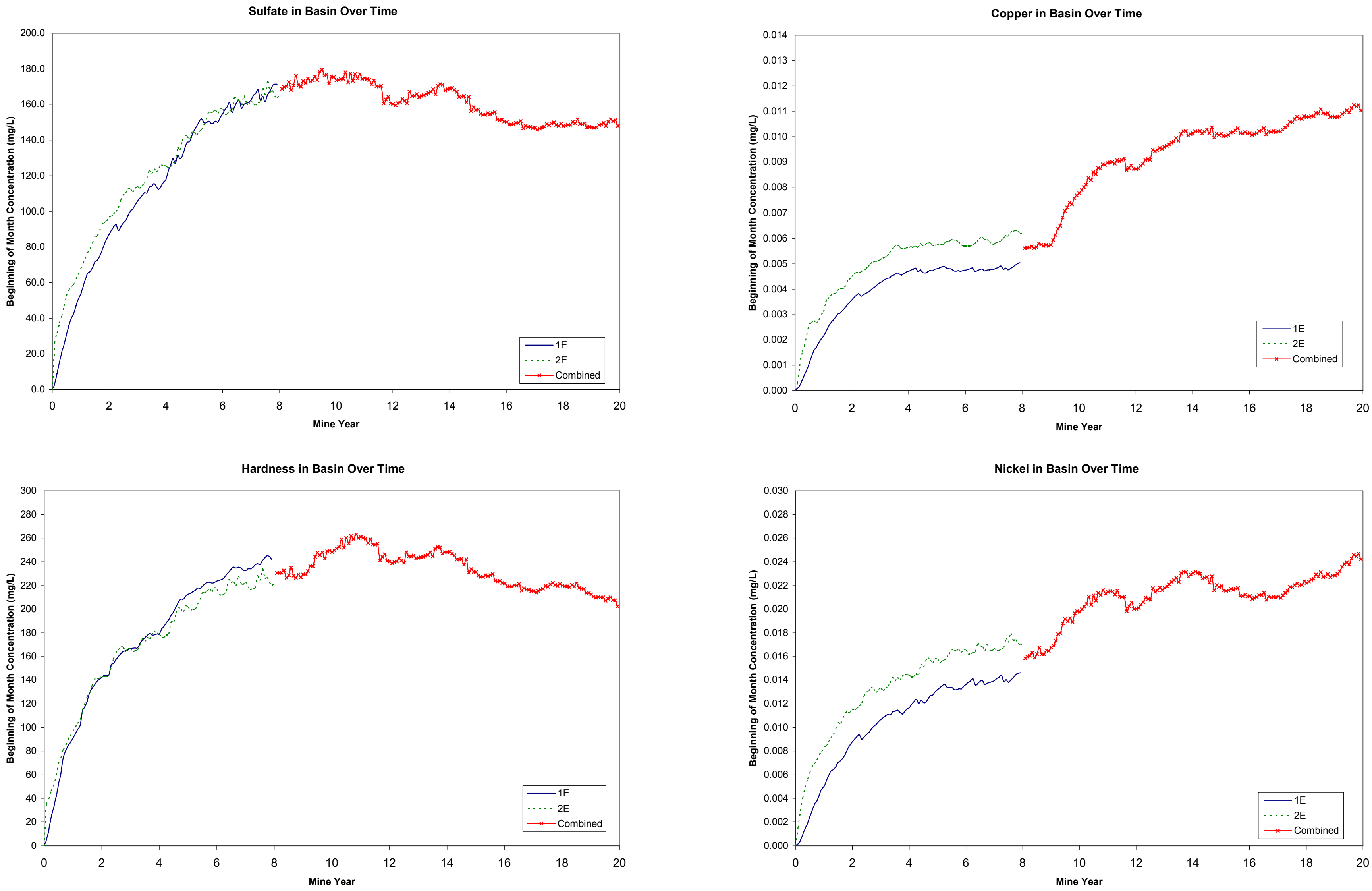

Figure 7-19: Predicted Sulfate, Hardness, Copper and Nickel in Tailings Ponds

The sulfate trend shows concentrations reaching a maximum of 180 mg/L in the combined pond in year 10 followed by a general decrease and then stabilization at about 150 mg/L. The main sources of added sulfate discharging to the pond are the WWTF flow which varies from 121 mg/L (Years 1 to 4) to 338 mg/L (Years 15 to 19), and seepage pumpback from the 2E horizontal drains (peaking over 300 mg/L during the operational period. The 1E horizontal drains do not show peak sulfate until after Year 20. Recirculation of water through the plant and addition of load by ore leaching results in accumulation of load. The hardness trend (i.e. calcium and magnesium) is similar to sulfate for the same reasons.

The copper trend was different from sulfate. Copper trended upward reaching maximum concentrations of 0.011 mg/L. Initial loadings to the pond are low and the main factor causing the increase is accumulation of load due to re-circulation through the mill. The increase in concentrations that occur in about Year 9 is due to a predicted increase in copper concentrations in WWTF effluent (from 0.001 mg/L to 0.016 mg/L). Copper loading from the Cell 2E horizontal drains also increases at about the same time. Copper concentrations are predicted to be below the hardness based water quality standard.

Likewise most of the initial accumulation of nickel load can be accounted for by re-circulation of water through the plant. Contributions from ore leaching and discharge from the WWTF are similar. The increase in nickel concentrations at Year 10 is due to increase in nickel in the WWTF discharge (from 0.01 mg/L to 0.04 mg/L in Year 15). Also, later in operations, nickel loading from Cell 1E and 2E horizontal drains becomes important. Nickel concentrations are predicted to be below the hardness based water quality standard. Cobalt (not shown) has a comparable trend to nickel and maximum predicted concentrations of 0.002 mg/L are expected to be below the water quality standard of 0.005 mg/L.

Overall predictions indicate that the tailings pond water can meet water quality objectives for most parameters by controlling the chemistry of WWTF effluent. Parameters for which water quality objectives are predicted to be exceeded are manganese, silver and thallium. The predictions for manganese are driven by naturally elevated concentrations in natural concentrations in surface water (Table 7-19) and groundwater (Table 4-1). Thallium and silver predictions are affected by the use of analytical detection limits above (thallium) or at (silver) their respective standards for some chemical balance inputs.

Mercury concentrations were not predicted for the pond due to the lack of low level analyses for several sources. Contact with tailings in the plant is expected to result in control of mercury concentrations in the pond. Testwork performed for RS54 showed that mercury concentrations in contact with tailings are between 2 and 5 ng/L. Likewise, NTS (2006) showed that contact with regional rain water containing 10 ng/L resulted in a similar range of concentrations. Pond concentrations are expected to be in the same range or less.

Effect of Lined vs. Un-Lined Disposal Basins

The Detailed Project Description assumes the basins will be constructed without liners. The effect of liners was not considered.

Sensitivity Analysis

To assess the sensitivity of the predictions for process water in the tailings ponds, the proportion of loadings from each source Year 8 (last year of single pond deposition) and Year 20 (last year of operation) was evaluated (Table 7-22).

For sulfate, the largest single source in Year 8 is the mine site water (40%), following by comparable loads from ore leaching, the use of copper sulfate in the process, make-up water from Colby Lake and total seepage collection. Colby Lake is a relatively large flow at low concentration. Toward the end of the operating period, reduced flow from the ine site (due to reclamation efforts and use of treated water to flood the West Pit) reduces the contribution from this source and total seepage becomes the main source (43%). Make-up water from Colby Lake continues to contribute significantly in Year 20 (21%).

The pattern of increasing contribution from seepage return is apparent for the three metals shown. In Year 20, the total loading from seepage is 60%, 51% and 59% for cobalt, copper and nickel, respectively. At the same time, the contribution from the mine site decreases to become insignificant at Year 20. The contribution from other sources varies by parameter. For cobalt, 40% of load in Year 8 comes from Colby Lake make-up and watershed runoff. For copper, Colby Lake and watershed runoff account for 55% of the load. For nickel, ore leaching is the dominant load in Year 8 (60%), and is second to seepage return in Year 20 (32% compared to 59%).

Table 7-22: Proportion of Loads by Source Contributing to the Process Water in the Tailings Pond

Year	Ore	Reagent	1E Seepage	2E Seepage	Colby Lake	Watershed Runoff	Tailings Beaches	Mine Site
SO_4								
8	0.12	0.14	0.07	0.05	0.17	0.05	0.01	0.40
20	0.13	0.14	0.35	0.08	0.21	0.00	0.02	0.06
Co								
8	0.26	0.00	0.07	0.04	0.18	0.22	0.00	0.23
20	0.19	0.00	0.52	0.08	0.16	0.01	0.01	0.03
Cu								
8	0.30	0.00	0.06	0.02	0.45	0.10	0.02	0.05
20	0.16	0.00	0.43	0.07	0.30	0.00	0.04	0.00
Ni								
8	0.60	0.00	0.02	0.01	0.10	0.04	0.01	0.23
20	0.32	0.00	0.53	0.06	0.06	0.00	0.01	0.02

This review indicates that reagent contributions and runoff from tailings beaches are relatively small loading sources for metals. Potentially the more significant sources in terms of loading are ore, tailings seepage collected in horizontal drains, Colby Lake and mine site water. Colby Lake is more a source of dilution but it affects the base level available to assimilate the load contributed by other sources.

The ore term is "worst" case because it is based on the highest rate of ore leaching observed in testwork. Because the samples under test had been oxidized in core boxes longer than will be exposed in the mine prior to mining, the leaching rates indicated by the tests are also likely to be worse than would naturally be observed.

The seepage terms contain several conservative factors, some of which may over-state leaching from the tailings seepage source. These include:

- The calculation of oxidation profile development assumed that coarse tailings are uniformly of the same particle size. No allowance for fine and coarse layers was included which would increase moisture content and reduce oxygen penetration.
- Long term (decades) rates of metal leaching were based on metal leaching effects observed in testwork which are known to be short-lived (years).
- No allowance for attenuation of metals within the NorthMet Project tailings deposit or in the materials below the tailings was included.
- Colby Lake is a significant source but its loading contribution is well-defined. The chemistry of the lake has been measured and the volume of make-up water is defined by the metallurgical process.

The contribution from the mine site is influenced by prediction of the water quality from the waste rock stockpiles and mine pits, and the ability of the water treatment process to achieve the concentrations used to predict process pond water quality. As discussed in RS42 (SRK 2007b) and RS31 (SRK 2007c), the waste rock and open pit predictions are based mainly on the conservative use of 95th percentile weathering rates and consequently are considered "reasonable worst case". Furthermore, water treatment studies are based on known and well demonstrated technology.

In conclusion, the predictions are expected to be sensitive mainly to the seepage return term and water from the mine site but both sources were estimated using methods that were reasonable worst case for loadings. Actual loadings are expected to be lower than calculated.

7.4 Seepage to Groundwater

The final step in the water quality prediction is for all uncollected seepage flowing north and northwest into groundwater toward the Embarrass River. This uncollected seepage water is predicted to not be intercepted by the Cell 2E horizontal drains or the other seepage collection systems. For Years 1 to 8, this reflects the operation of Cell 2E for tailings disposal and Cell 1E as the clear water pond. Following Year 8, the seepage originates from the combined pond and the seepage chemistry reflects the influence of tailings deposition occurring in the original Cell 2E and Cell 1E. The uncollected seepage and groundwater that flows beneath the tailings facility are only to the north and northwest.

Time profiles for the estimated sulfate, copper and nickel, and cobalt concentrations in seepage to groundwater are shown in Figure 7-20. As shown, the seepage water quality is expected to vary little over time. The seepage water quality is expected to mainly be dominated by the pond water quality. All concentrations are predicted to be below water quality standards with the exception of manganese, silver and thallium, for the reasons discussed previously.

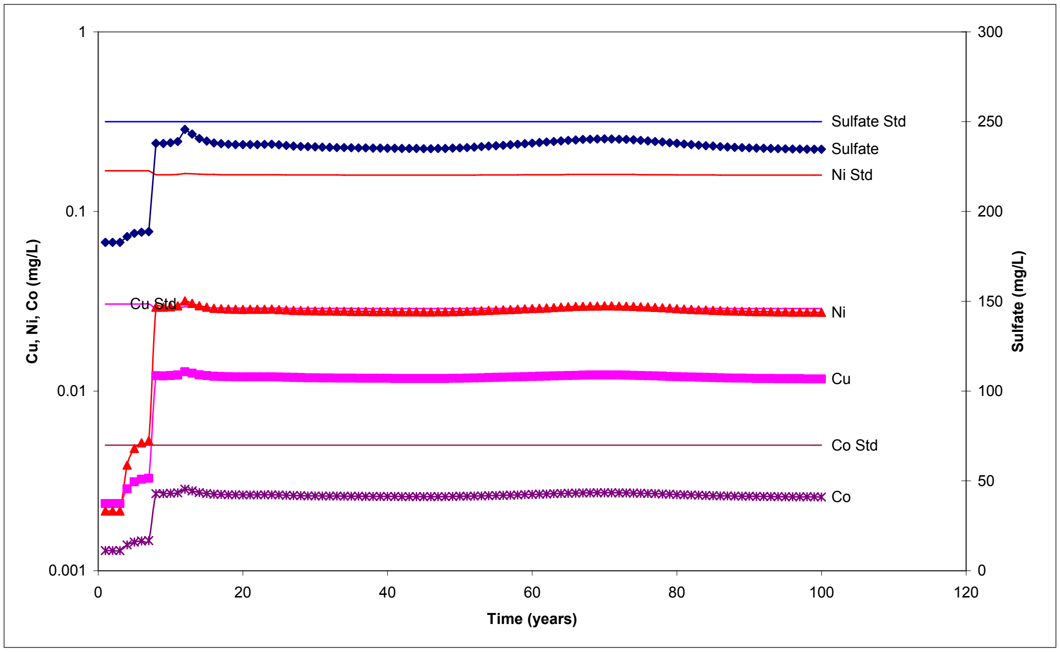

Figure 7-20: Estimated Sulfate, Cobalt, Copper and Nickel Concentrations in Seepage to Groundwater

8 Conclusions

The following conclusions have been reached based on historical testwork completed by the MDNR and PolyMet's recent project-specific characterization of tailings:

- Pilot plant testwork showed that the proposed flotation process can produce tailings containing much less than 0.2% sulfur. This level of sulfur can be achieved using copper sulfate to improve flotation of pyrrhotite.

- Tailings from the NorthMet Project containing negligible carbonate which is consistent with the origin of the mineral deposit.

- Four years of testwork on tailings containing 0.2% sulfur from the Babbitt Deposit produced by Cominco Ltd. did not result in acidic leachate despite depletion of over 50% of sulfur.

- The explanation for the lack of acidic leachate is that alkalinity produced by weathering of silicates exceeds the acidity produced by oxidation of sulfides.

- Geochemical predictions supported by the MDNR's 18 years of testwork on waste rock samples discussed in RS42 shows that at the sulfur concentrations expected in the NorthMet tailings, alkalinity produced by weathering of silicates will always exceed acid produced by oxidation of sulfides.

- Small decreases in pH near 7 appear to cause short term (several months) peaks in nickel and cobalt leaching possibly due to dissolution of silicate weathering products. This effect has been demonstrated by MDNR testwork conditions that artificially depressed pH in the tailings, and PolyMet testwork on coarse (>200 mesh) tailings samples.

- Provided that sulfur concentration in tailings produced using copper sulfate to enhance flotation of pyrrhotite remain below 0.2%, tailings pHs are expected to remain above pH 5.5.

- Column testwork showed that the LTVSMC taconite tailings are more leachable in terms of major ion chemistry than the PolyMet tailings. PolyMet tailings are expected to leach more nickel than the LTVSMC tailings but the LTVSMC removed nickel from the NorthMet tailing water.

- Predictions of tailings seepage chemistry show that water chemistry collected in the horizontal drains will exceed water quality standards for some parameters.

- Water collected at Cell 1E seepage recovery barrier will only exceed the sulfate standard and marginally the cobalt standard. The predictions did not consider metal attenuation and are based on worst case assumptions, therefore actual exceedances for cobalt are not expected.

- A mass balance model for the water in the operational tailings impoundment showed that concentrations should be below water quality standards for most parameters. Silver and thallium could not be reliably predicted because analytical detection limits for some inputs were above the standards. Manganese exceeds it standard due to naturally elevated concentrations in surface water and groundwater.

- All uncollected seepage from the tailings basin will flow with groundwater to north and northwest toward the Embarrass River. Overall, it is predicted that this water will not exceed water quality standards except for manganese, silver and thallium for the reasons indicated previously.

9 References

Barr Engineering Co. 2006a. RS32 – Plant Environmental Results – Part 1, Liquids and Solids Sampling Flotation Report. Report prepared for PolyMet Mining Inc. January 2006.

Barr Engineering Co. 2006b. RS32 – DRAFT – Environmental Sampling and Analysis Flotation Process Optimization Test. Report prepared for PolyMet Mining Inc. January 2006.

Barr Engineering Co. 2006c. RS63 - PolyMet Mining Baseline Surface Water Quality Information Report. Technical Memo prepared for PolyMet Mining Inc. February, 2006.

Barr Engineering Co. 2006d. RS64 – Existing Tailings Basin Water Information. Technical Memo prepared for PolyMet Mining Inc. February, 2006.

Barr Engineering Co. 2007a. RS39/40T - Tailings Basin Geotechnical and Design. Report prepared for PolyMet Mining Inc. February 2007.

Barr Engineering Co. 2007b. RS29T – Waste Water Treatment Technology. Report prepared for PolyMet Mining Inc. February 2007.

Barr Engineering Co. 2007c. RS13 – Process Design – Tailings Basin Water Balance. Report prepared for PolyMet Mining Inc. March 2007.

Bethke, C.M. 2005. The Geochemist's Workbench® Release 6.0 Reaction Modeling Guide - A User's Guide to React and Gtplot. Hydrogeology Program. University of Illinois.

Berndt, M.E., Lapakko, K.A. and Jakel, E.M. 1999. In-pit disposal of taconite tailings: geochemistry. Final Report. MN Dept. Natural Resources, Division of Minerals, St. Paul, MN.

Cussler, E., 1997. Diffusion, Mass Transfer in Fluid Systems, 2nd ed. Cambridge Univ. Press, Cambridge, UK.

Drever, J.I., 1982. The Geochemistry of Natural Waters. Prentice-Hall, Inc. 388p.

Elberling, B., R.V.Nicholson, E.J.Reardon and P.Tibble, Evaluation of sulphide oxidation rates. Nordic Hydrology, 24(5), 323-338, 1993.

Folman, J. 2006a. RE: Drainage quality files. Email to S. Day transmitting drainage chemistry data for MDNR testwork on Babbitt and Dunka Road (NorthMet Deposit) rock and tailings samples. November 9, 2006.

Folman, J. 2006b. RE: Drainage quality files. Email to S. Day transmitting drainage chemistry data (alkalinity and acidity data) for MDNR testwork on Babbitt and Dunka Road (NorthMet Deposit) rock and tailings samples. November 20, 2006.

Golightly, J. 1981. Nickeliferous laterite deposits, In Skinner, B., ed., Seventy-Fifth Anniversary Volume: Englewood, CO, Economic Geology Publishing Co., pp. 710-735.

Lapakko, K.A. 1993. Laboratory Dissolution of Drill Core Samples of Duluth Complex Rock. Report to the US Bureau of Mines, Salt Lake City Research Center. MN Dept. Natural Resources, Division of Minerals, St. Paul, MN. 28p.

Lapakko, K.A. and Antonson, D.A. 2006. Laboratory Dissolution of Duluth Complex Rock from the Babbitt and Dunka Road Prospects. Status Report. MN Dept. Natural Resources, Division of Lands and Minerals, St. Paul, MN. 35p. October 2006.

Lapakko, K.A., Antonson, D., Folman, J. and Johnson, A. 2002. Assessment of Test Methods for Waste Rock Dissolution and Laboratory Drainage Quality from Duluth Complex Rock. Report on Contract BLM JSP012002 to the U.S. Bureau of Land Management, Salt Lake City Office. MN Dept. Natural Resources, Division of Minerals, St. Paul, MN. 63p.

Lapakko, K.A., Antonson, D., Leopold and E., Berndt, M.E. 2001. Mine Waste Characterization and Drainage Mitigation. Research Summary 2001. MN Dept. Natural Resources, Division of Lands and Minerals, Reclamation Section, St. Paul, MN. 58p.

Lapakko, K.A. and White, W.W. 2000. Modification of the ASTM 5744-96 Kinetic Test. In Proceedings from the Fifth International Conference on Acid Rock Drainage. 639p.

MDNR. 2004a. Duluth Complex Mine Waste Drainage. MN Dept. Natural Resources, Division of Lands and Minerals, Reclamation Section, St. Paul, MN. March 2004.

MDNR 2004b. Drainage from Copper-Nickel Tailings: Summary of a Three-Year Field Study. MN Dept. Natural Resources, Division of Lands and Minerals, St. Paul, MN. 17p.

MEND. 1991. Acid Rock Drainage Prediction Manual. Mine Environment Neutral Drainage Program. Report 1.16.1b.

NorthEast Technical Services Inc. 2006. Bench Scale Mercury Testing Report. Prepared for PolyMet Mining Corp. May 2006.

Paktunc, A.D. 1999. Mineralogical constraints on the determination of neutralization potential and prediction of acid mine drainage. Environmental Geology. Volume 39, pp.103-112.

PolyMet Mining Company. 2006. RS18 – Mine Plan. Report prepared for PolyMet Mining Inc. December 2006.

PolyMet Mining Inc. 2007. ER03 - PolyMet NorthMet Geology and Resource Background, August 2006 (Revised January 2007). PolyMet Project Description Support Document. January 2007.

Scharer, JM; Nicholson, RV; Halbert, B; Snodgrass, W. 1994. A computer program to assess acid generation in pyritic tailings. ACS Symposium Series. 1994.

Schmiermund, R. 2006. No Subject. Email transmitting thermodynamic data for nickel silicates to S. Day, MDNR Staff and ERM Staff. December 15, 2006.

SRK Consulting 2004. Analysis and Prediction of Long Term Attenuation of Metal Loadings Holden Mine, Washington State. Reported prepared for URS Corporation. February 2004.

SRK Consulting. 2006. Flotation Tailings and Hydrometallurgical Residue Geochemical Characterization Plan NorthMet Project, Minnesota". Prepared for PolyMet Mining Corp. May 2006.

SRK Consulting. 2007a. RS65 – Reactive Residue Water Quality Model. Report prepared for PolyMet Mining Inc. February 2007.

SRK Consulting. 2007b. RS42 – Wastewater Modeling – Waste Rock and Lean Ore. Report prepared for PolyMet Mining Inc. February 2007.

SRK Consulting. 2007c. RS31 – Mine Pit Water quality Model. Report prepared for PolyMet Mining Inc. July 2007.

White, W.W. and Lapakko, K.A. 2000. Preliminary Indications of Repeatability and Reproducibility of the ASTM 5744-96 Kinetic Test for Drainage pH and Sulfate Release Rate. In: Proceedings from the Fifth International Conference on Acid Rock Drainage. 630p.

M.D. Wunderly, D.W. Blowes, E.O. Frind, C.J. Ptacek. 1996. Sulfide mineral oxidation and subsequent reactive transport of oxidation products in mine tailings impoundments: A numerical model. Water Resour. Res. Vol. 32 , No. 10 , p. 3173.

This report, **1UP005.001 – RS54/RS46 – Waste Water Modelling – Tailings, NorthMet Project - DRAFT,** was prepared by SRK Consulting (Canada) Inc.

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Appendices

Appendix A

LTVMSC Tailings Drilling Program

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Memo

To:	Jennifer Engstrom, MDNR	**Date:**	September 23, 2005
cc:	Jim Scott, PolyMet John Borovsky, Barr	**From:**	Stephen Day
Subject:	Drilling Program LTVSMC Tailings Area	**Project #:**	1UP005.001

Jennifer

As a follow-up to our meeting on September 14, 2005, PolyMet, SRK and MDNR have designed a program to obtain initial samples for characterization of LTVSMC tailings. These data are needed to design the laboratory column testing on the interaction of NorthMet Project tailings water with the LTVSMC tailings. This memorandum describes the program.

1 Background and Program Design

Review of the history of deposition at the tailings area indicates that the tailings are a result of processing ore feed from several pits and working faces in those pits. The ore was blended by truck delivery to loading pockets and then train delivery to crusher. Once in the plant ore was further blended in the coarse ore bins by a coarse ore tripper which continuously spread coarse ore across 7 fine crushing lines and in the fine ore bins by a fine ore tripper which continuously spread fine ore across 34 mill lines. The fine ore was then processed through 34 mill lines in parallel. The tailings are a recombination from the 34 mill lines pumped to the basin and discharged at many spigots at the periphery of the basin. The tailings were deposited over many years as many layers in the basin.

Since deposition occurred at the periphery, tailings near the margins are likely to be coarse whereas slimes tailings in the center of the impoundment will be finer. Based on this distribution, the preferential pathway for groundwater flow from the impoundment will be through the dam tailings along the beaches. This zone will likely have the higher groundwater velocities, shorter flow path and smaller contact area for attenuation reactions. Actual flow paths will depend on internal layering in the tailings, and the design and operating plan for management of NorthMet Project Tailings. Overall, material in the beaches represents the least favourable conditions for attenuation reactions.

Based on this history and conceptual flow model, a few deep holes in the dam and extending to the slimes area should provide an initial indication of the physical, chemical and mineralogical variations due to historical deposition and particle size segregation.

PolyMet is not aware of any existing characterization data that will allow the location of the proposed holes to be specifically selected to capture known variability. Therefore, a line of holes will be drilled perpendicular to the dam where access is favourable and safe. Once a tailings basin construction and operating plan has been finalized, submitted and approved, additional drilling can be defined to more fully characterize the variability in the basin.

2 Field Program

PolyMet will mobilize a geoprobe to the site. This rig advances a 2” core barrel producing continuous solid core for logging and sampling. The approximate proposed drilling locations are shown in Figure 1[1].

One hole will be drilled in the dam area of Cell 2E (Figure 1) where flow from the disposal area will be focussed and where tailings are expected to be coarse. Five additional holes will be drilled perpendicular to this location extending into the slimes area. If practical all holes will be advanced to the foundation. The penetration depth of the geoprobe is approximately 80’. As indicated above, actual locations will be selected based on access and safety considerations in the field.

During drilling, core will be logged for visual characteristics including colour, particle size, moisture content, odor, reaction with dilute hydrochloric acid and magnetism. Sampling intervals will be defined to characterize relatively homogenous layers expected to be indicated primarily by particle size and possibly colour, or zones of finely interbedded coarser and fine layers. Individual sampling intervals will likely be no thinner than 3’ unless field data indicate a need for narrower intervals.

3 Analysis

Core intervals will be selected based on review of core logs and analyzed as follows:

- Physical parameters (particle size, moisture, relative density)
- Chemical parameters (total oxides, trace elements).
- Mineralogy. XRD will be used to provide screening level results to select suitable samples for column testing. Detailed optical and sub-optical mineralogical analyses of samples used in column testing, including variation in composition as a function of particle size will be completed to assist with interpretation of results.

4 Application of Characterization Data to Column Test Design

Field observations and chemical analyses will be used to design column tests to evaluate the interaction of NorthMet Project tailings water with the LTVSMC tailings. The column tests could use a few (two to three) composites of the LTVSMC beach tailings. The composites will be prepared to represent a range of conditions that could influence interactions such as mineralogical differences (inferred from chemical analyses and colour) and particle size. A detailed program will be developed by PolyMet, SRK and MDNR prior to initiation.

---

[1] Note that the tailings disposal concept involves use of Cell 2W for disposal of hydrometallurgical wastes in lined cells and use of basins 1E and 2E for disposal of flotation tailings.

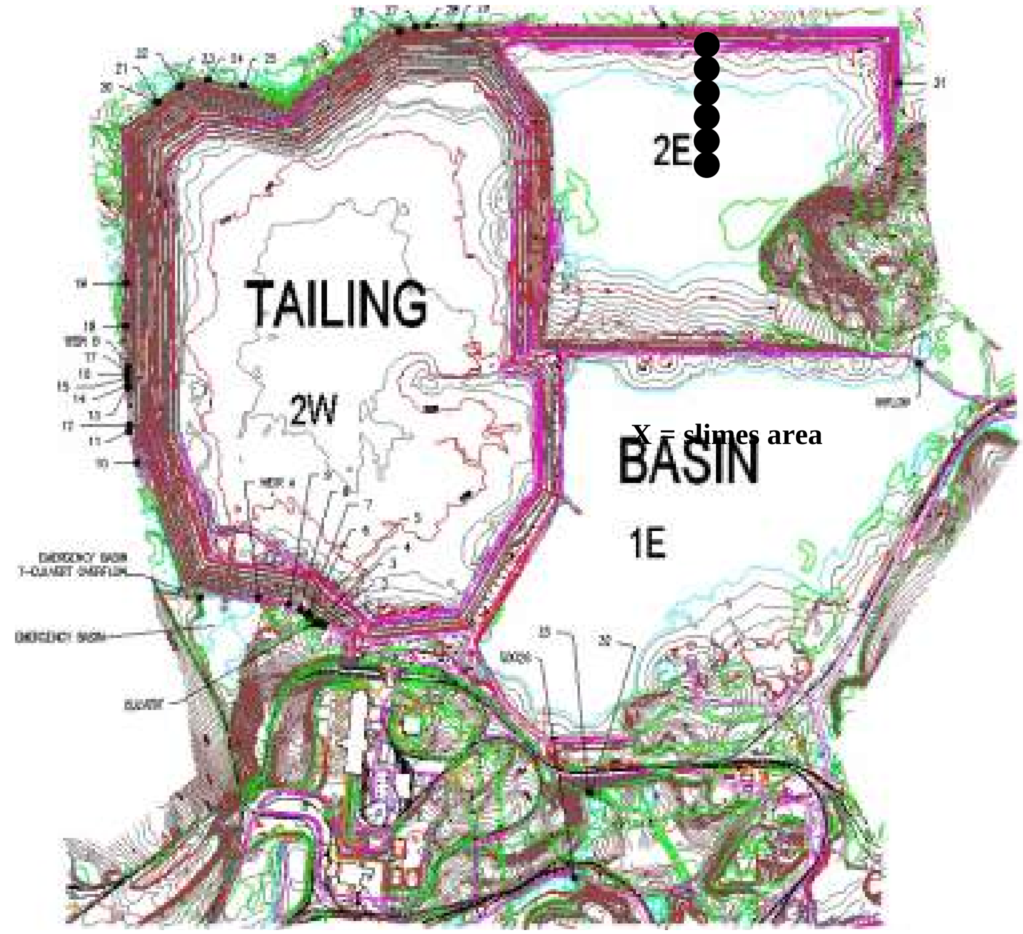


Figure 1. LTVSMC Tailings Area. Conceptual drilling locations in Cell 2E are shown. Actual locations will be finalized in the field based on access and safety considerations.

Appendix B

Static Characterization of PolyMet Tailings Samples

Appendix B.1

Tailings Petrographic Description

Appendix B.1
Tailings Petrographic Description

Description of Samples for Petrographic Report

The subsequent mineralogical report received from PolyMet Mining Inc. describes whole PolyMet tailings characteristics. PolyMet tailings samples were generated from three ore parcels (P1, P2, and P3). Parcel 2 (sample P2S) was processed entirely without using copper sulfate. Parcel 1 was evaluated both with (samples P1S and P1SA) and without (sample P1SOLIDS) copper sulfate. Parcel 3 (sample P3S) was prepared using copper sulfate additive.

Appendix B.1
Tailings Petrographic Description

Sample Identification	Vancouver	Description	Mineralogy								
	Petrographic #		% Gypsum	Grain Size	% Plagioclase	Grain Size	% Olivine	Grain Size	% CPX	Grain Size	% OPX
P1S	Z-1	Tailings prepared with CuSO4			80.00	0.01-0.30	12.00	0.01-0.20	4.00	0.01-0.20	1.00
P1SA	Z-1A	Tailings prepared with CuSO4			75.00	0.01-0.20	15.00	0.01-0.15	5.00	0.01-0.20	2.00
P1SOLID	Z-2	Tailings prepared without CuSO4			60.00	0.01-0.10	15.00	0.01-0.10	5.00	0.01-0.10	1.00
P2S	Z-3	Tailings			50.00	0.01-0.15	10.00	0.01-0.10	4.00	0.01-0.15	
P3S	Z-4	Tailings			60.00	0.01-0.20	10.00	0.01-0.15	5.00	0.01-0.30	1.00
			Sulfides								
			% Pyrite	Grain Size	% Pyrrhotite	Grain Size	% Chalcopyrite	Grain Size	% Bornite	Grain Size	% Cubanite
P1S	Z-1	Tailings prepared with CuSO4	rare	0.05	0.25	0.01-0.10	rare	0.05			
P1SA	Z-1A	Tailings prepared with CuSO4	rare	0.05-0.10	0.25	0.01-0.10	rare	0.01			
P1SOLID	Z-2	Tailings prepared without CuSO4	rare	0.01-0.10	0.25	0.01-0.05	rare	0.04			
P2S	Z-3	Tailings	rare	0.01-0.10	0.50	0.01-0.10	rare	0.01-0.05			
P3S	Z-4	Tailings	rare	0.15	0.25	0.01-0.10	rare	0.01-0.04			
*Note: All grain sizes in mm											

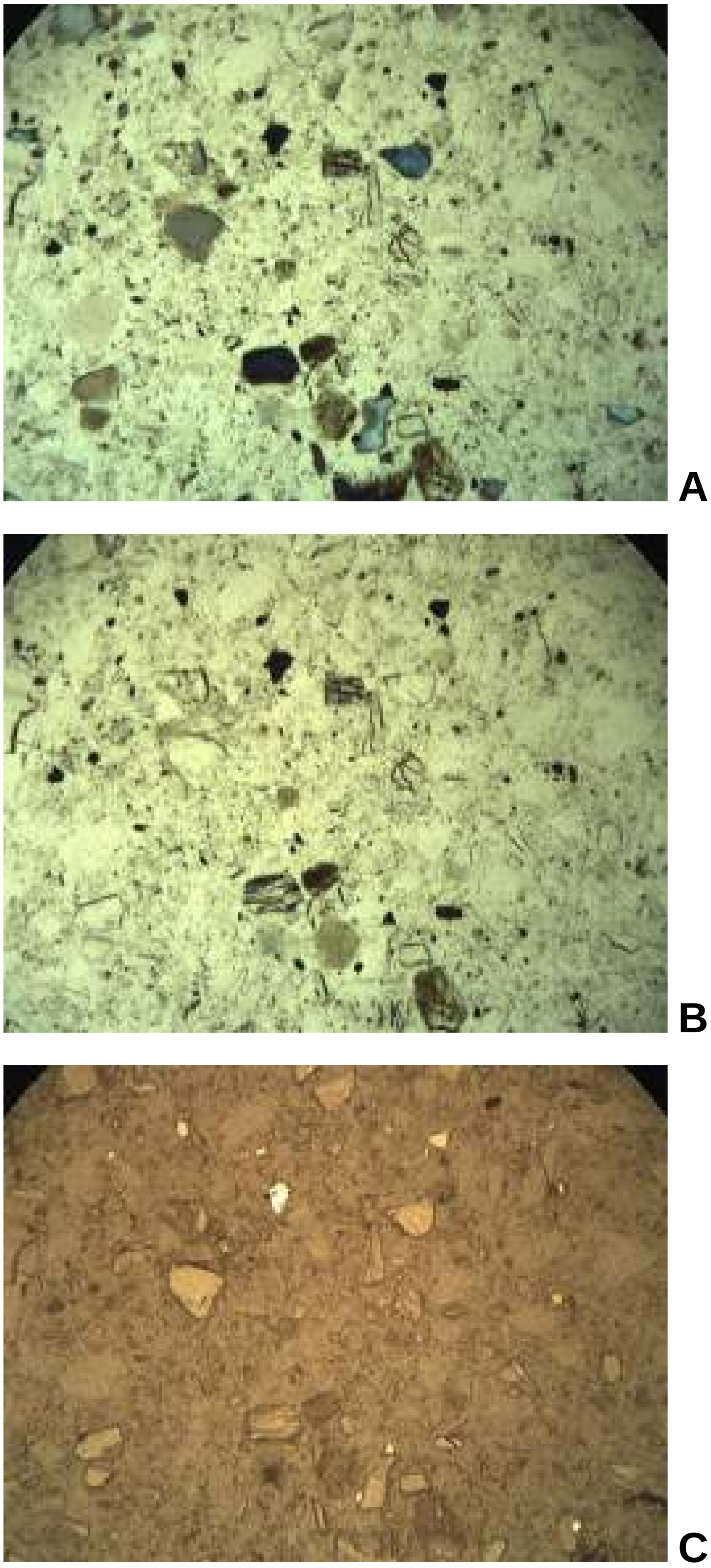
Sample Identification												
	Grain Size	**% Biotite**	**Grain Size**	**% Chlorite**	**Grain Size**	**% Serpentine**	**Grain Size**	**% Sericite/Musc.**	**Grain Size**	**% Quartz**	**Grain Size**	**% Calcite**
P1S	0.01-0.10	1.00	0.05-0.25	0.50	0.01-0.20			0.25	0.01-0.05			
P1SA	0.01-0.10	1.00	0.05-0.30	0.25	0.01-0.10			0.50	0.01-0.02			
P1SOLID	0.01-0.05	1.00	0.05-0.15	1.00	0.01-0.05			1.00	0.01-0.05			
P2S		1.00	0.05-0.10	1.50	0.01-0.05			2.00	0.01-0.02			
P3S	0.01-0.10	1.00	0.05-0.30	1.00	0.01-0.15	0.25	0.01-0.05	1.00	0.01-0.03			
	Grain Size	**% Pentlandite**	**Grain Size**	**% Violarite**	**Grain Size**	**% Silver/PGE**	**Grain Size**	**% Mack./Vall.**	**Grain Size**	**% Sphalerite**	**Grain Size**	**% Galena**
P1S										rare	0.01-0.10	rare
P1SA										rare	0.01-0.10	rare
P1SOLID										rare	0.01-0.10	rare
P2S												rare
P3S										rare	0.01-0.05	rare
*Note: All grain sizes in m												

Appendix B.1
Tailings Petrographic Description

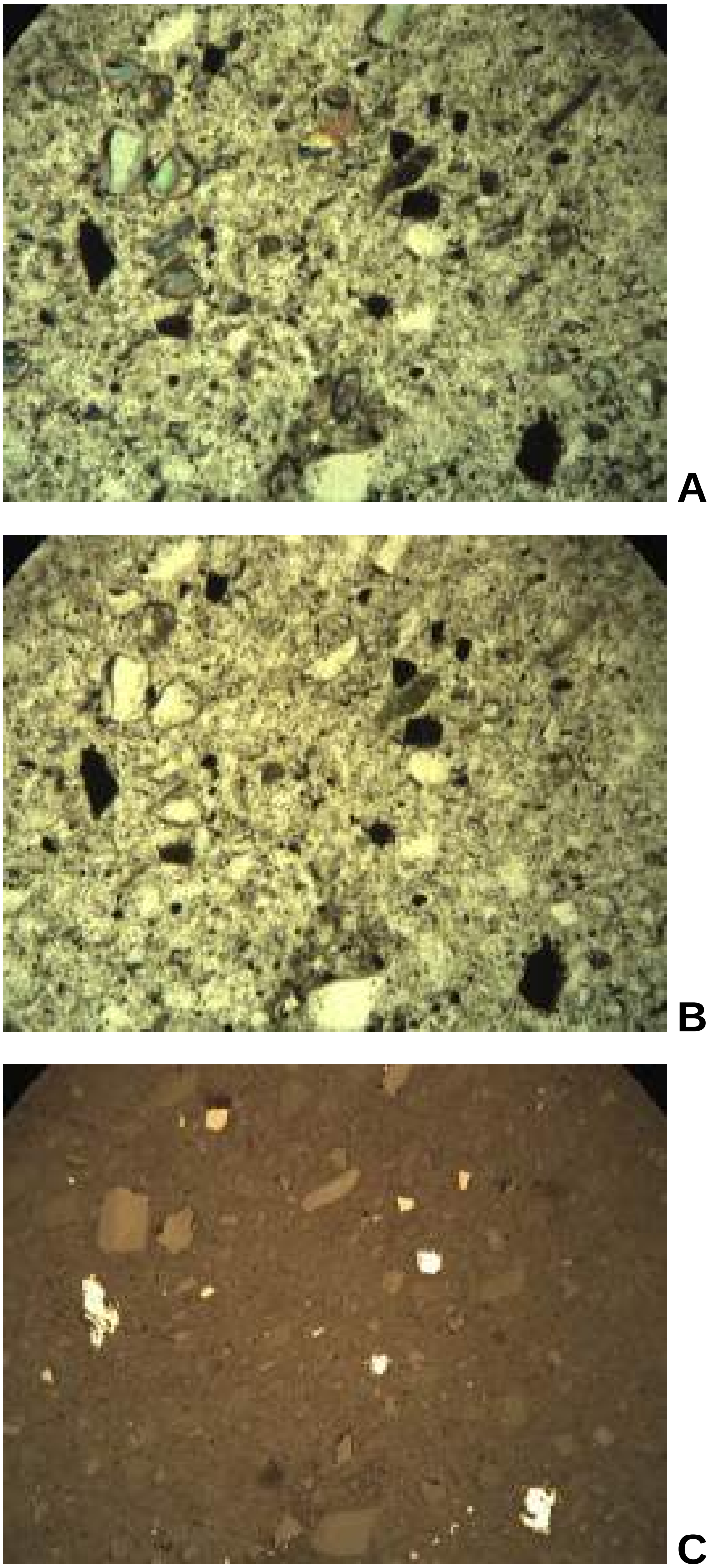
Sample Identification										
	Grain Size	% Ilmenite	Grain Size	% Magnetite	Grain Size	% Graphite	Grain Size	% Clay/Unidentified		Total
P1S		1.00	0.01-0.10							100.00
P1SA		1.00	0.01-0.15							100.00
P1SOLID		0.75	0.01-0.10					15.00		100.00
P2S		1.00	0.01-0.10					30.00		100.00
P3S		0.50	0.01-0.15					20.00		100.00
	Grain Size									Sulfide (only) Total
P1S	0.04									0.25
P1SA	0.05									0.25
P1SOLID	0.01-0.05									0.25
P2S	0.01-0.02									0.50
P3S	0.03									0.25
*Note: All grain sizes in										

Appendix B.2

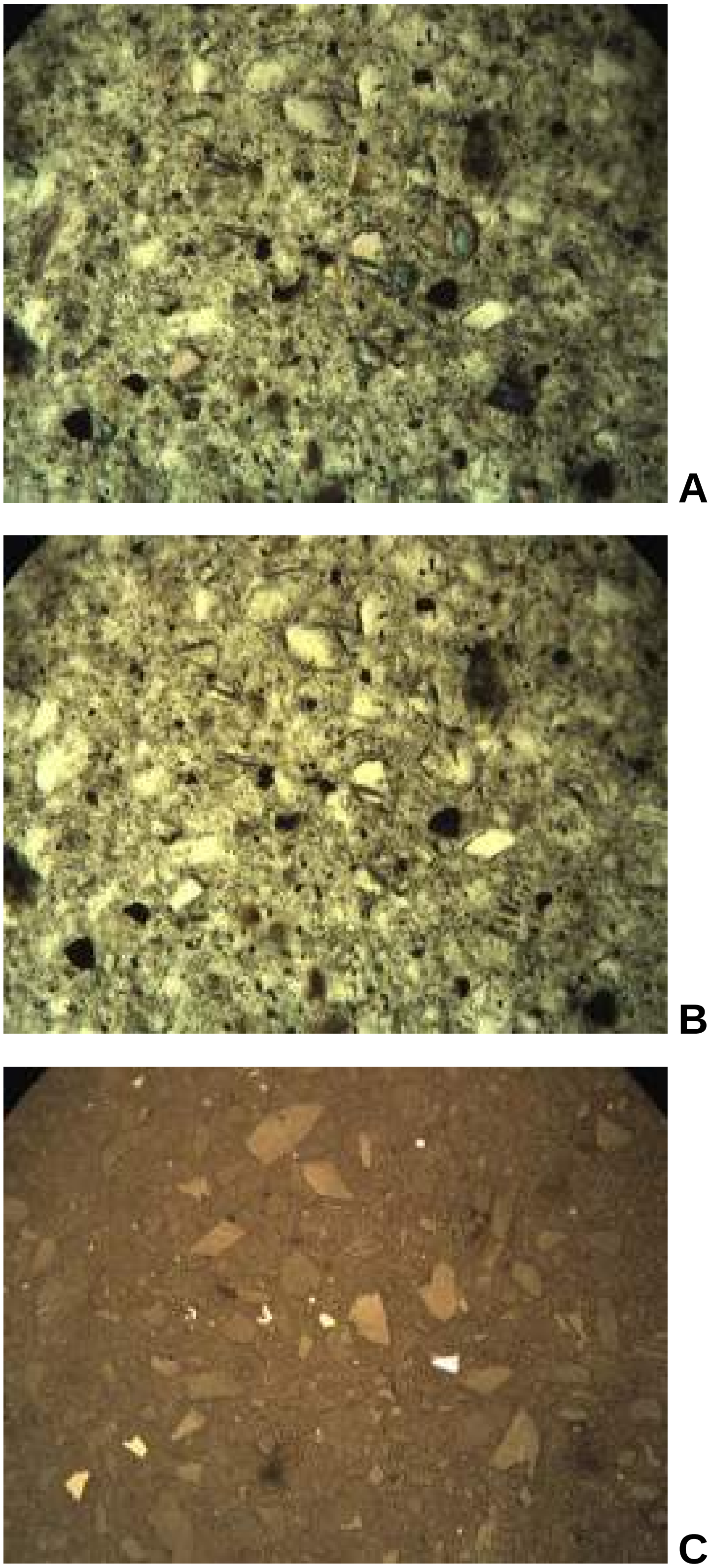
Tailings Photomicrographs



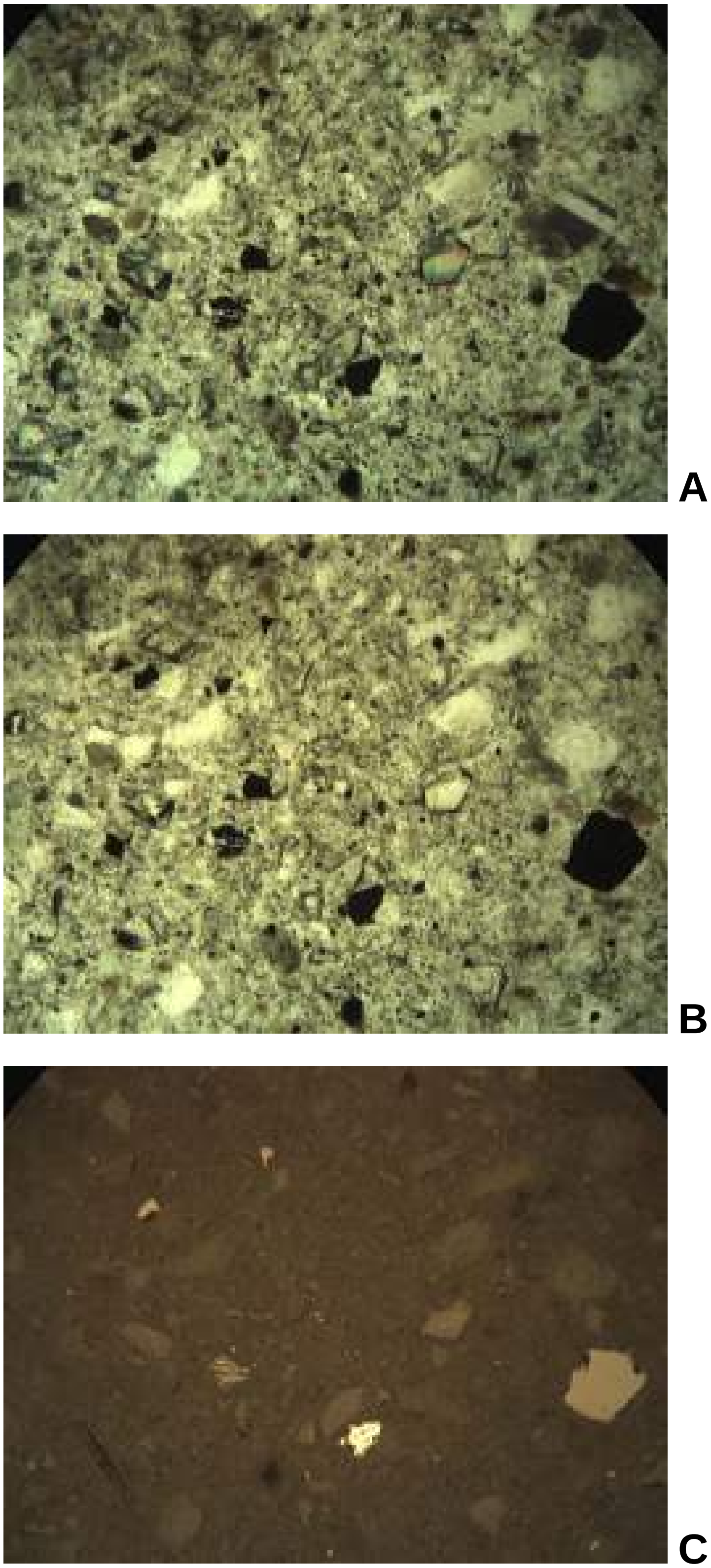
P1S Bulk Tailings: A) Cross Polarized Light, Field of View = ~0.8 mm, B) Plain Polarized Light, Field of View = ~0.8 mm, C) Reflected Light, Field of View = ~0.8 mm



P1Solids Bulk Tailings: A) Cross Polarized Light, Field of View = ~0.8 mm, B) Plain Polarized Light, Field of View = ~0.8 mm, C) Reflected Light, Field of View = ~0.8 mm



P2S Bulk Tailings: A) Cross Polarized Light, Field of View = ~0.8 mm, B) Plain Polarized Light, Field of View = ~0.8 mm, C) Reflected Light, Field of View = ~0.8 mm



P3S Bulk Tailings: A) Cross Polarized Light, Field of View = ~0.8 mm, B) Plain Polarized Light, Field of View = ~0.8 mm, C) Reflected Light, Field of View = ~0.8 mm

Appendix B.3

Chemical Analysis

			ABA										
Sample Description	**Test ID**	**Type of Material**	**FIZZ**	**pH**	**NP**	**MPA**	**NNP**	**NP:MPA**	**Total S**	**S as Sulfide**	**S as SO_4**	**C**	**CO_2**
			Unity	**Unity**	**tCaCO3/1000t ore**	**tCaCO3/1000t ore**	**t CaCO3/ 1000 t ore**	**Unity**	**%**	**%**	**%**	**%**	**%**
P1 (CuSO4)	T1	Tailings with CuSO4	1	8.3	21	3.1	18	6.8	0.10	0.01		<0.05	<0.2
P1 (no CuSO4)	T2	Tailings without CuSO4	1	8.3	20	7.2	13	2.8	0.23	<0.01		<0.05	0.2
P2 (no CuSO4)	T3	Tailings without CuSO4	1	8.3	20	6.3	14	3.2	0.20	0.01		<0.05	0.2
P3 (CuSO4)	T4	Tailings with CuSO4	1	8.4	20	4.7	15	4.3	0.15	0.01		<0.05	<0.2
Parcel 2 P2S +100 mesh	T5	Tailings without CuSO4	1	9.0	20	4.7	15	4.3	0.15	<0.01	0.10	<0.05	<0.2
Parcel 2 P2S -100 +200 mesh	T6	Tailings without CuSO4	1	9.2	22	5.3	17	4.1	0.17	0.01	0.12	<0.05	<0.2
Parcel 2 P2S -200 mesh	T7	Tailings without CuSO4	1	9.0	21	7.5	14	2.8	0.24	0.01	0.18	<0.05	0.2
Parcel 1-2 PISCS +100 mesh	T8	Tailings with CuSO4	1	9.1	22	3.4	19	6.4	0.11	0.02	0.07	<0.05	<0.2
Parcel 1-2 PISCS -100 +200 mesh	T9	Tailings with CuSO4	1	9.3	20	3.1	17	6.4	0.10	<0.01	0.07	<0.05	<0.2
Parcel 1-2 PISCS -200 mesh	T10	Tailings with CuSO4	1	8.8	22	2.8	19	7.8	0.09	0.02	0.05	<0.05	0.2
Parcel 3 P3S +100 mesh	T11	Tailings with CuSO4	1	9.2	18	3.4	15	5.2	0.11	0.02	0.08	<0.05	<0.2
Parcel 3 P3S -100 +200 mesh	T12	Tailings with CuSO4	1	9.3	21	4.4	17	4.8	0.14	0.01	0.10	<0.05	<0.2
Parcel 3 P3S -200 mesh	T13	Tailings with CuSO4	1	9.0	21	4.4	17	4.8	0.14	0.01	0.10	0.05	0.2

Notes:

Blank cells indicate no analysis was performed.

NP: Neutralization Potential as determined by the standard Sobek method.

MPA: Maximum Potential Acidity. Calculated from Total Sulfur.

NNP: Net Neutralization Potential.

	Metals by 4-Acid Digestion														
Sample Description	**Cu**	**Ni**	**S**	**S%ICP**	**Pt**	**Pd**	**Au**	**Co**	**Ag**	**Zn**	**Cd**	**Mo**	**Pb**	**As**	**Cr**
	%	**%**	**%**	**%**	**ppb**	**ppb**	**ppb**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
P1 (CuSO4)	0.022	0.032	0.10	0.10	0.015	0.046	0.008	59	<0.5	95	<0.5	<1	8	<5	186
P1 (no CuSO4)	0.025	0.033	0.23	0.26	0.011	0.045	0.008	62	<0.5	97	<0.5	<1	8	<5	188
P2 (no CuSO4)	0.053	0.039	0.20	0.23	0.016	0.073	0.011	61	<0.5	93	<0.5	<1	8	<5	199
P3 (CuSO4)	0.042	0.037	0.15	0.17	0.010	0.059	0.014	60	0.5	92	<0.5	1	6	<5	175
Parcel 2 P2S +100 mesh	0.046	0.0284	0.15												
Parcel 2 P2S -100 +200 mesh	0.03	0.0306	0.17												
Parcel 2 P2S -200 mesh	0.0295	0.0314	0.24												
Parcel 1-2 PISCS +100 mesh	0.0303	0.0213	0.11												
Parcel 1-2 PISCS -100 +200 mesh	0.0176	0.0273	0.1												
Parcel 1-2 PISCS -200 mesh	0.01075	0.0267	0.09												
Parcel 3 P3S +100 mesh	0.0385	0.0225	0.11												
Parcel 3 P3S -100 +200 mesh	0.0249	0.0288	0.14												
Parcel 3 P3S -200 mesh	0.0139	0.0323	0.14												

Notes:

Blank cells indicate no analysis was performed

NP: Neutralization Potential as determined by t

MPA: Maximum Potential Acidity. Calculated fr

NNP: Net Neutralization Potential.

	Metals by 4-Acid Digestion															
Sample Description	**V**	**Ti**	**Al**	**Ca**	**Fe**	**K**	**Na**	**Mg**	**Mn**	**P**	**Ba**	**Be**	**Bi**	**Sb**	**Sr**	**W**
	ppm	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
P1 (CuSO4)	137	0.82	10.05	6.13	9.09	0.47	1.97	5.29	1130	790	170	0.6	<2	<5	302	10
P1 (no CuSO4)	136	0.80	10.35	6.14	9.43	0.48	1.96	5.41	1140	800	170	0.6	<2	<5	300	<10
P2 (no CuSO4)	136	0.81	10.15	5.96	9.22	0.47	1.87	5.24	1125	750	160	0.6	<2	<5	282	<10
P3 (CuSO4)	131	0.76	10.45	6.14	9.03	0.5	1.94	5.27	1110	770	170	0.6	<2	<5	296	<10
Parcel 2 P2S +100 mesh																
Parcel 2 P2S -100 +200 mesh																
Parcel 2 P2S -200 mesh																
Parcel 1-2 PISCS +100 mesh																
Parcel 1-2 PISCS -100 +200 mesh																
Parcel 1-2 PISCS -200 mesh																
Parcel 3 P3S +100 mesh																
Parcel 3 P3S -100 +200 mesh																
Parcel 3 P3S -200 mesh																

Notes:

Blank cells indicate no analysis was performed

NP: Neutralization Potential as determined by t

MPA: Maximum Potential Acidity. Calculated fr

NNP: Net Neutralization Potential.

	Metals by Aqua Regia Digestion													
Sample Description	**Cu**	**Ni**	**S**	**Co**	**Ag**	**Zn**	**Cd**	**Mo**	**Pb**	**As**	**Cr**	**V**	**Ti**	**Al**
	%	**%**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**%**	**%**
P1 (CuSO4)	0.0206	0.0267	0.10	46	0.2	69	<0.5	<1	5	<2	76	44	0.16	3.72
P1 (no CuSO4)	0.0238	0.0282	0.26	46	0.2	68	<0.5	1	2	7	77	44	0.16	3.61
P2 (no CuSO4)	0.0474	0.034	0.23	48	0.3	67	<0.5	1	2	4	82	46	0.16	3.55
P3 (CuSO4)	0.0377	0.032	0.16	47	0.3	65	<0.5	1	<2	4	79	45	0.18	3.89
Parcel 2 P2S +100 mesh			0.15	47.4	0.31	57	0.08	1.6	3.2	1.1	109	34	0.116	4.04
Parcel 2 P2S -100 +200 mesh			0.16	57	0.24	71	0.06	1.85	2.8	1.4	130	39	0.142	3.45
Parcel 2 P2S -200 mesh			0.22	56.3	0.23	70	0.07	1.41	3.3	3.3	120	49	0.18	4.05
Parcel 1-2 PISCS +100 mesh			0.1	38.4	0.24	52	0.11	2.82	6.9	1.8	167	29	0.106	4.71
Parcel 1-2 PISCS -100 +200 mesh			0.1	52.2	0.18	70	0.06	1.79	3.1	2.9	135	39	0.151	3.91
Parcel 1-2 PISCS -200 mesh			0.09	52.8	0.16	69	0.06	1.42	2.8	2.2	115	49	0.184	4.18
Parcel 3 P3S +100 mesh			0.11	35.3	0.29	45	0.08	2.09	4.3	1.8	133	33	0.114	5.15
Parcel 3 P3S -100 +200 mesh			0.12	53.8	0.25	66	0.07	2.03	3.1	1.1	134	36	0.13	3.85
Parcel 3 P3S -200 mesh			0.15	58.3	0.22	79	0.09	1.63	7	2.8	135	53	0.21	4.47

Notes:

Blank cells indicate no analysis was performed

NP: Neutralization Potential as determined by t

MPA: Maximum Potential Acidity. Calculated fr

NNP: Net Neutralization Potential.

	Metals by Aqua Regia Digestion														
Sample Description	**Ca**	**Fe**	**K**	**Na**	**Mg**	**Mn**	**P**	**B**	**Ba**	**Be**	**Bi**	**Ga**	**Hg**	**La**	**Sb**
	%	**%**	**%**	**%**	**%**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**	**ppm**
P1 (CuSO4)	2.12	6.59	0.21	0.52	3.73	724	660	<10	50	<0.5	<2	<10	<1	10	<2
P1 (no CuSO4)	2.06	6.84	0.2	0.51	3.73	728	660	<10	50	<0.5	<2	10	2	10	<2
P2 (no CuSO4)	2.03	6.87	0.2	0.5	3.73	745	680	10	50	<0.5	<2	10	1	10	<2
P3 (CuSO4)	2.22	6.68	0.22	0.55	3.69	731	700	<10	60	<0.5	<2	10	1	10	2
Parcel 2 P2S +100 mesh	2.17	5.34	0.2	0.56	3.15	612	290	<10	50	0.21	0.11	7.81	0.01	3.8	0.12
Parcel 2 P2S -100 +200 mesh	1.88	6.4	0.2	0.49	3.78	732	390	10	50	0.19	0.12	7.24	0.02	4.3	0.14
Parcel 2 P2S -200 mesh	2.25	6.78	0.22	0.56	3.83	753	810	10	60	0.23	0.17	8.71	0.01	7.9	0.18
Parcel 1-2 PISCS +100 mesh	2.55	4.51	0.21	0.67	2.72	518	280	<10	60	0.23	0.12	9.12	0.05	4.1	0.25
Parcel 1-2 PISCS -100 +200 mesh	2.14	6.23	0.21	0.55	3.76	714	400	<10	60	0.2	0.15	7.77	0.01	4.5	0.17
Parcel 1-2 PISCS -200 mesh	2.33	6.61	0.23	0.57	3.92	748	880	<10	60	0.21	0.11	8.64	0.01	8.3	0.17
Parcel 3 P3S +100 mesh	2.77	4.1	0.26	0.74	2.44	468	260	<10	70	0.26	0.16	10.05	<0.01	4.3	0.18
Parcel 3 P3S -100 +200 mesh	2.08	5.88	0.22	0.53	3.53	678	370	<10	60	0.2	0.12	8.06	0.01	4.5	0.11
Parcel 3 P3S -200 mesh	2.47	7.18	0.24	0.61	4.16	808	870	<10	60	0.24	0.1	9.3	0.04	8.6	0.22

Notes:

Blank cells indicate no analysis was performed

NP: Neutralization Potential as determined by t

MPA: Maximum Potential Acidity. Calculated fr

NNP: Net Neutralization Potential.

	Whole Rock Oxides															
Sample Description	**SiO_2**	**Al_2O_3**	**TiO_2**	**Fe_2O_3**	**FeO**	**CaO**	**MgO**	**MnO**	**Na_2O**	**K_2O**	**P_2O_5**	**Cr_2O_3**	**BaO**	**SrO**	**LOI**	**Total**
	%	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**	**%**
P1 (CuSO4)	45.8	17.7	1.36	13.7	10.85	8.99	8.79	0.09	2.55	0.62	0.13	0.03	0.02	0.03	0.21	100.0
P1 (no CuSO4)	45.4	17.5	1.35	14.0	11.1	8.86	8.73	0.08	2.52	0.60	0.10	0.04	0.02	0.03	0.66	99.8
P2 (no CuSO4)	46.1	18.0	1.32	13.9	11.25	8.66	8.68	0.14	2.43	0.58	0.11	0.04	0.02	0.03	0.67	100.5
P3 (CuSO4)	46.3	17.9	1.19	13.1	10.55	8.57	8.41	0.13	2.42	0.59	0.12	0.03	0.02	0.03	0.79	99.6
Parcel 2 P2S +100 mesh																
Parcel 2 P2S -100 +200 mesh																
Parcel 2 P2S -200 mesh																
Parcel 1-2 PISCS +100 mesh																
Parcel 1-2 PISCS -100 +200 mesh																
Parcel 1-2 PISCS -200 mesh																
Parcel 3 P3S +100 mesh																
Parcel 3 P3S -100 +200 mesh																
Parcel 3 P3S -200 mesh																

Notes:

Blank cells indicate no analysis was performed

NP: Neutralization Potential as determined by t

MPA: Maximum Potential Acidity. Calculated fr

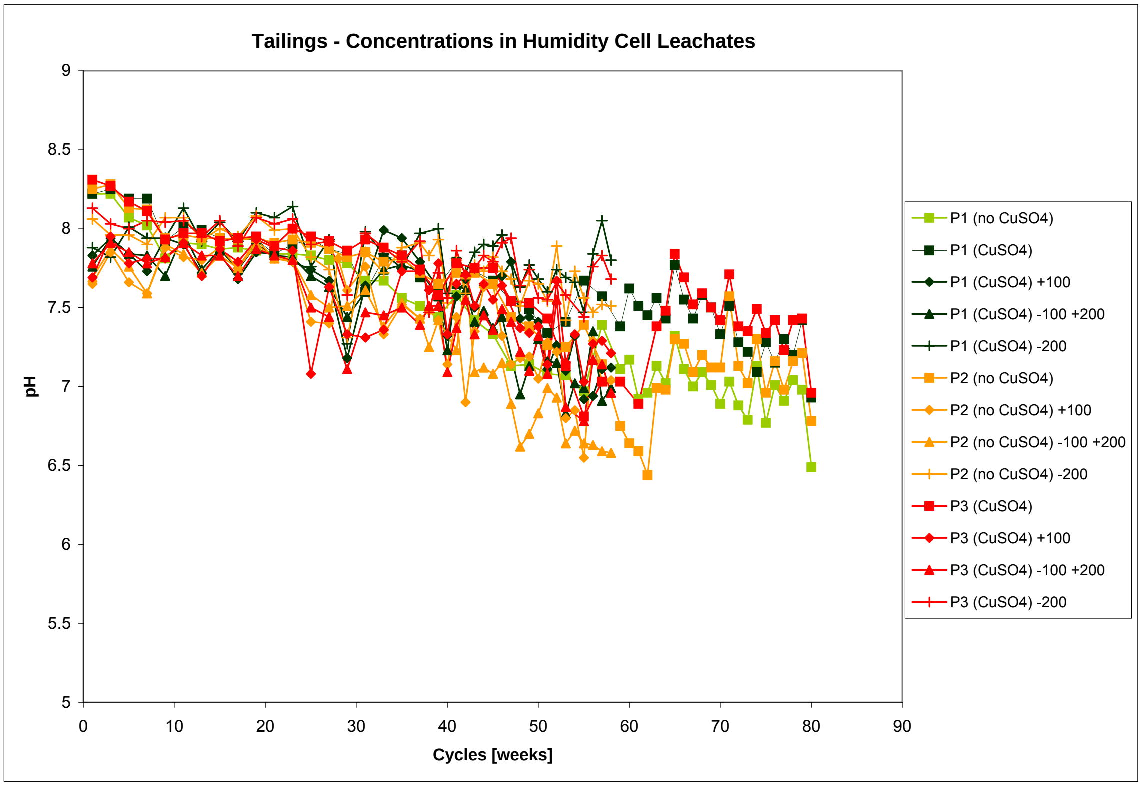
NNP: Net Neutralization Potential.

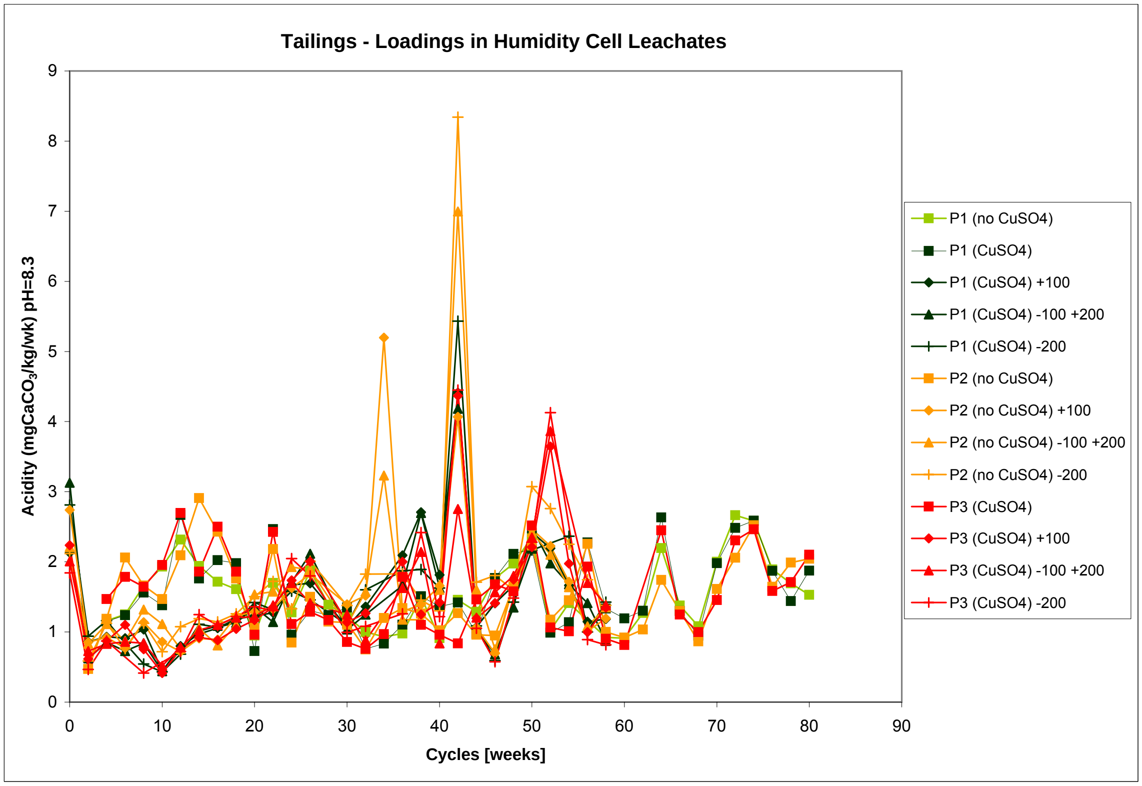
Appendix C

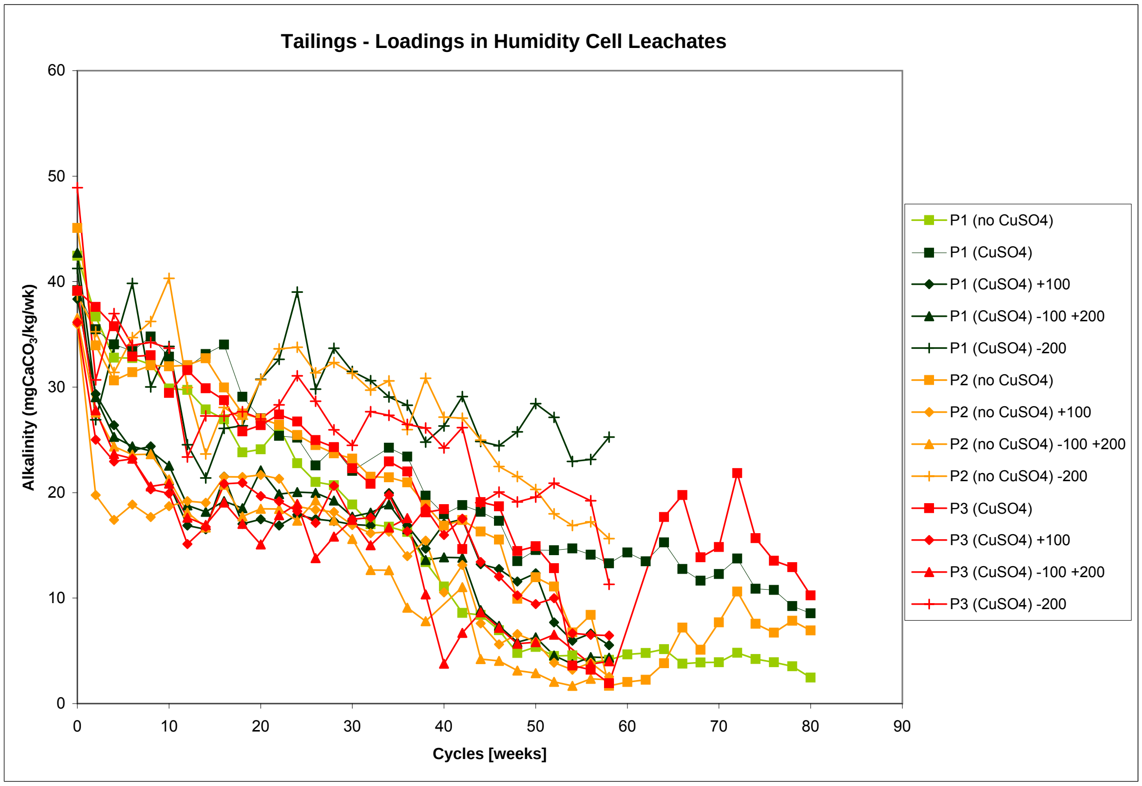
Kinetic Test Results

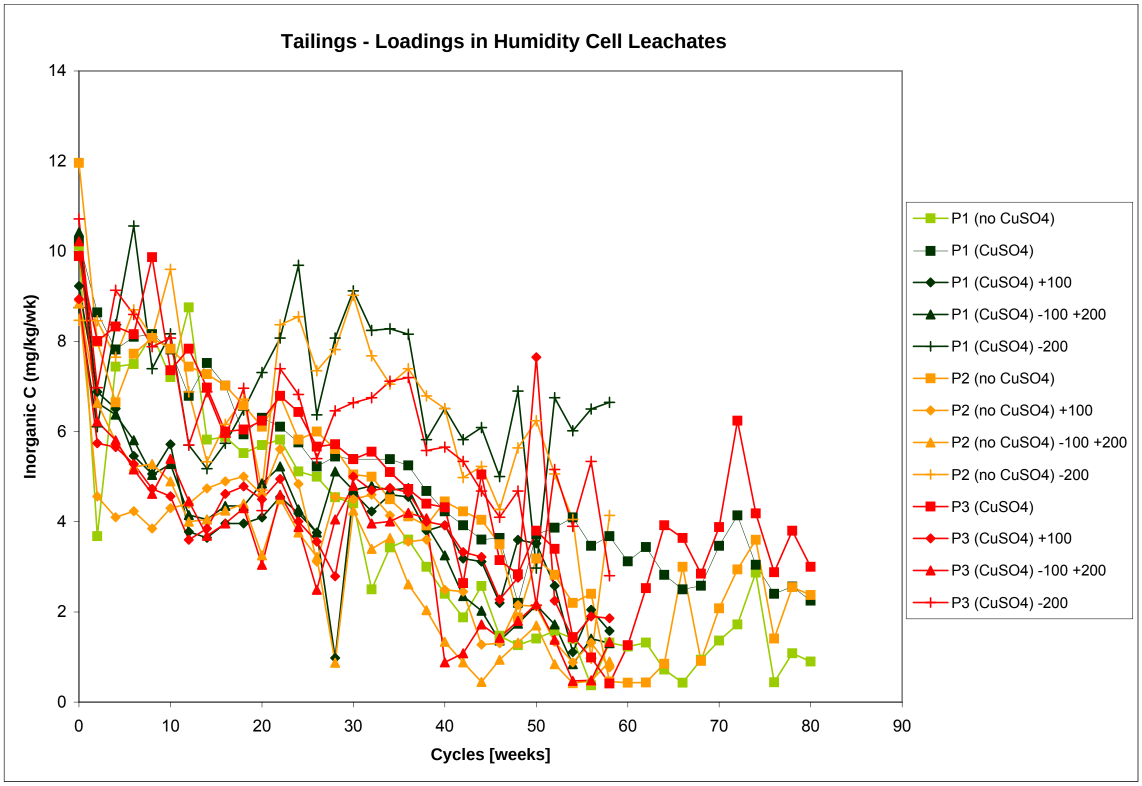
Appendix C.1

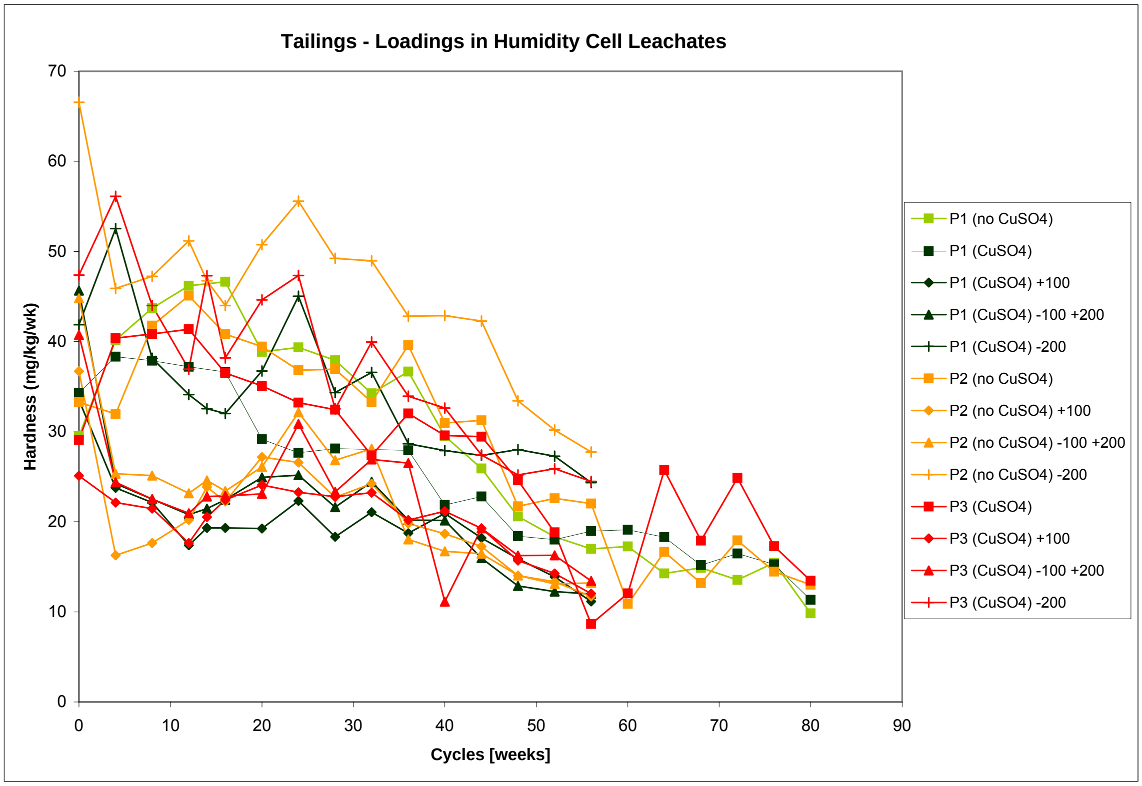
ASTM Cells (Loadings)

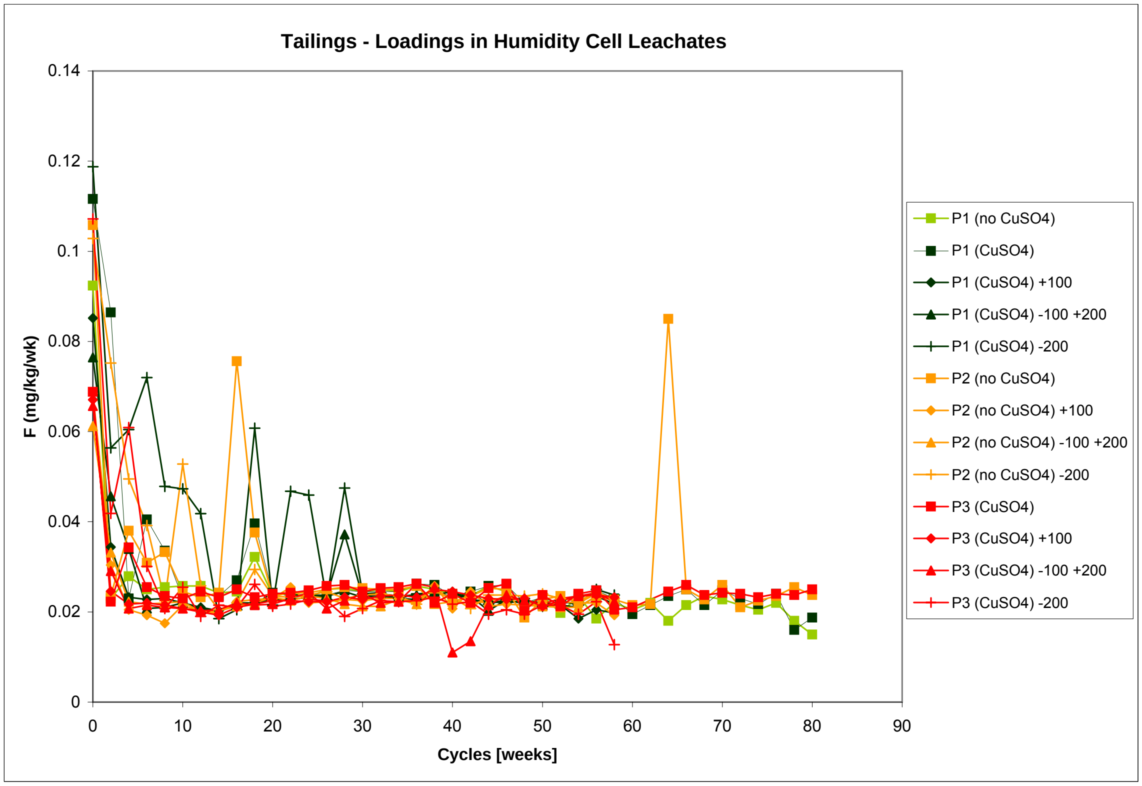

Tailings - Concentrations in Humidity Cell Leachates
pH
9
8.5
8
7.5
7
6.5
6
5.5
5
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

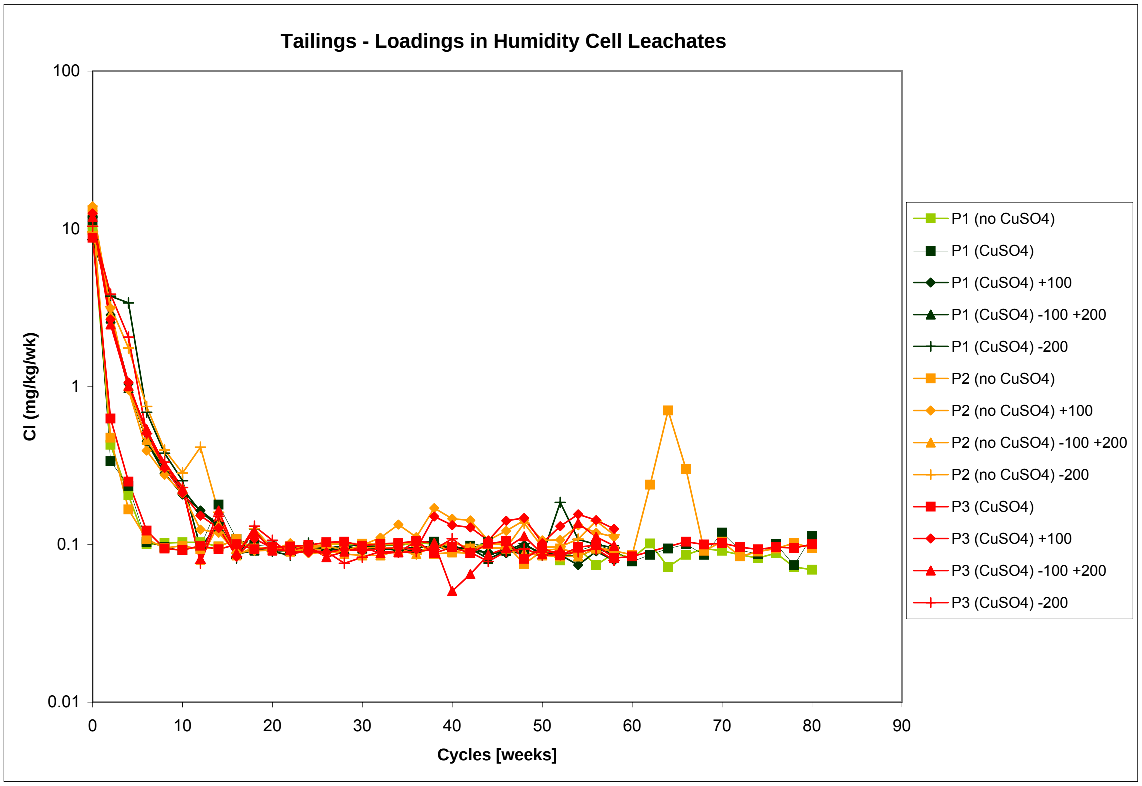

Tailings - Loadings in Humidity Cell Leachates
Acidity (mgCaCO$_3$/kg/wk) pH=8.3
9
8
7
6
5
4
3
2
1
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

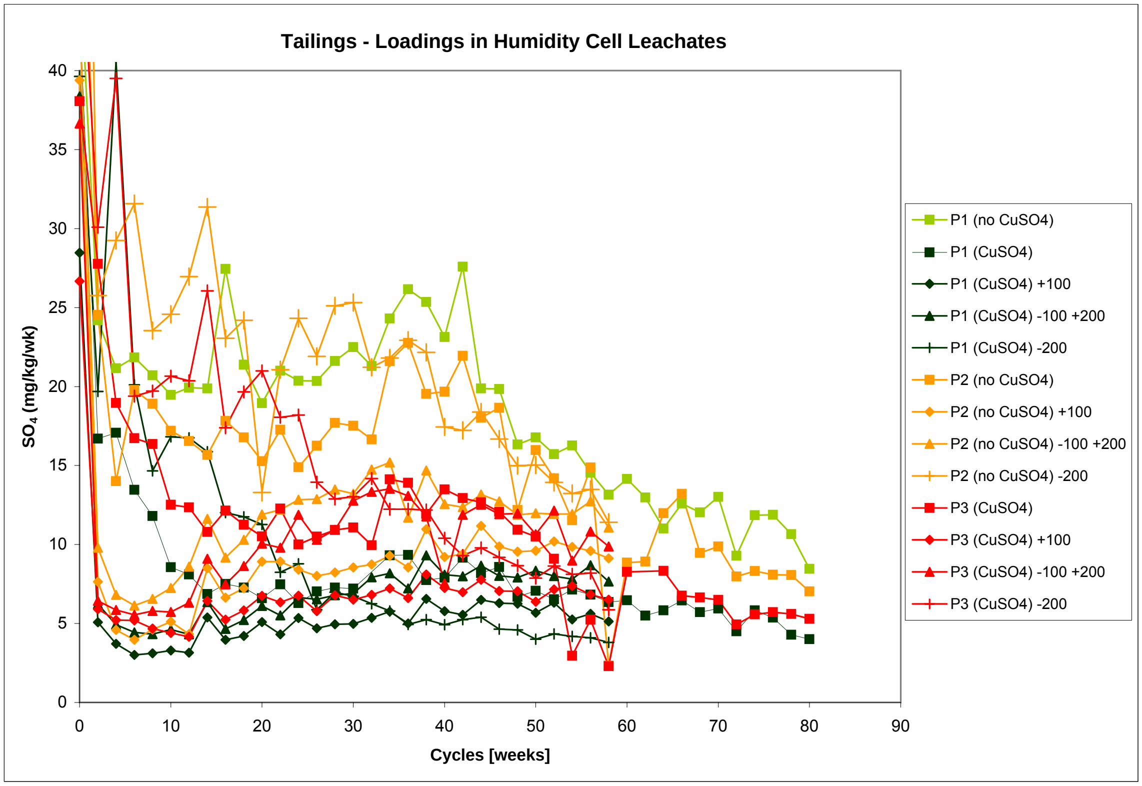

Tailings - Loadings in Humidity Cell Leachates
Alkalinity (mgCaCO$_3$/kg/wk)
0
10
20
30
40
50
60
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

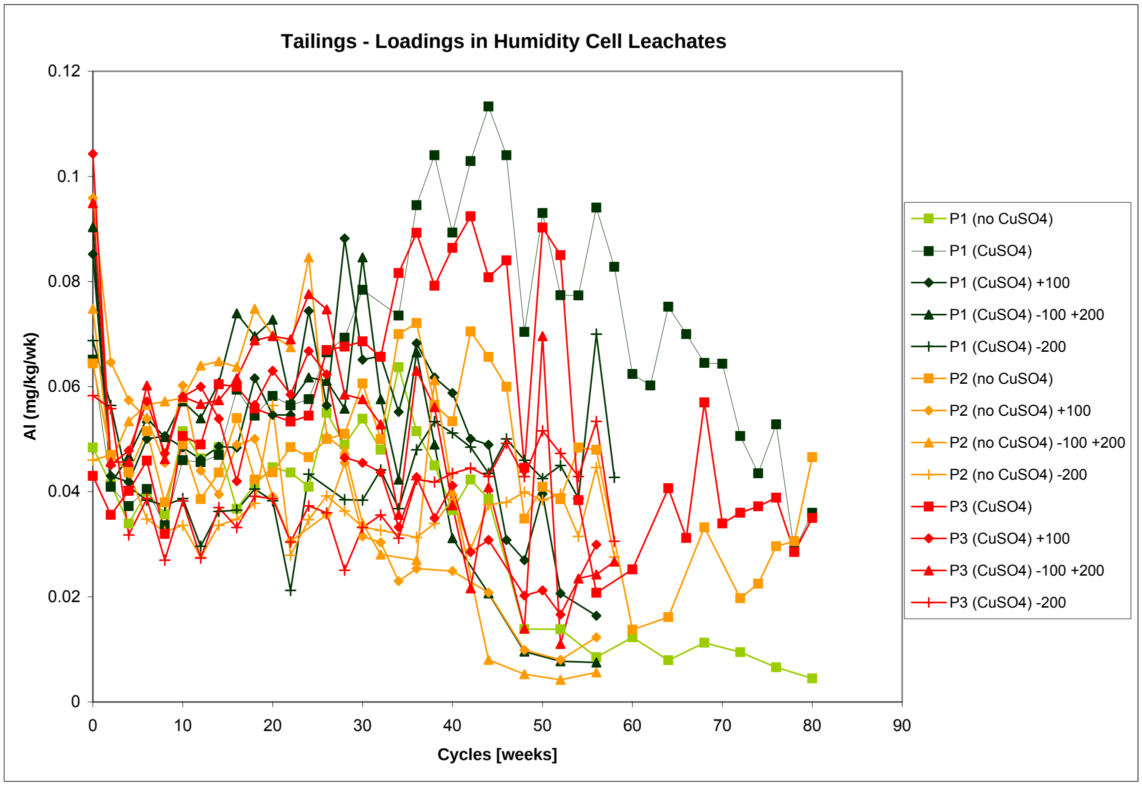

Tailings - Loadings in Humidity Cell Leachates
Inorganic C (mg/kg/wk)
0
2
4
6
8
10
12
14
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

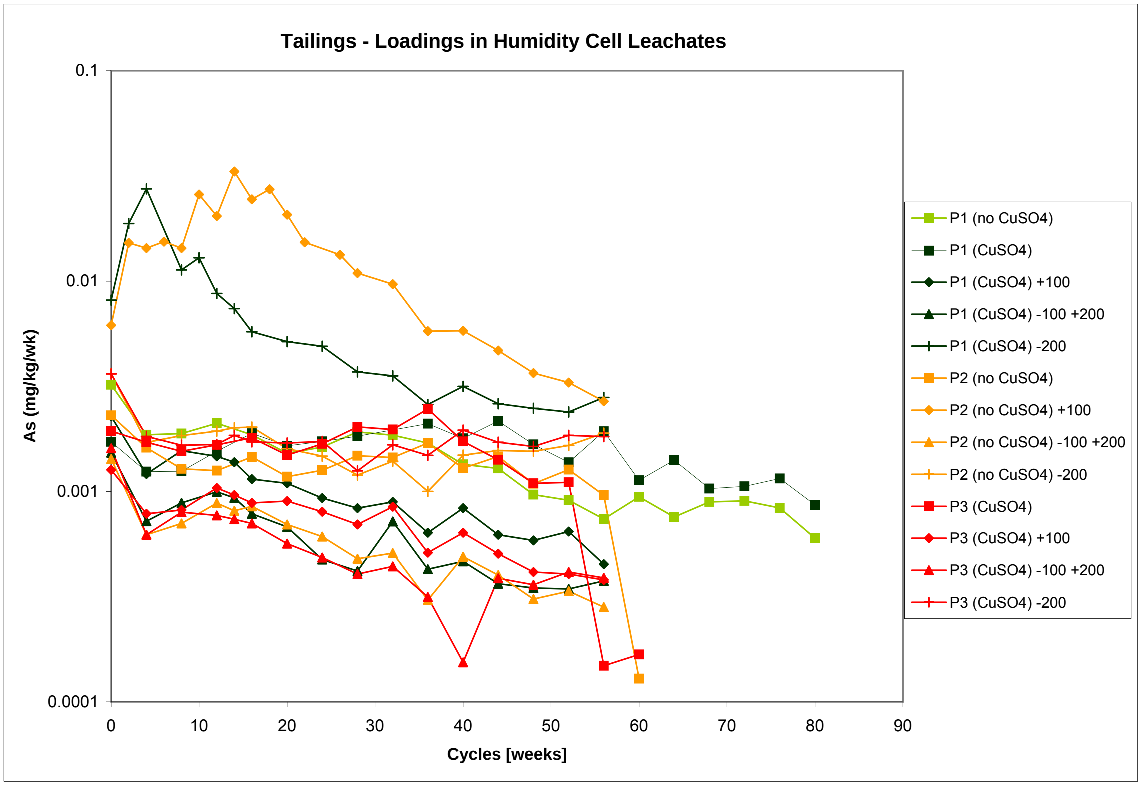

Tailings - Loadings in Humidity Cell Leachates
Hardness (mg/kg/wk)
0
10
20
30
40
50
60
70
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
F (mg/kg/wk)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

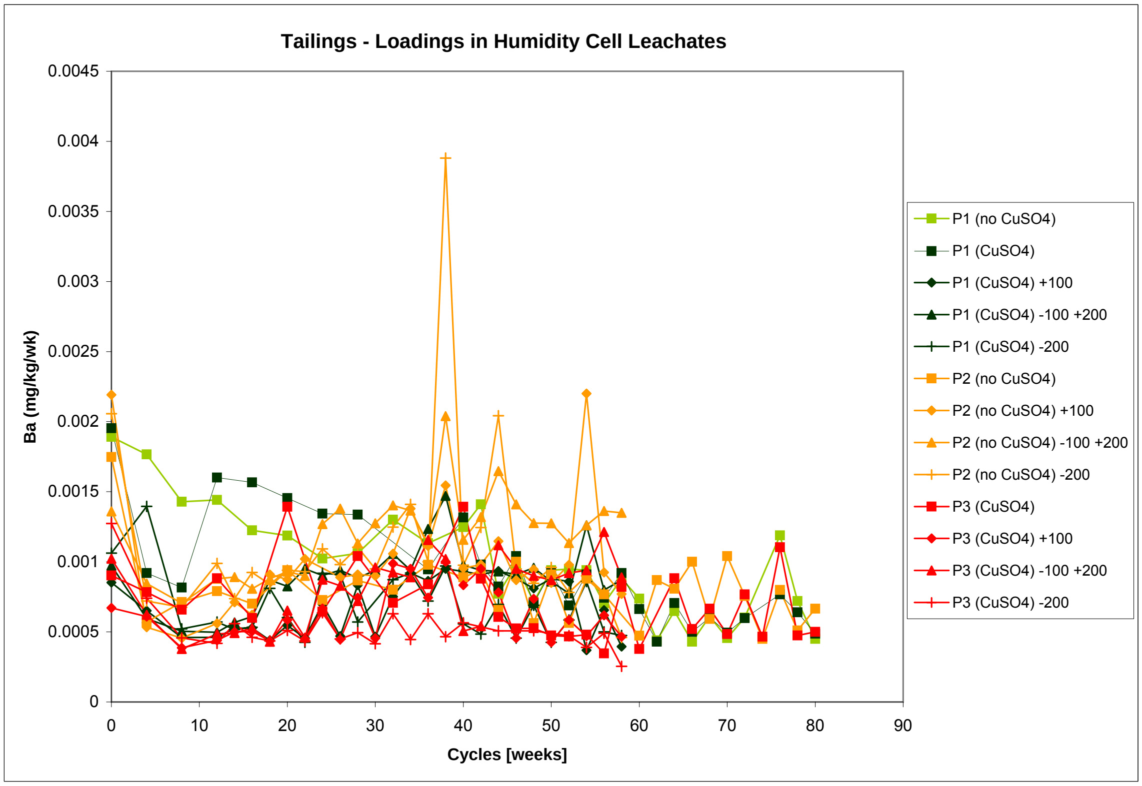

Tailings - Loadings in Humidity Cell Leachates
Cl (mg/kg/wk)
100
10
1
0.1
0.01
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
SO4 (mg/kg/wk)
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

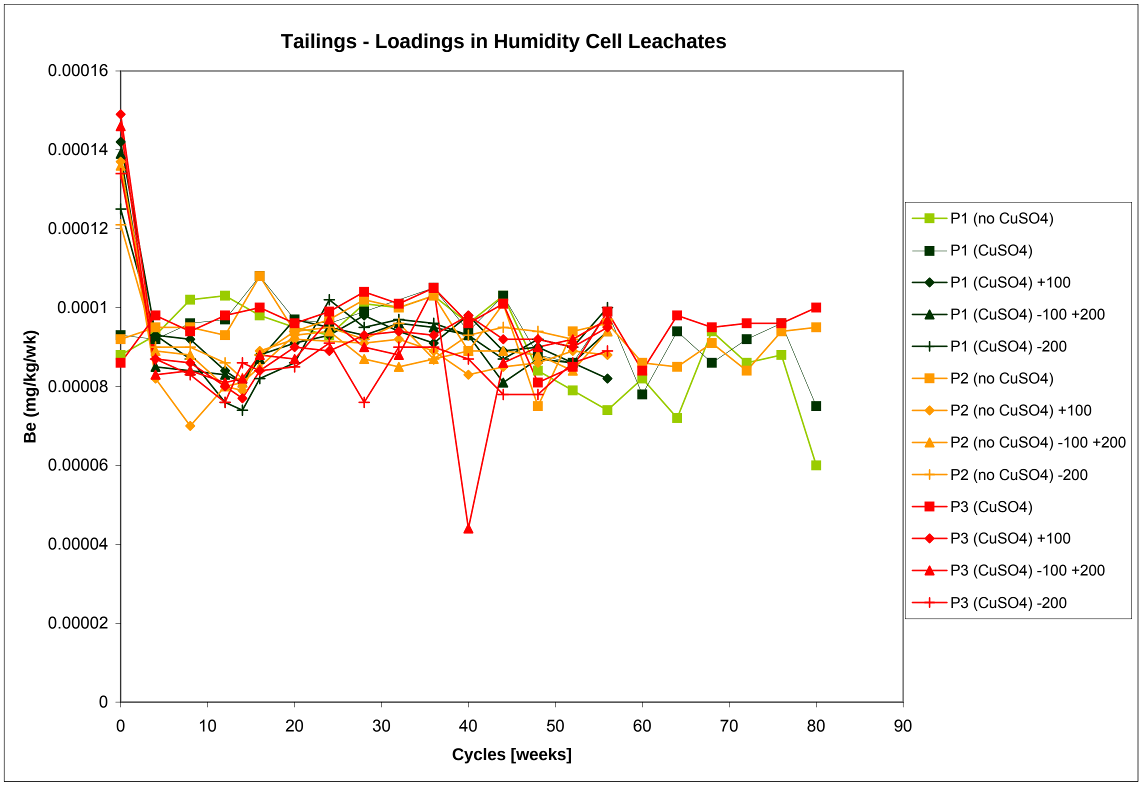

Tailings - Loadings in Humidity Cell Leachates
Al (mg/kg/wk)
0.12
0.1
0.08
0.06
0.04
0.02
0
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
As (mg/kg/wk)
0.1
0.01
0.001
0.0001
Cycles [weeks]
0
10
20
30
40
50
60
70
80
90
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

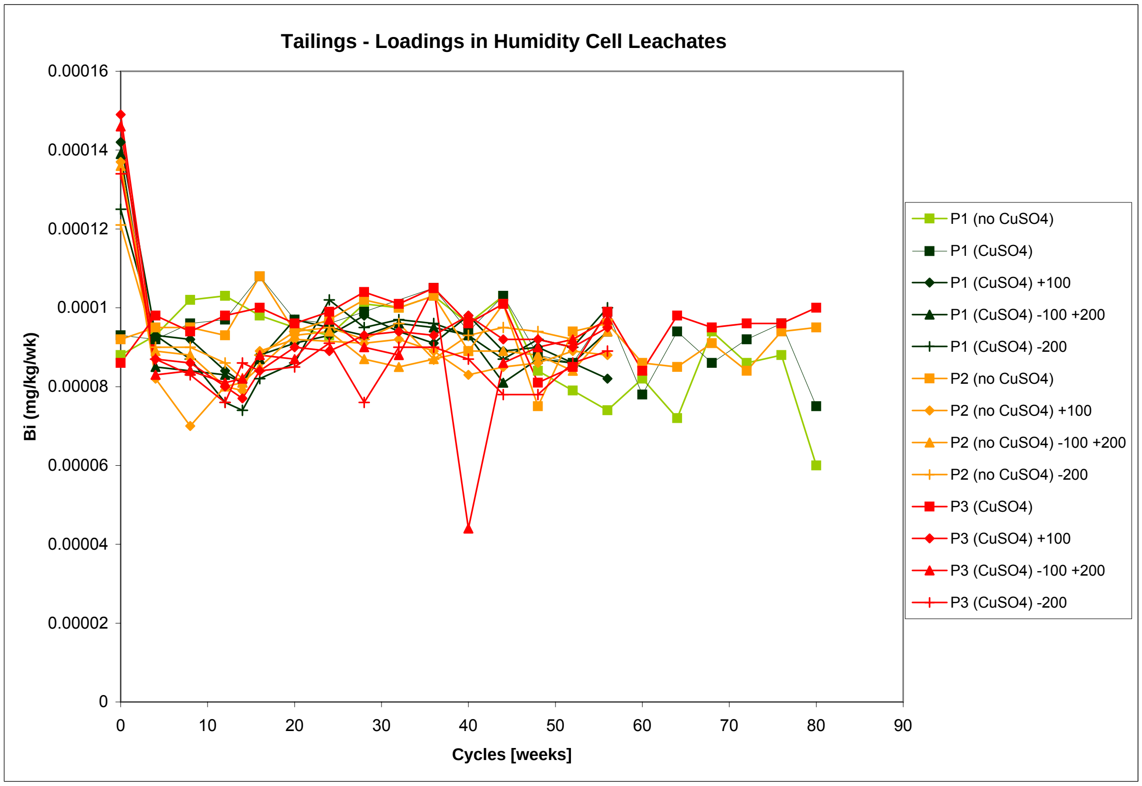
Graph C.1.11



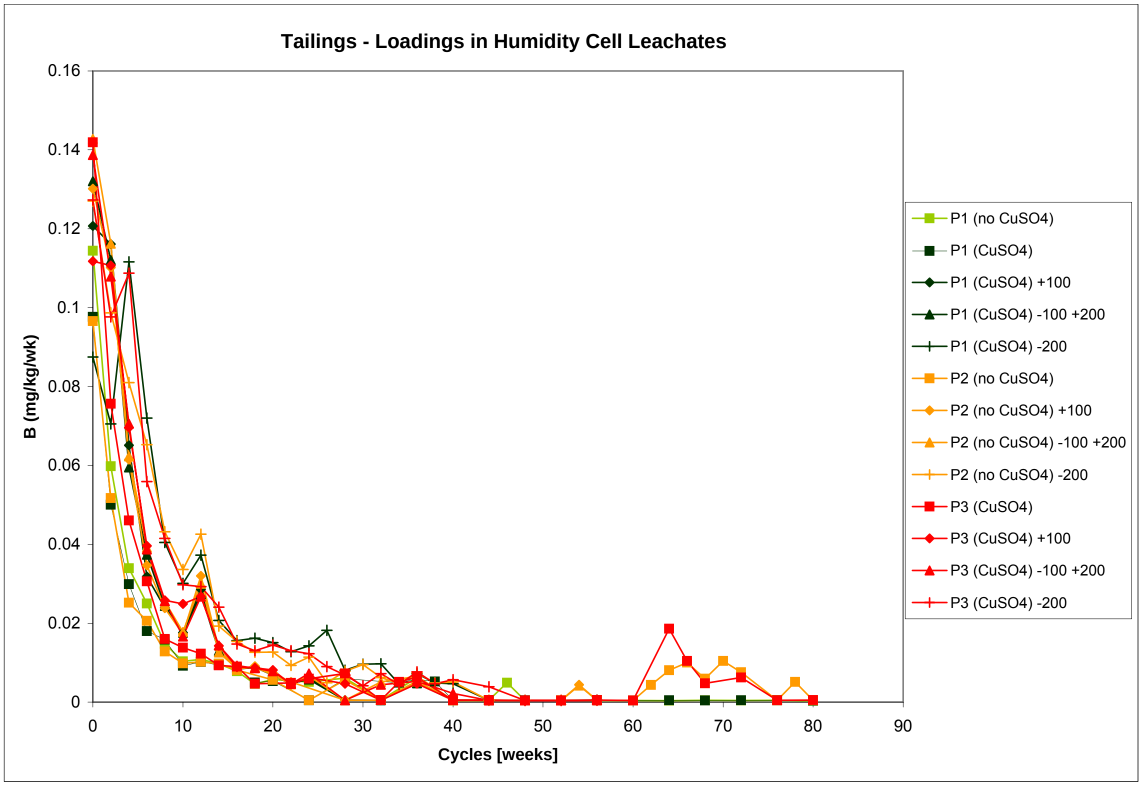
Graph C.1.12

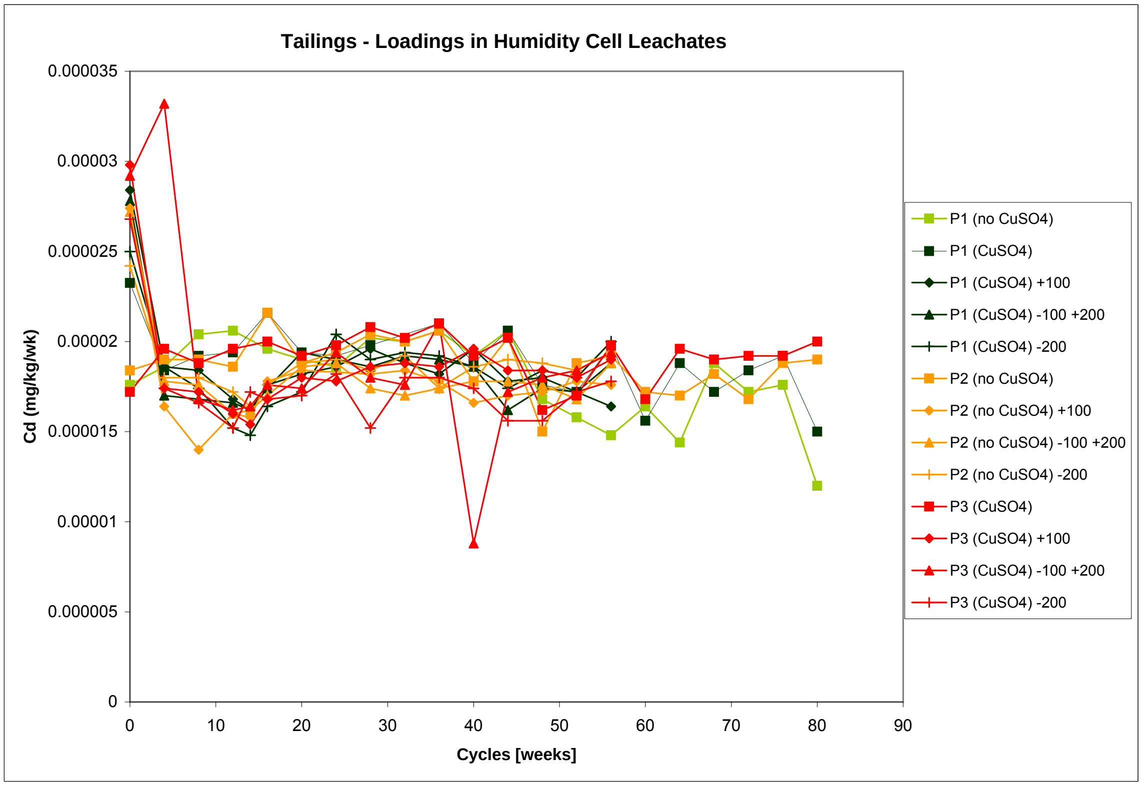


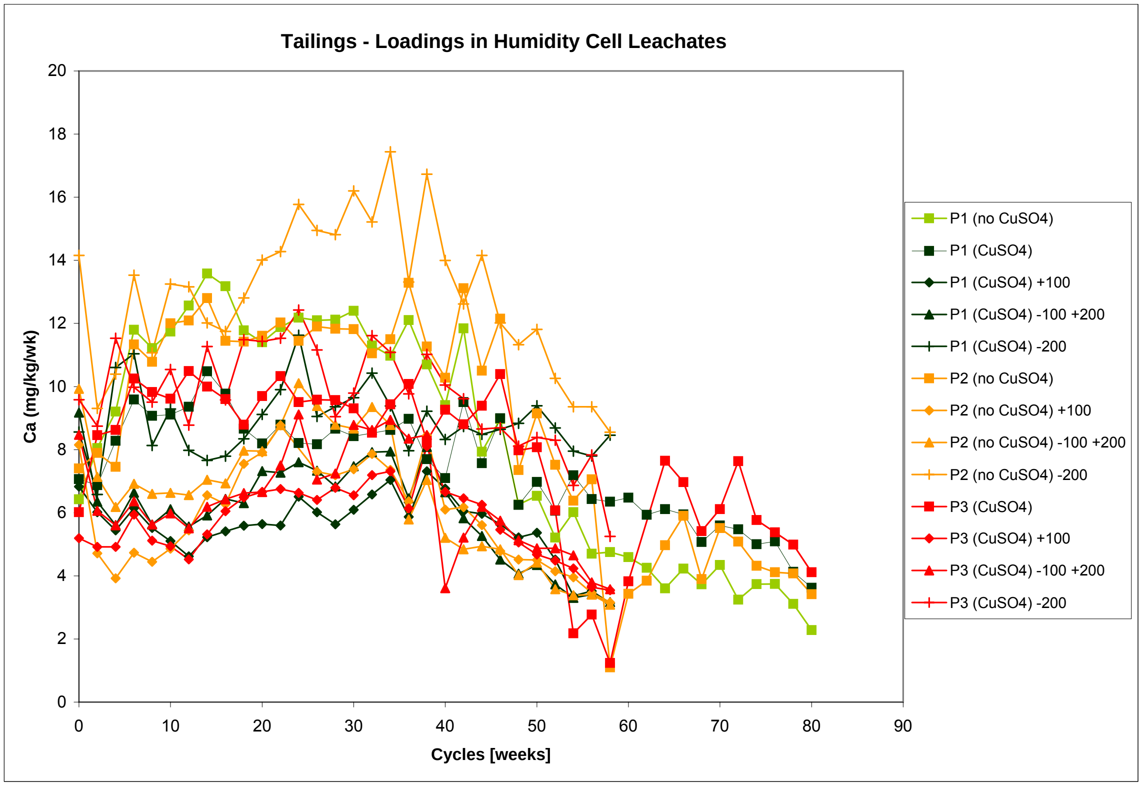
Graph C.1.13

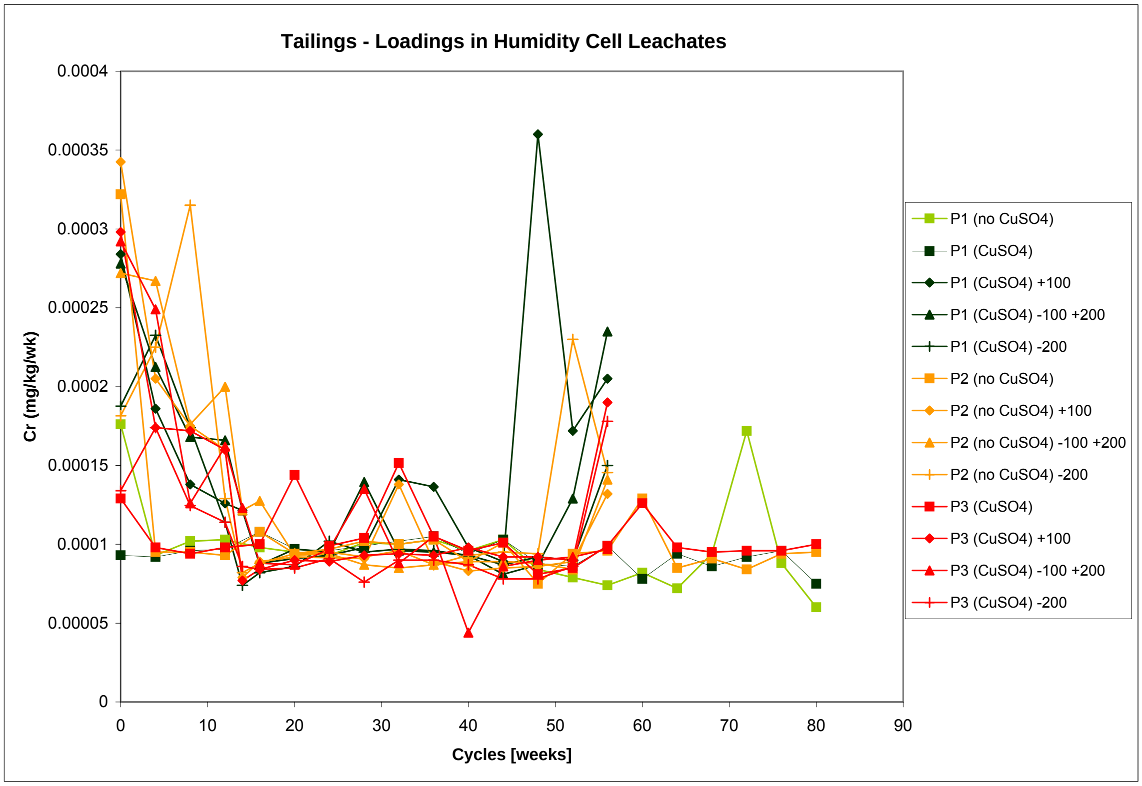


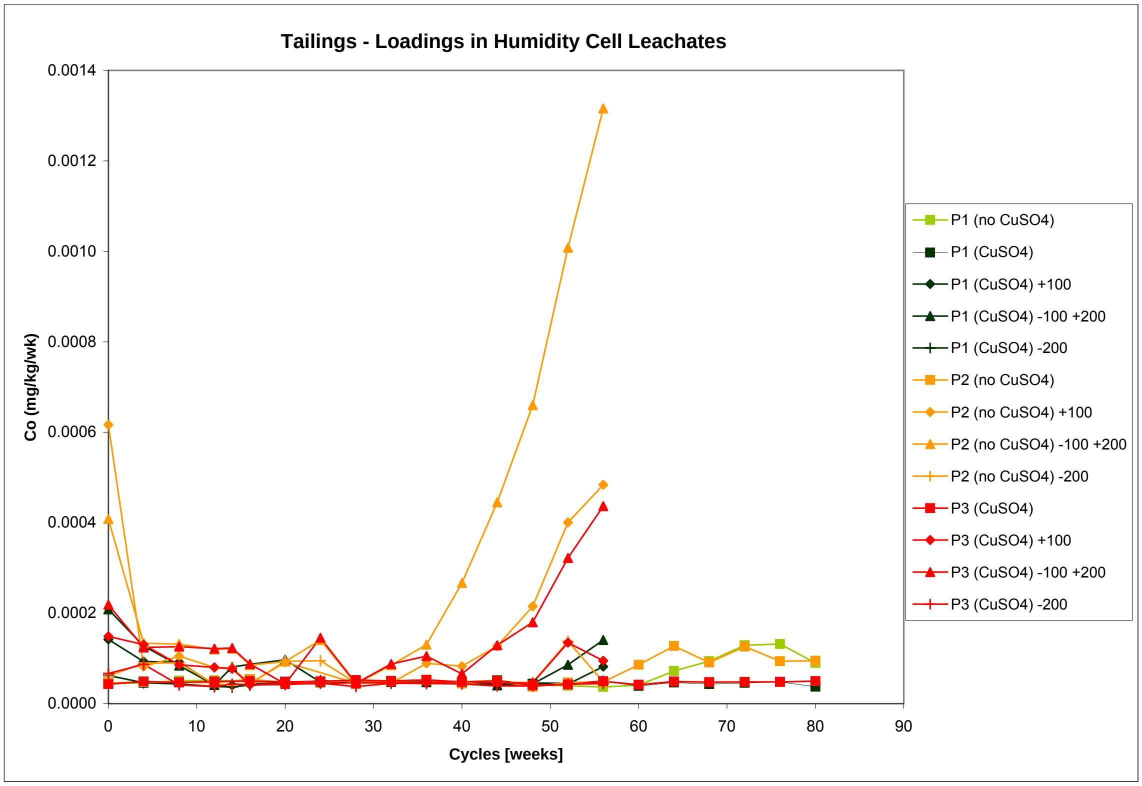
Graph C.1.14

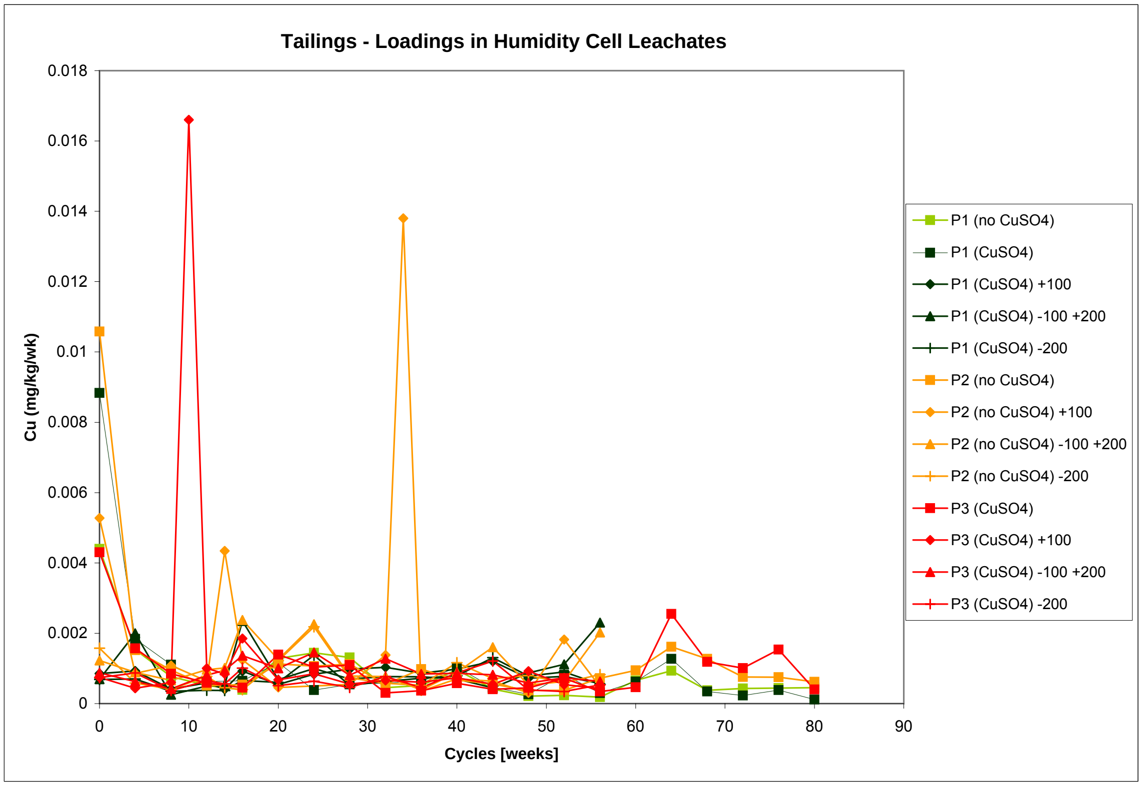


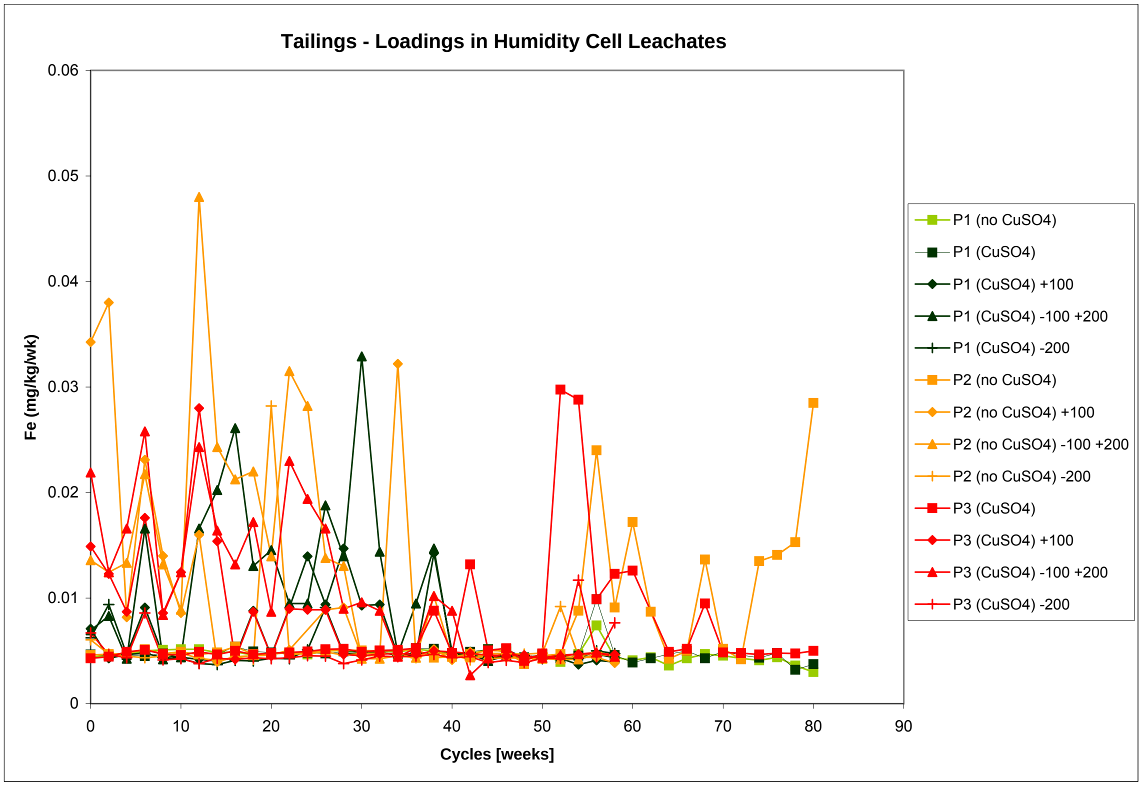

Tailings - Loadings in Humidity Cell Leachates
Cd (mg/kg/wk)
0.000035
0.00003
0.000025
0.00002
0.000015
0.00001
0.000005
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

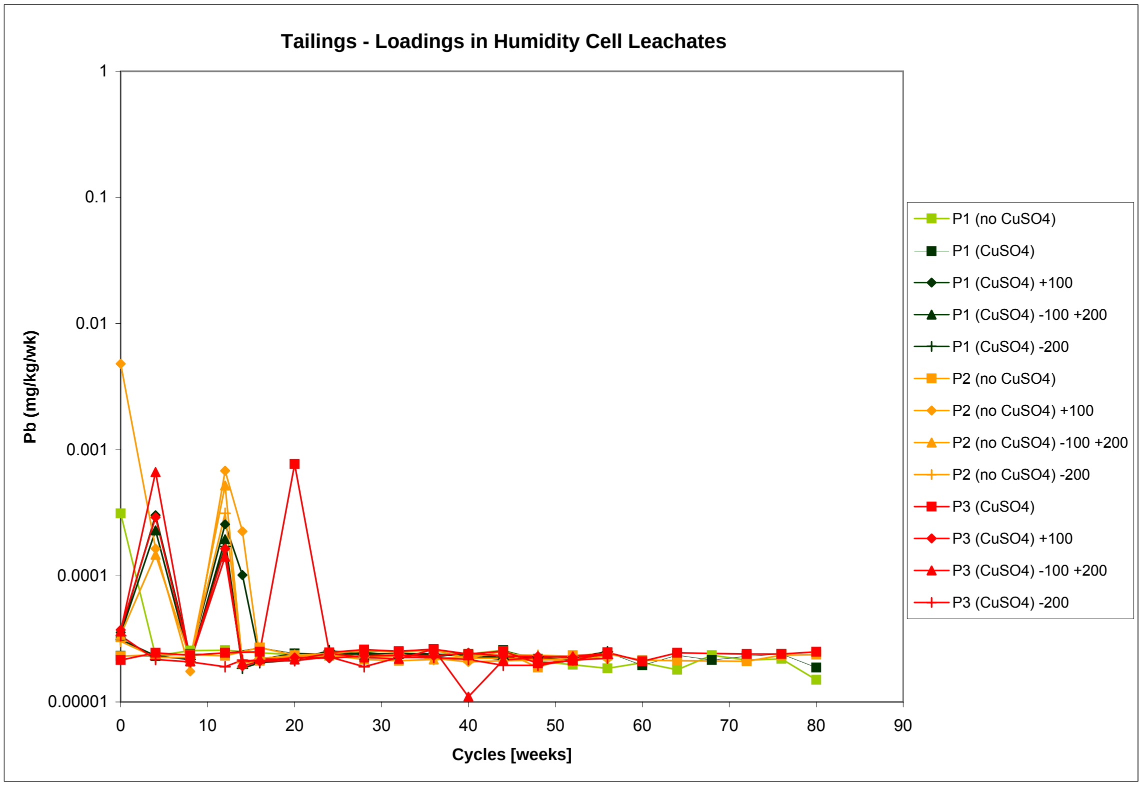

Tailings - Loadings in Humidity Cell Leachates
Ca (mg/kg/wk)
20
18
16
14
12
10
8
6
4
2
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

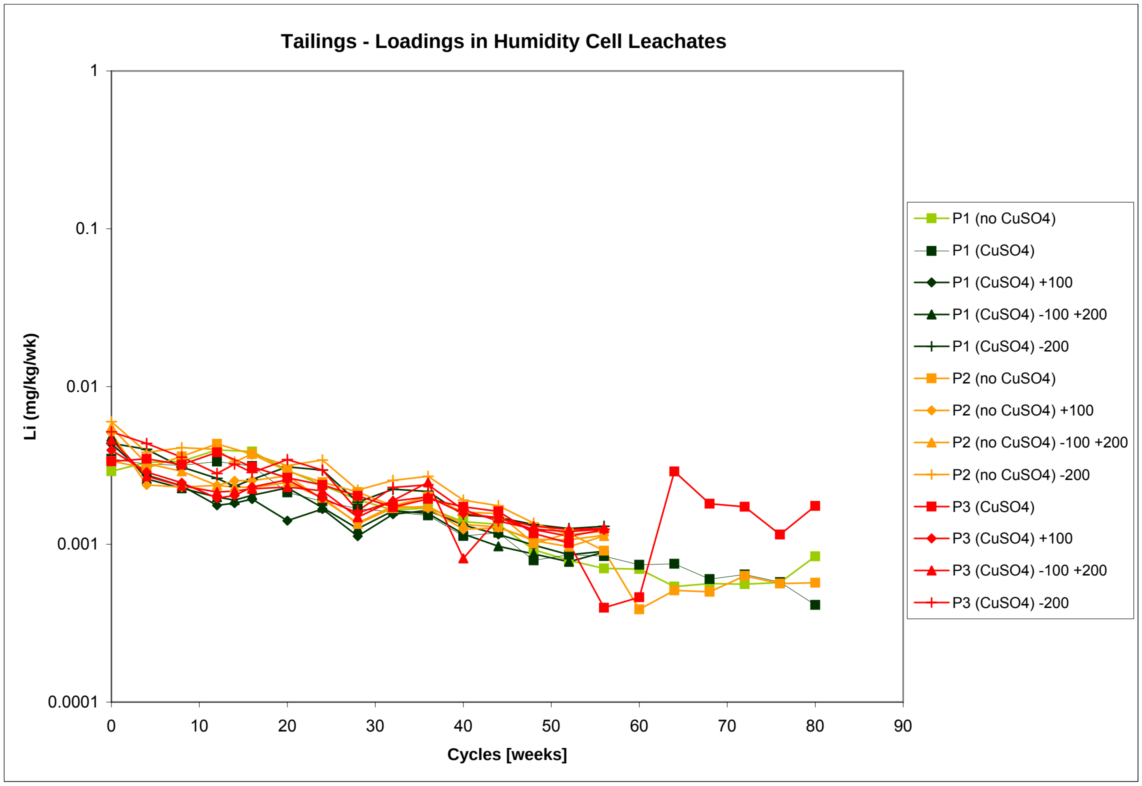

Tailings - Loadings in Humidity Cell Leachates
Cr (mg/kg/wk)
0.0004
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

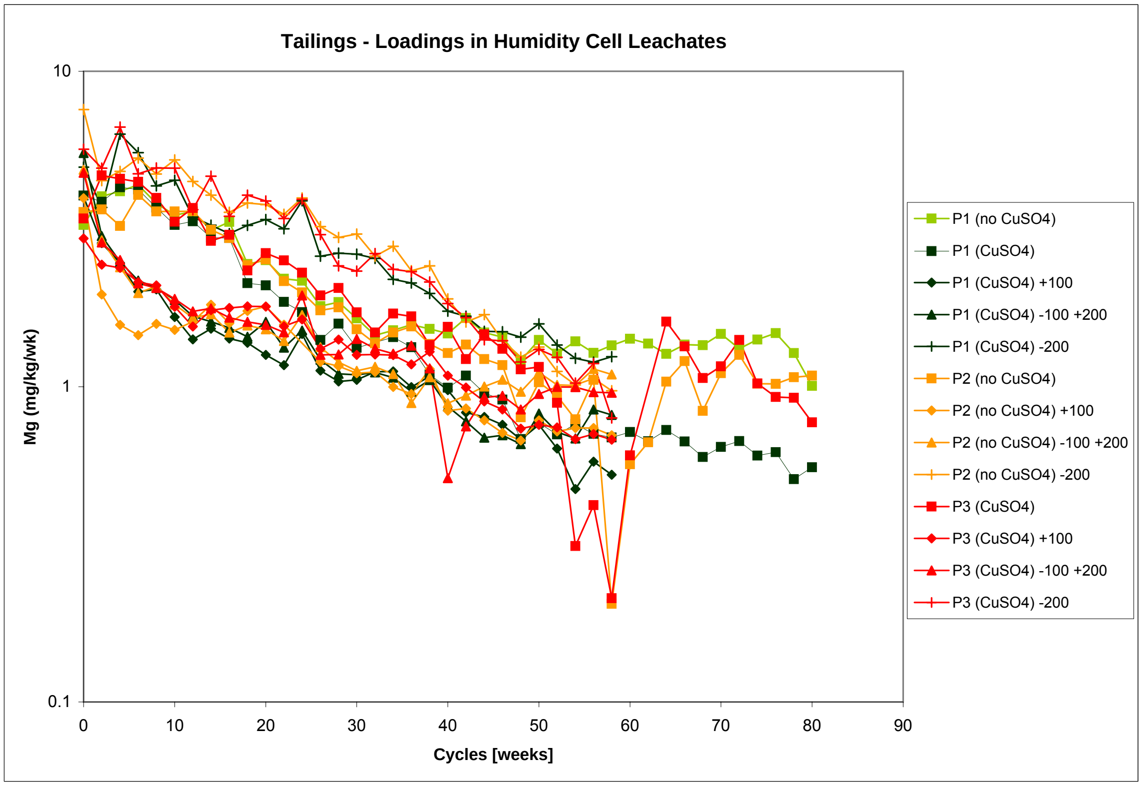

Tailings - Loadings in Humidity Cell Leachates
Co (mg/kg/wk)
0.0014
0.0012
0.0010
0.0008
0.0006
0.0004
0.0002
0.0000
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

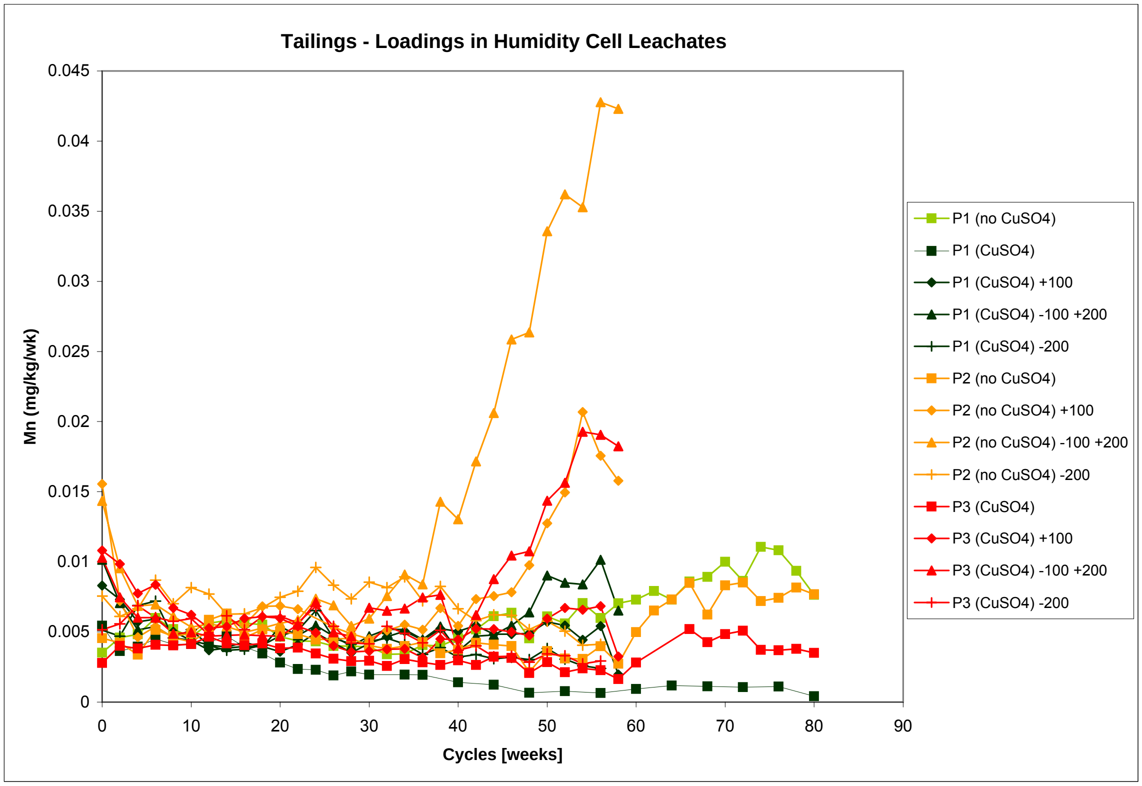

Tailings - Loadings in Humidity Cell Leachates
Cu (mg/kg/wk)
0
0.002
0.004
0.006
0.008
0.01
0.012
0.014
0.016
0.018
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

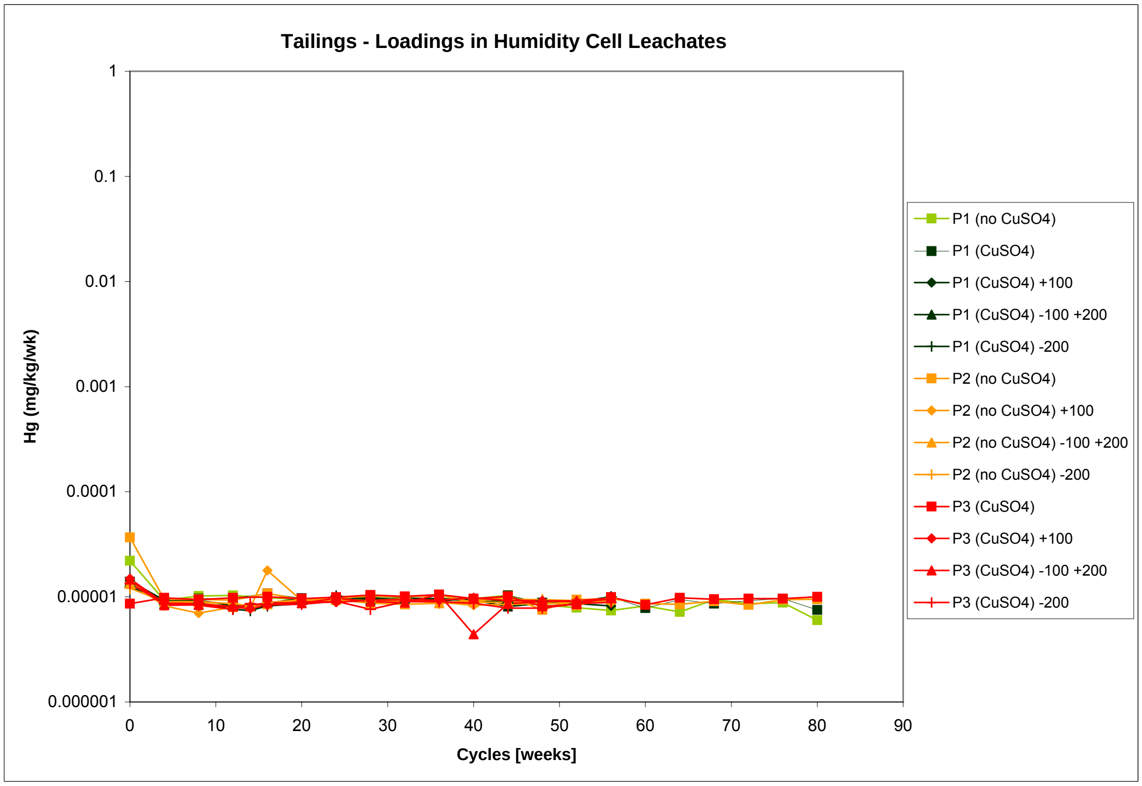

Tailings - Loadings in Humidity Cell Leachates
Fe (mg/kg/wk)
0
0.01
0.02
0.03
0.04
0.05
0.06
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

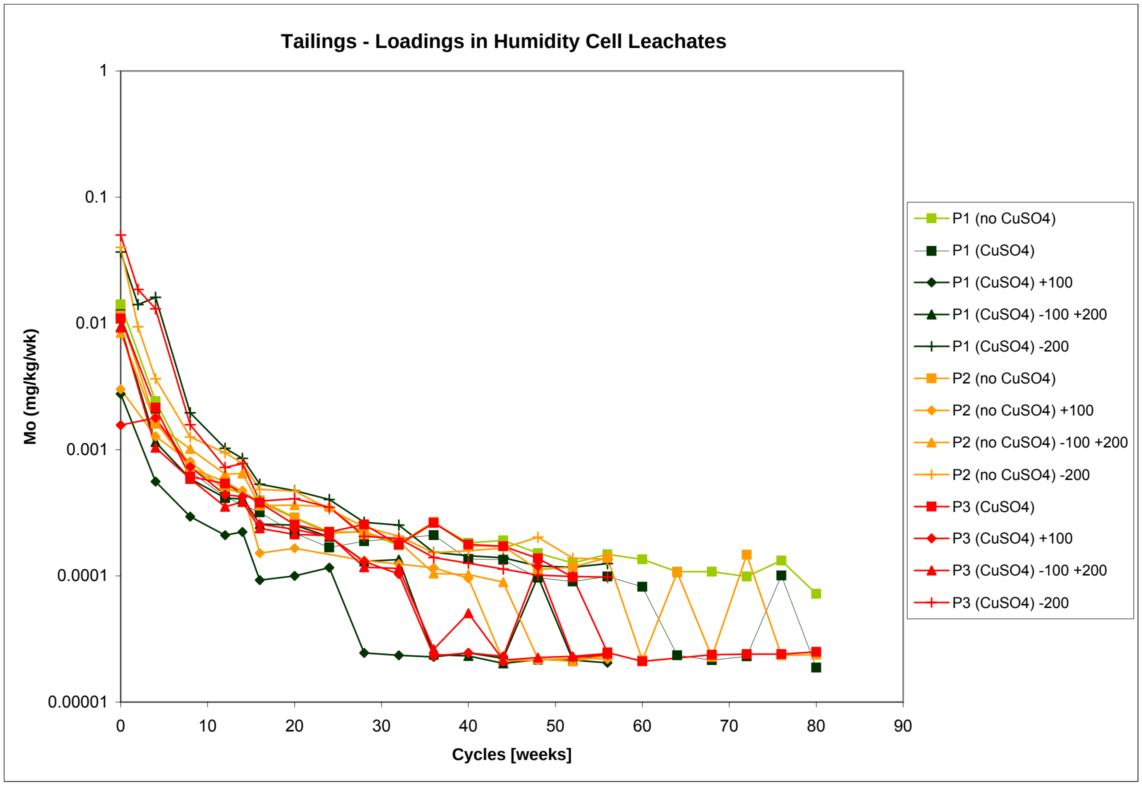

Tailings - Loadings in Humidity Cell Leachates
Pb (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0.00001
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
Li (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

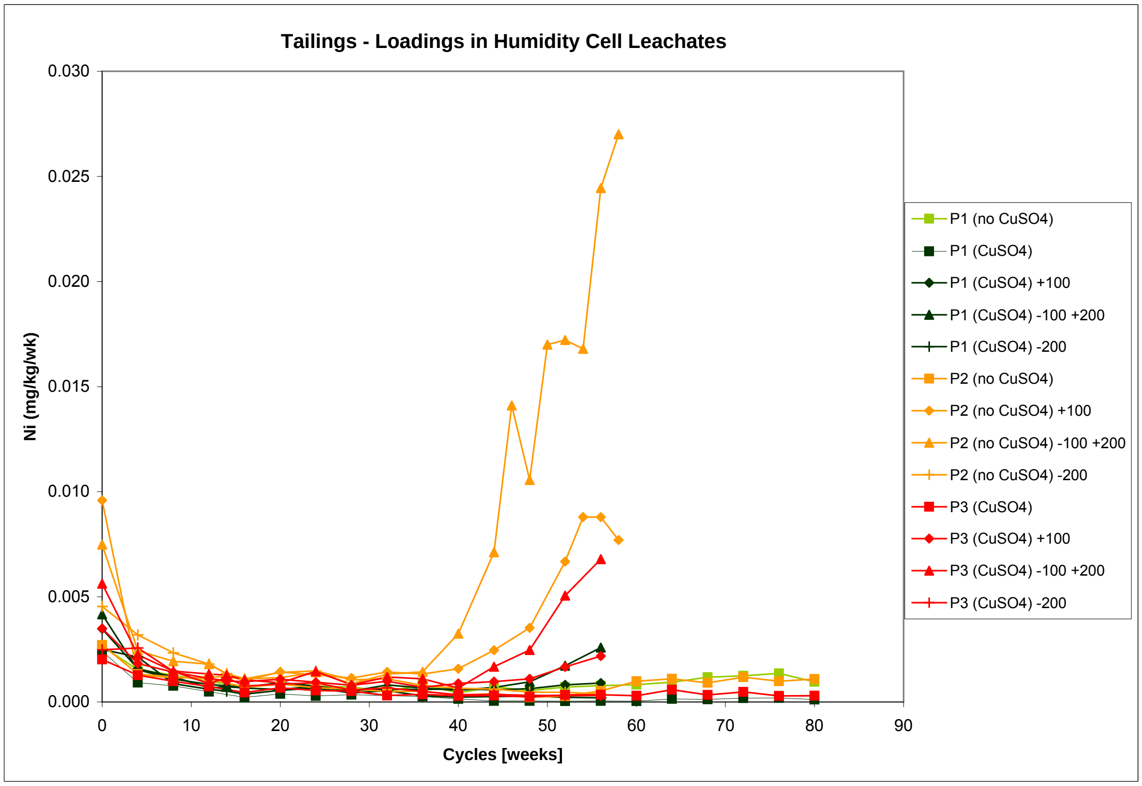

Tailings - Loadings in Humidity Cell Leachates
10
1
0.1
Mg (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
Mn (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

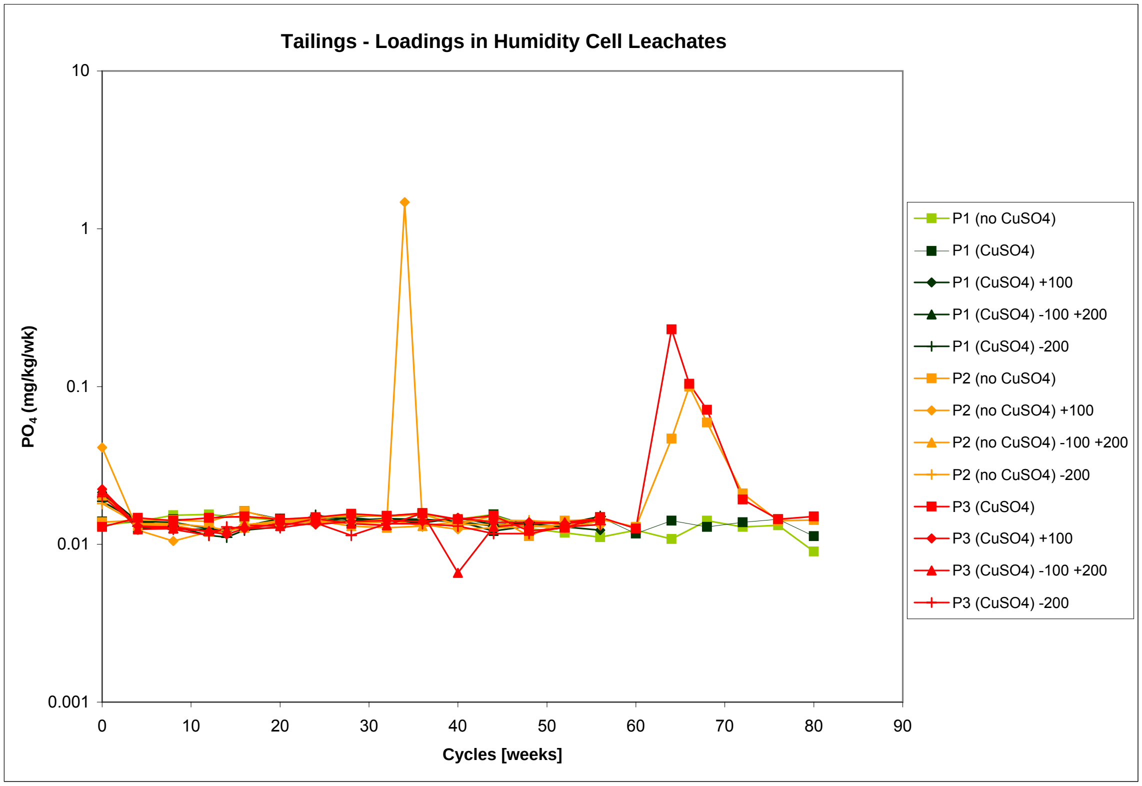

Tailings - Loadings in Humidity Cell Leachates
Hg (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0.00001
0.000001
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

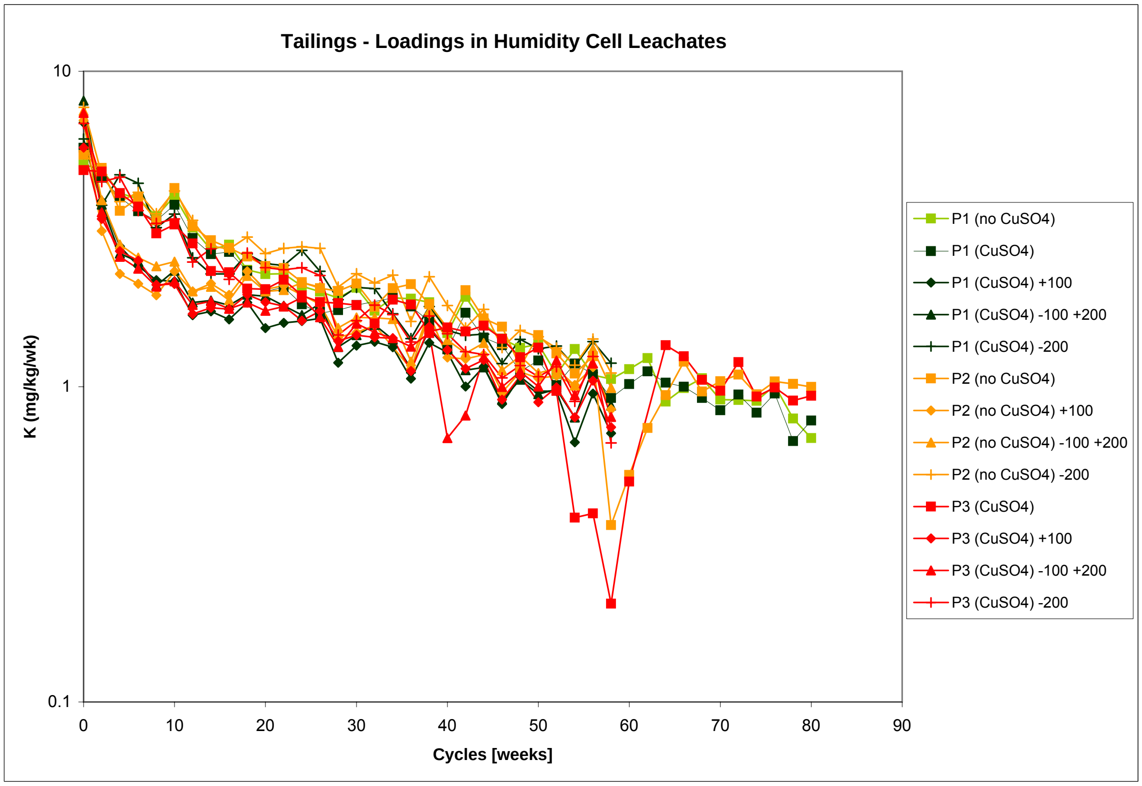

Tailings - Loadings in Humidity Cell Leachates
Mo (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0.00001
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

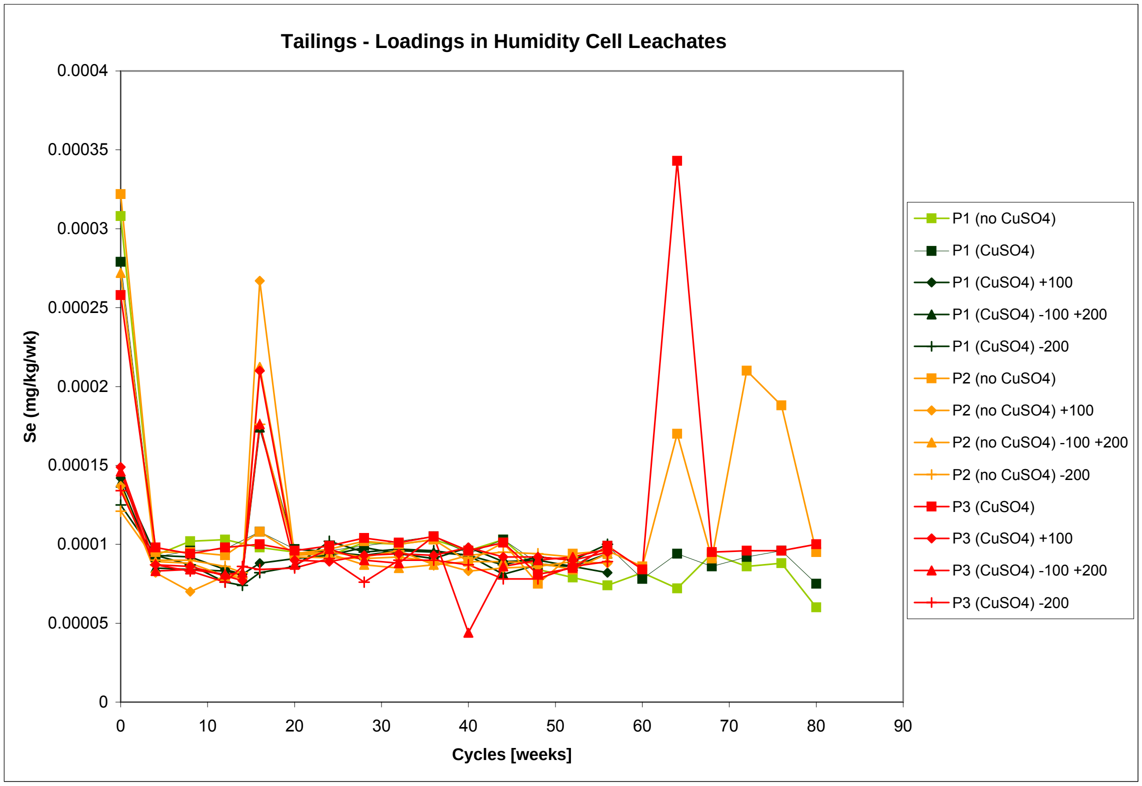
Graph C.1.27

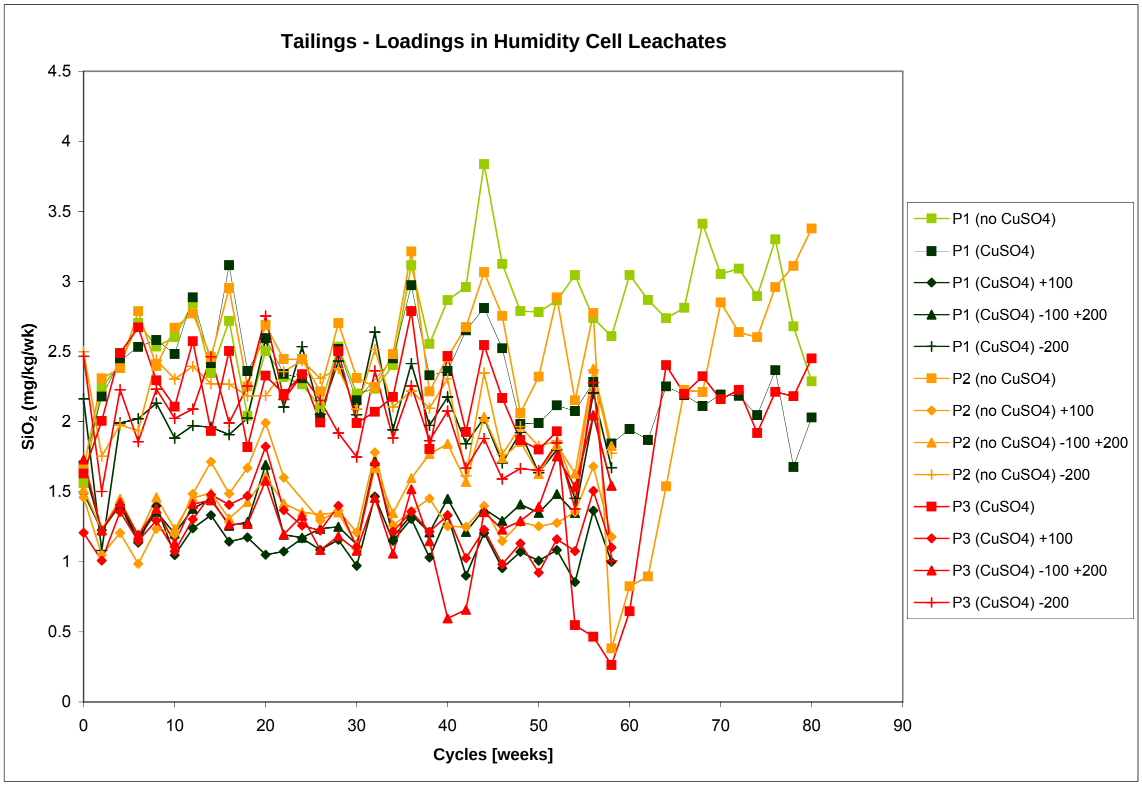


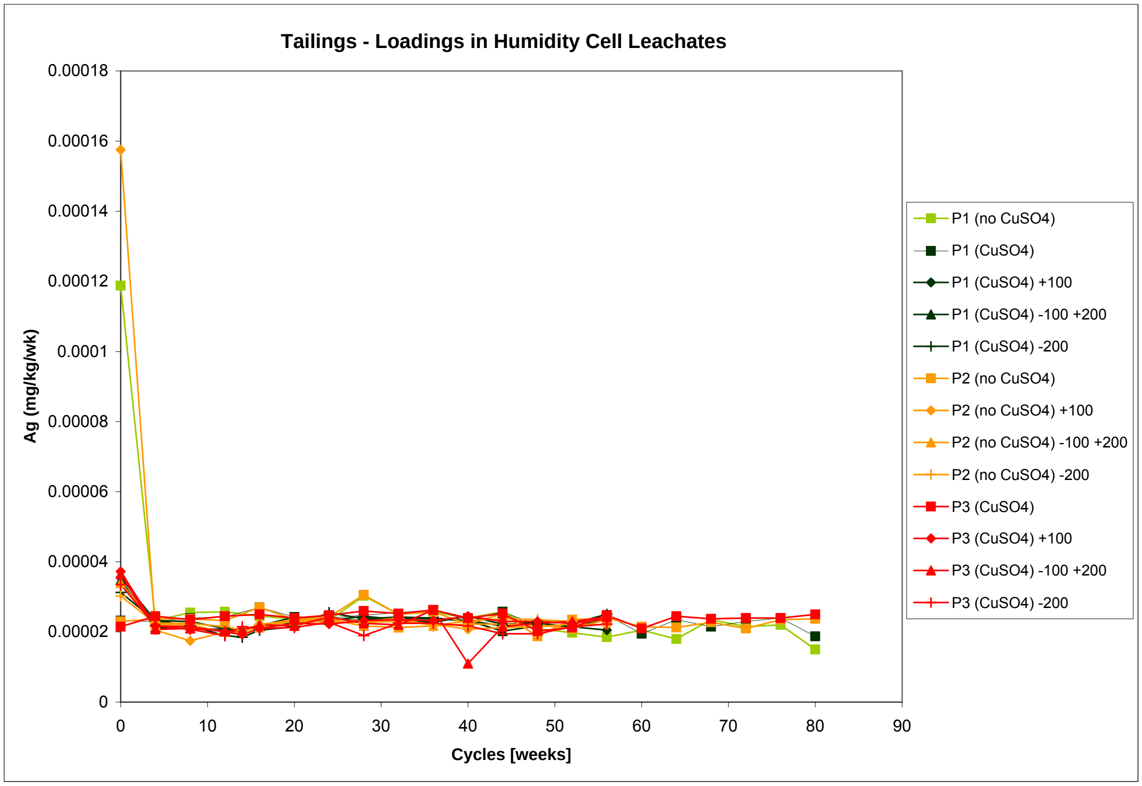
Graph C.1.28



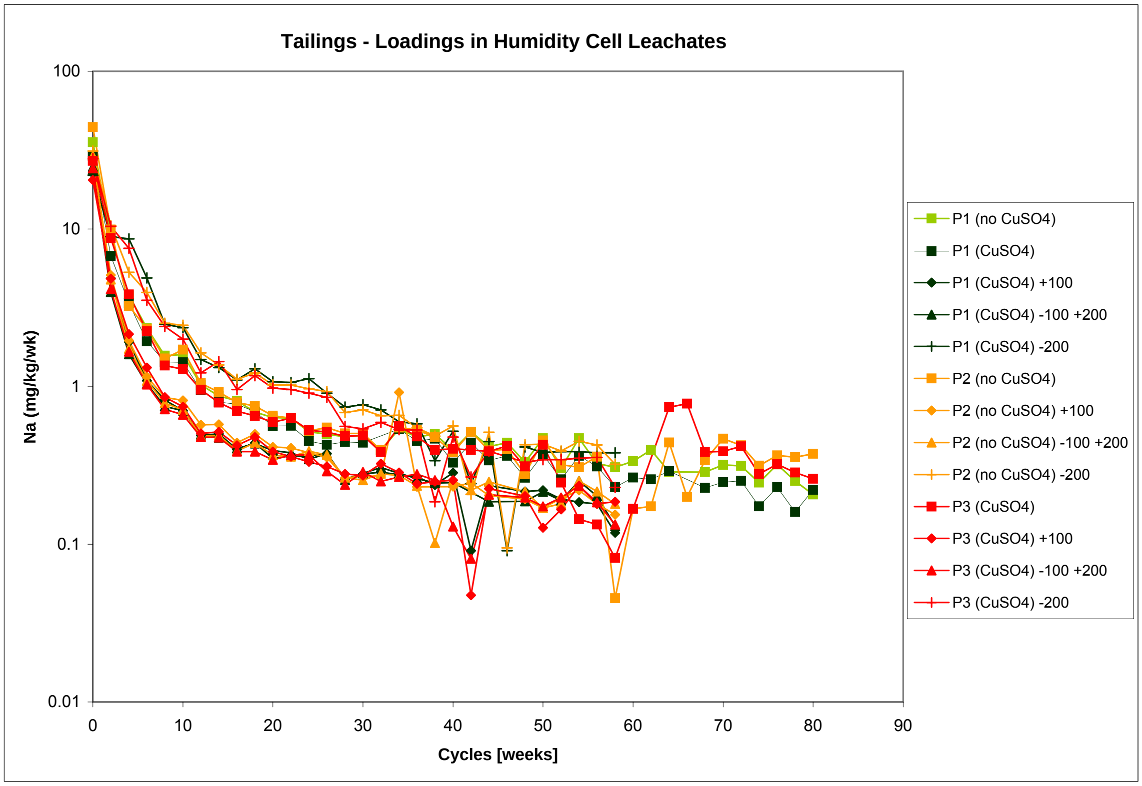

Tailings - Loadings in Humidity Cell Leachates
10
1
0.1
K (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
0.0004
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
Se (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

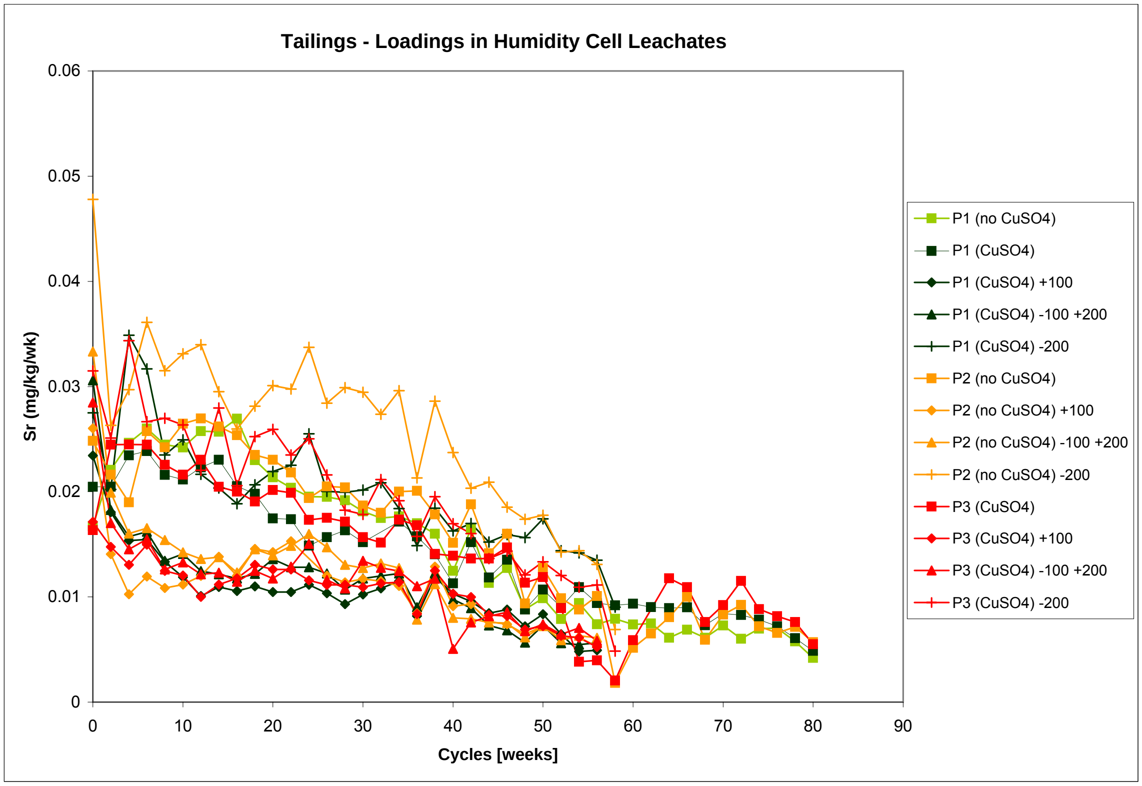

Tailings - Loadings in Humidity Cell Leachates
SiO$_2$ (mg/kg/wk)
4.5
4
3.5
3
2.5
2
1.5
1
0.5
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

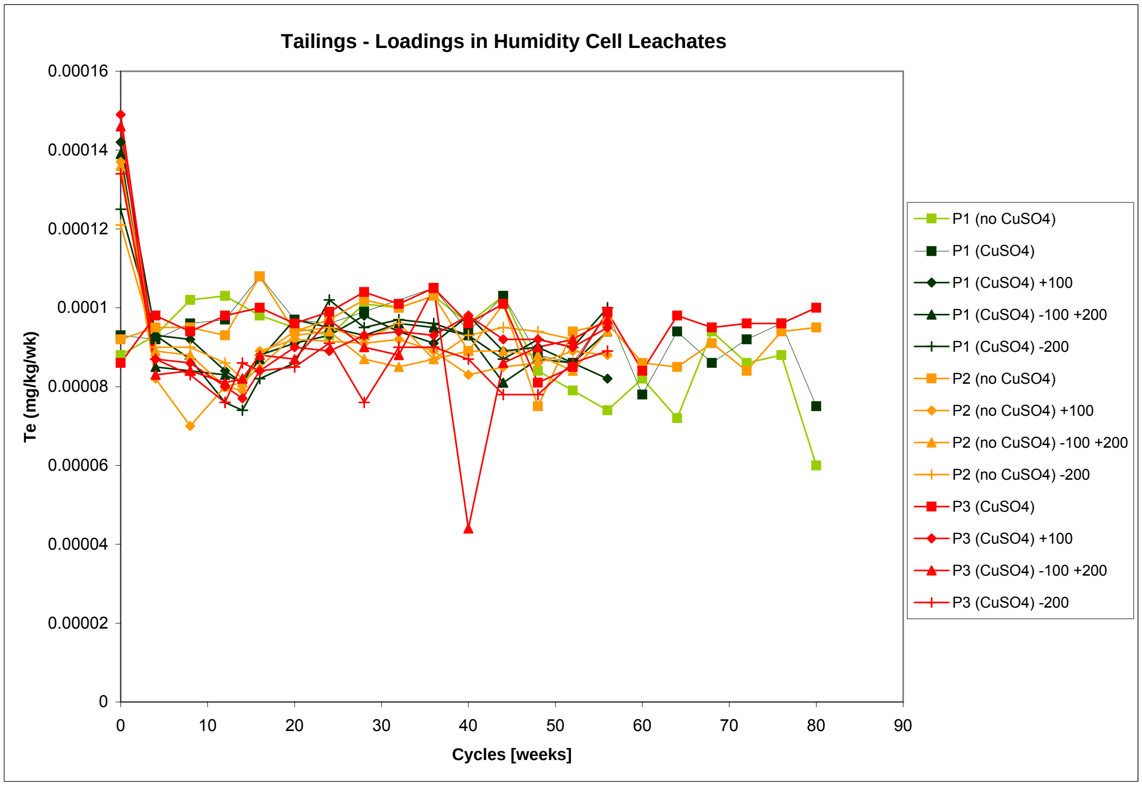

Tailings - Loadings in Humidity Cell Leachates
Ag (mg/kg/wk)
0.00018
0.00016
0.00014
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

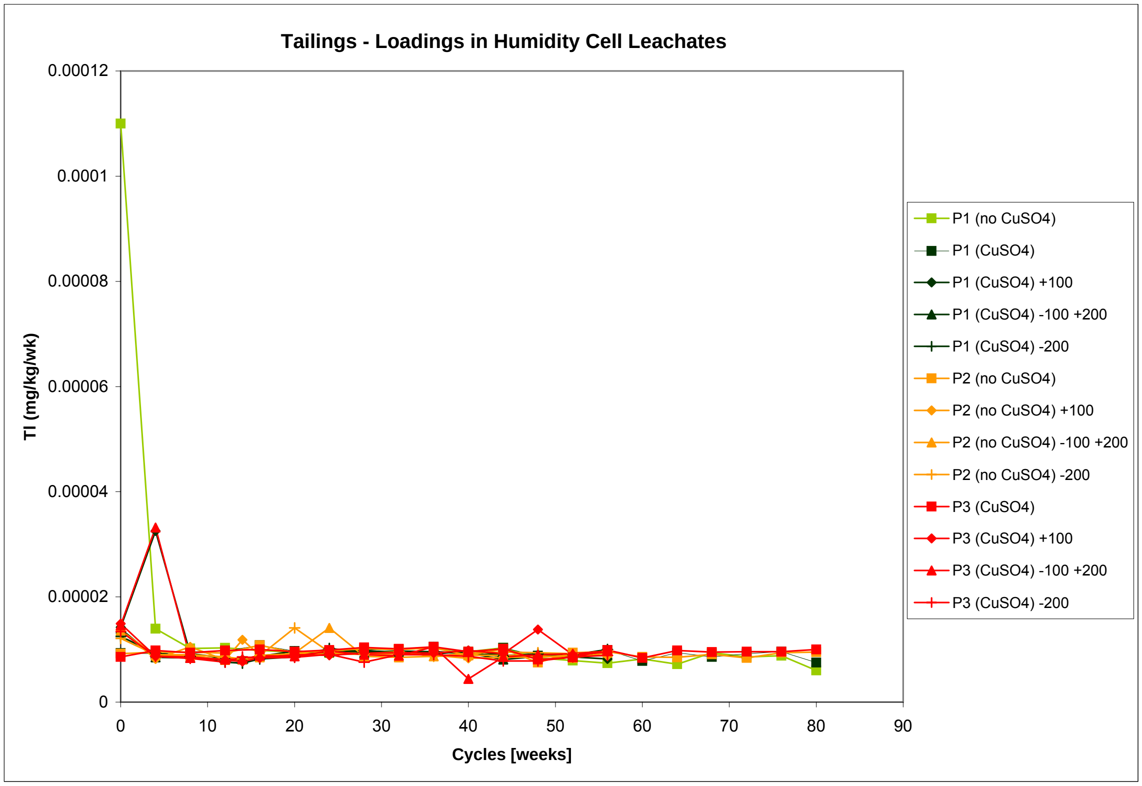
Graph C.1.33

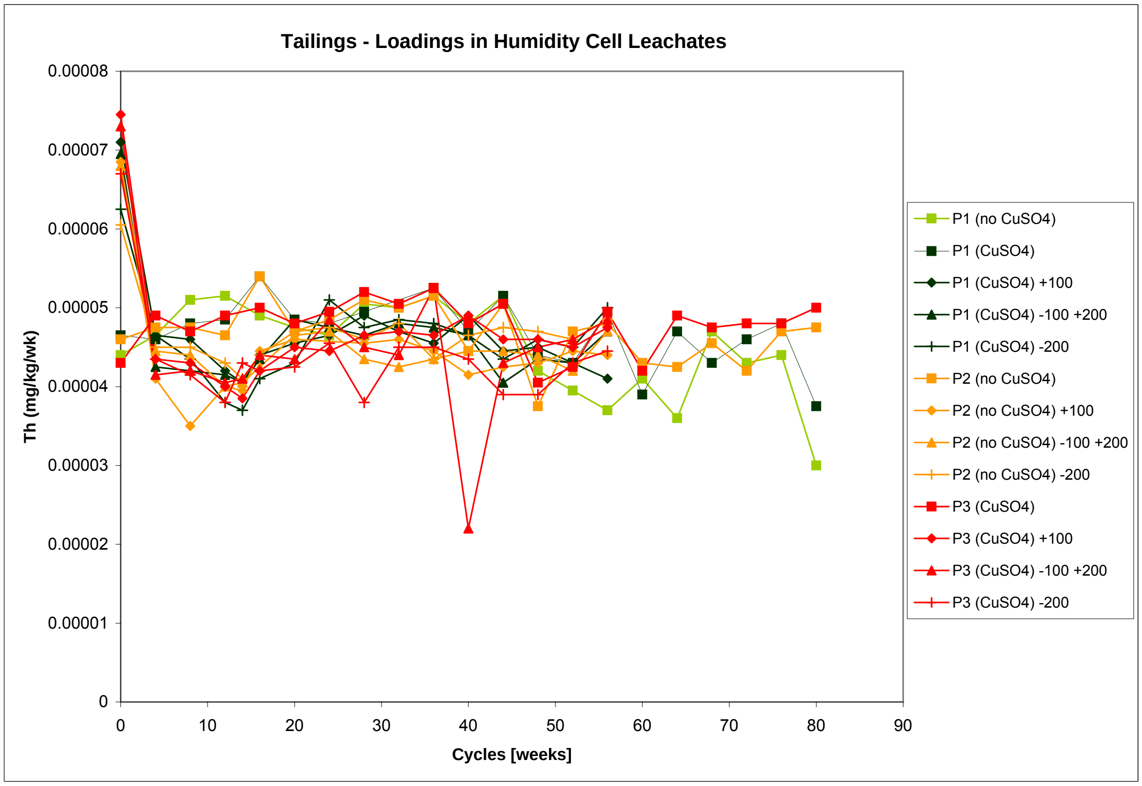


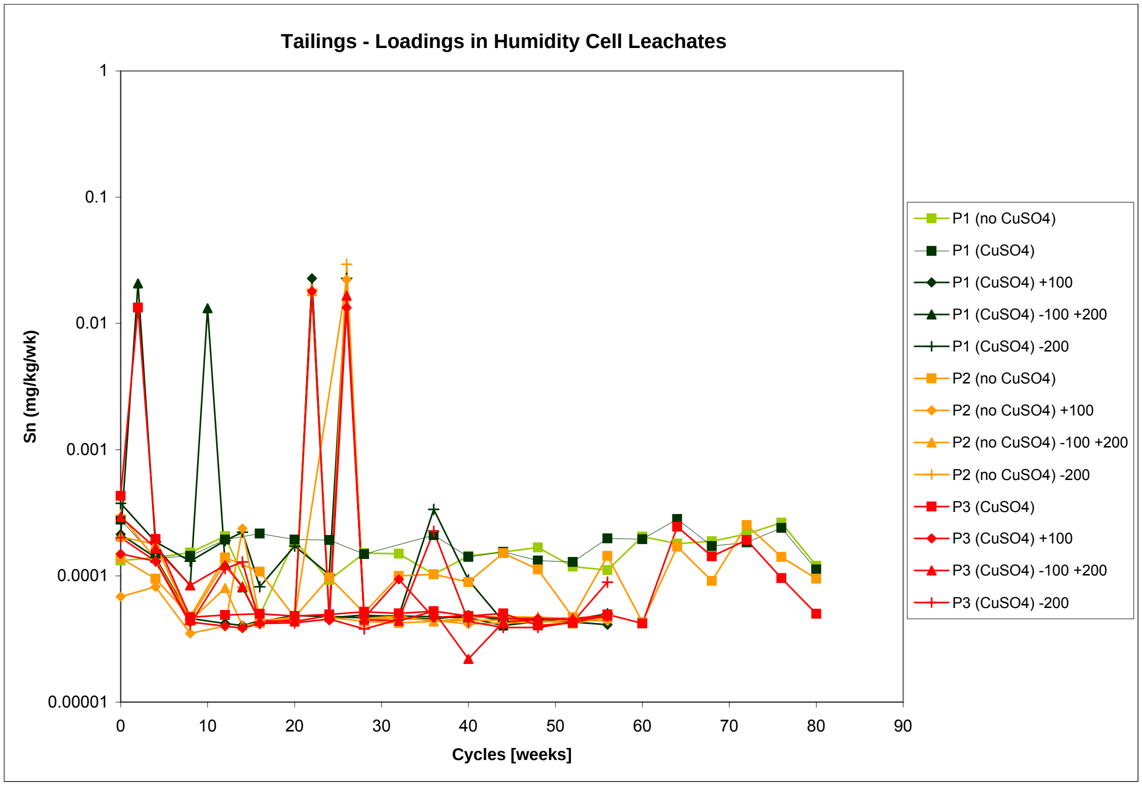
Graph C.1.34

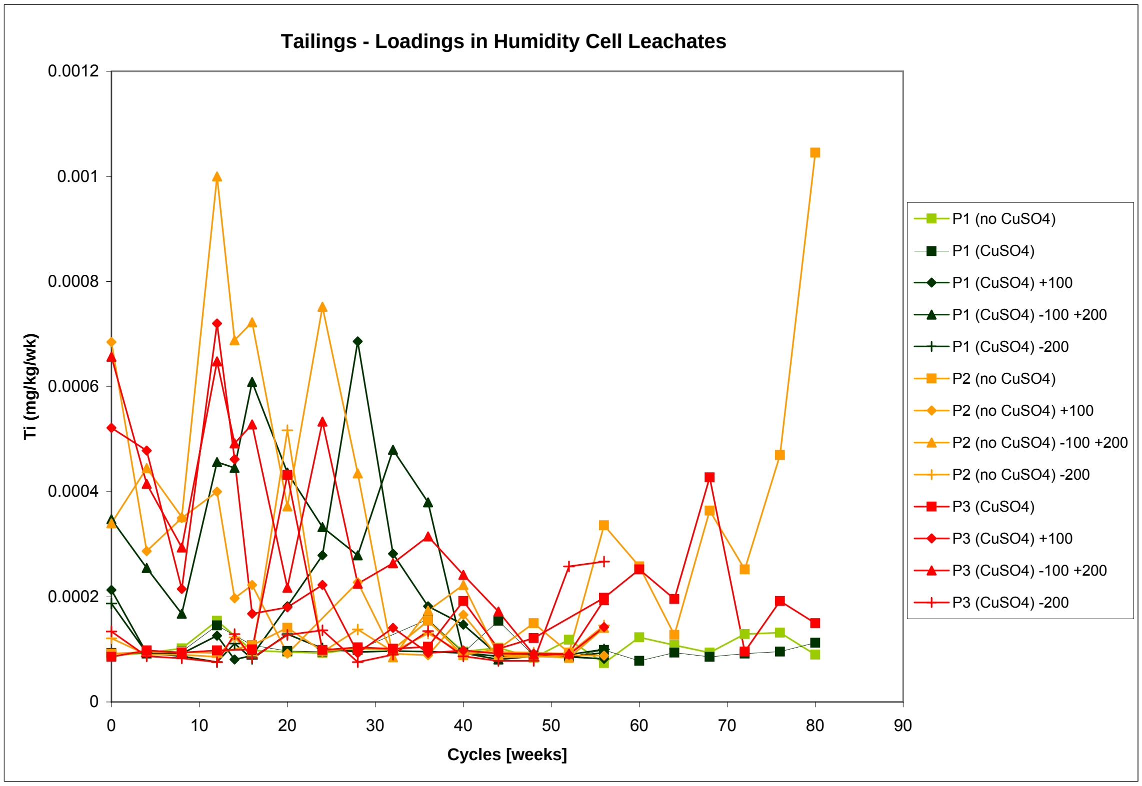


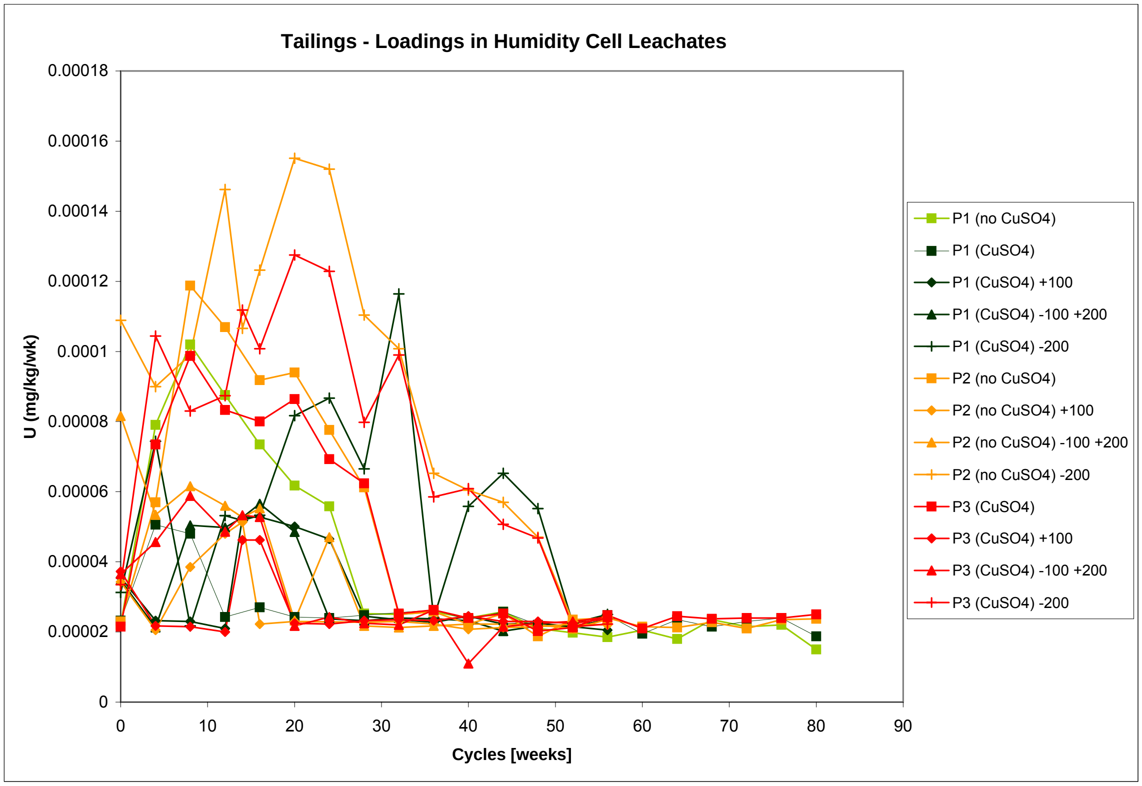

Tailings - Loadings in Humidity Cell Leachates
Te (mg/kg/wk)
0.00016
0.00014
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
Tl (mg/kg/wk)
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

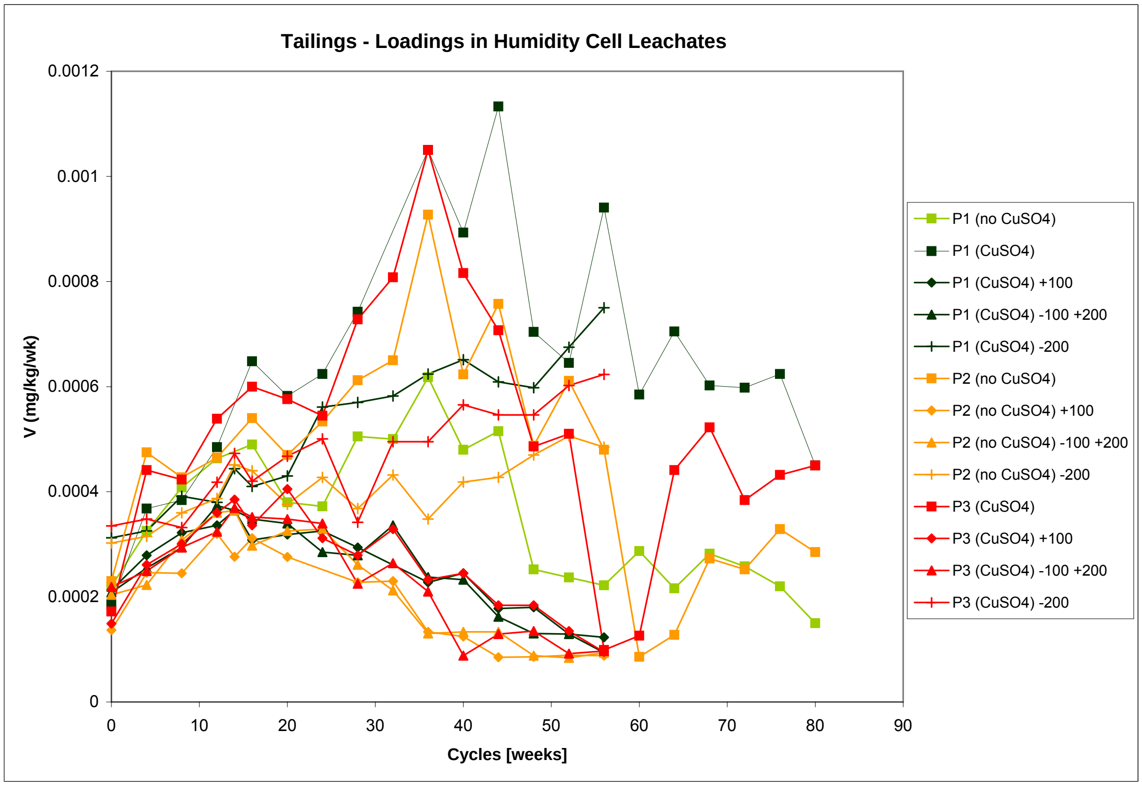

Tailings - Loadings in Humidity Cell Leachates
Th (mg/kg/wk)
0.00008
0.00007
0.00006
0.00005
0.00004
0.00003
0.00002
0.00001
0
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in Humidity Cell Leachates
Sn (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0.00001
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

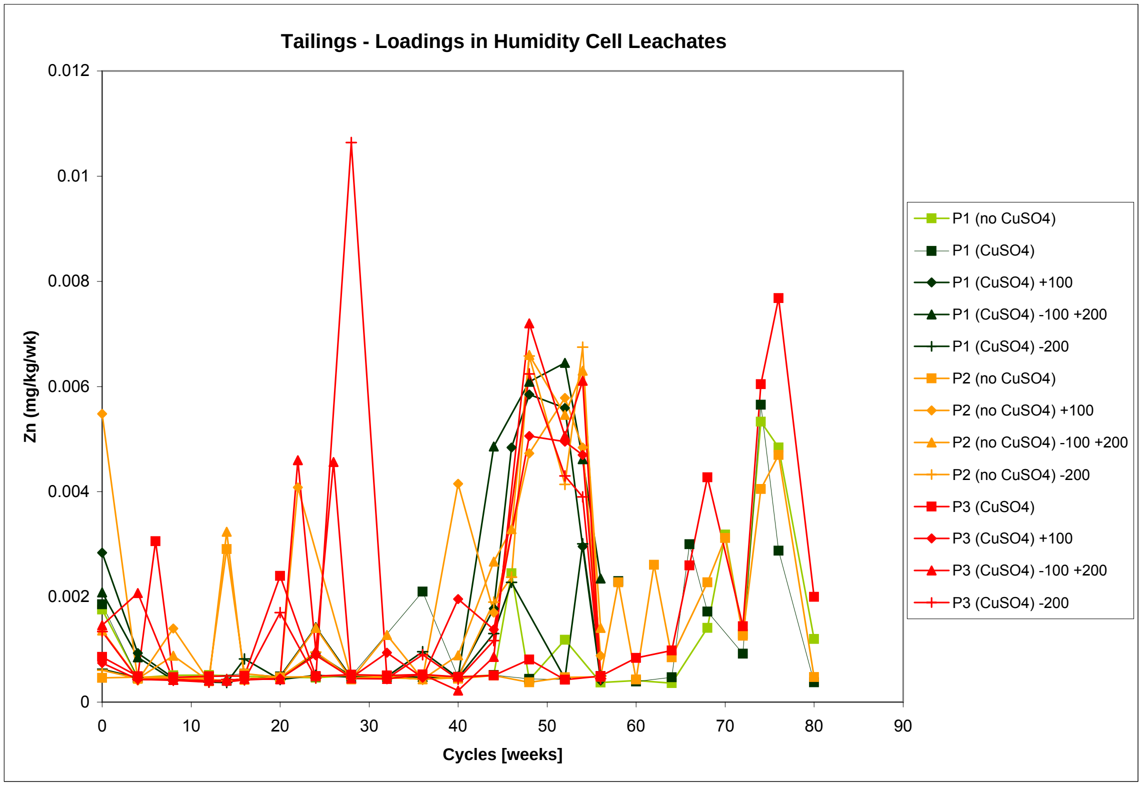

Tailings - Loadings in Humidity Cell Leachates
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Ti (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

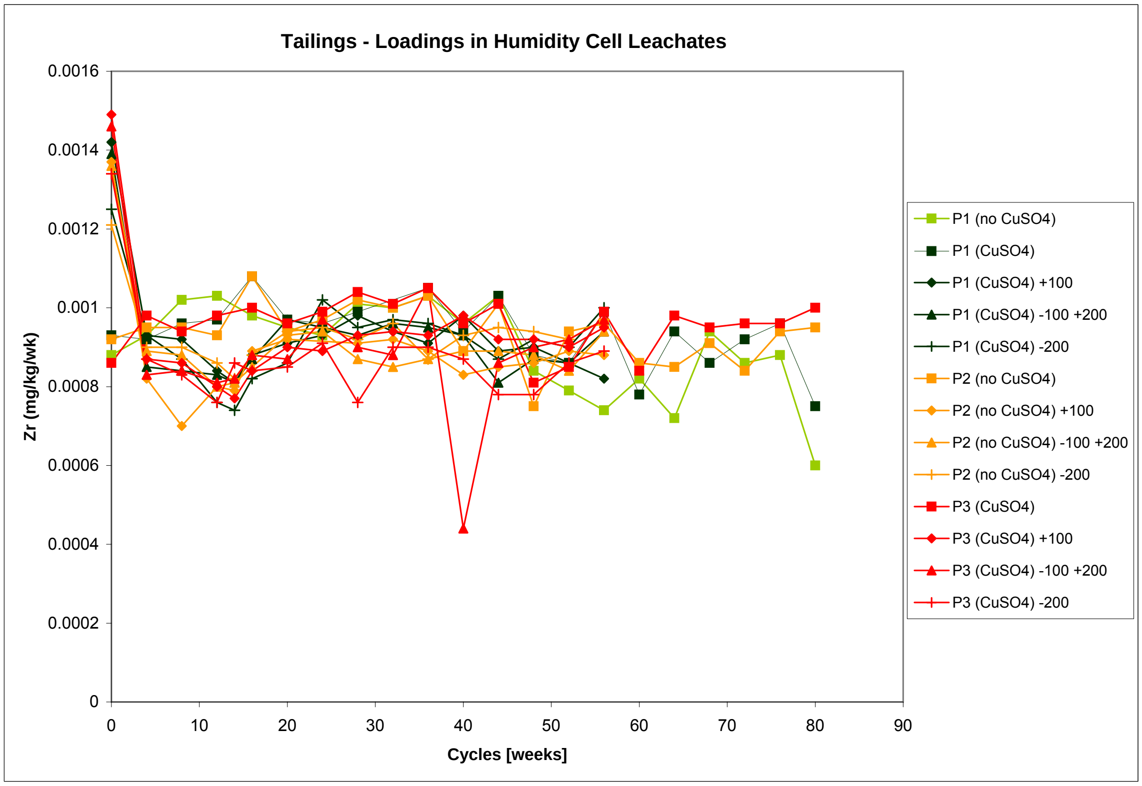

Tailings - Loadings in Humidity Cell Leachates
0.00018
0.00016
0.00014
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
U (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

Graph C.1.41



Graph C.1.42

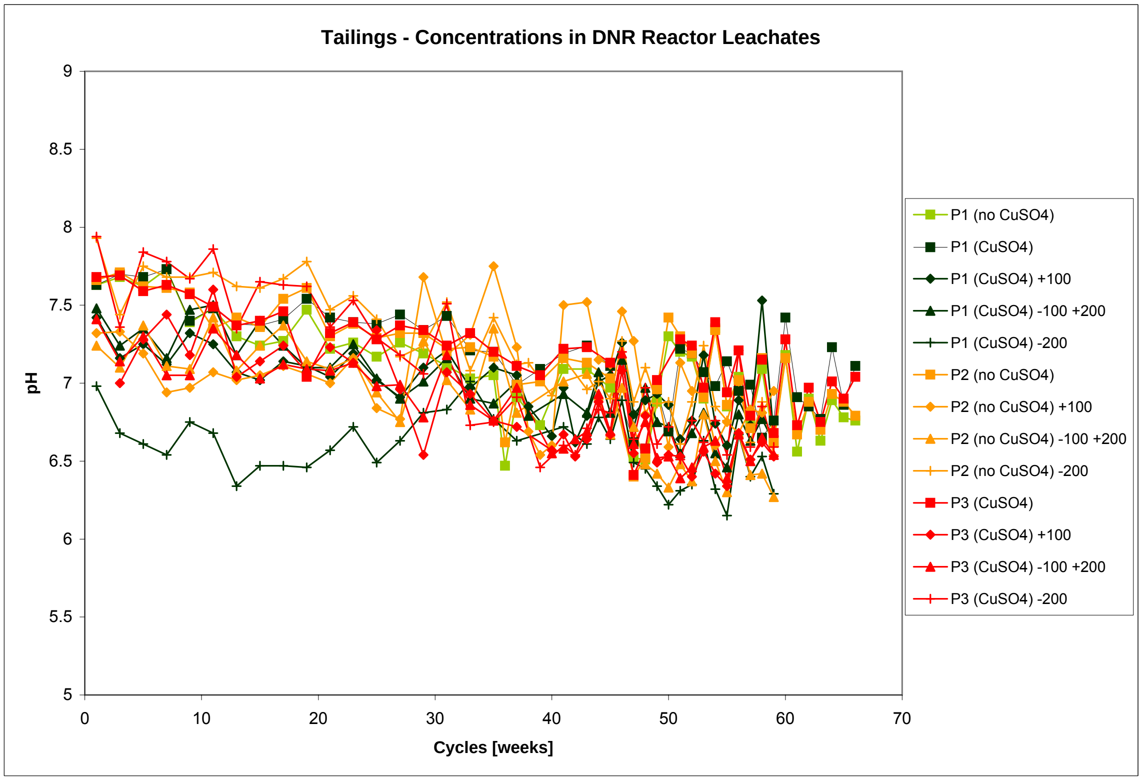



Tailings - Loadings in Humidity Cell Leachates
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Zr (mg/kg/wk)
0
10
20
30
40
50
60
70
80
90
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

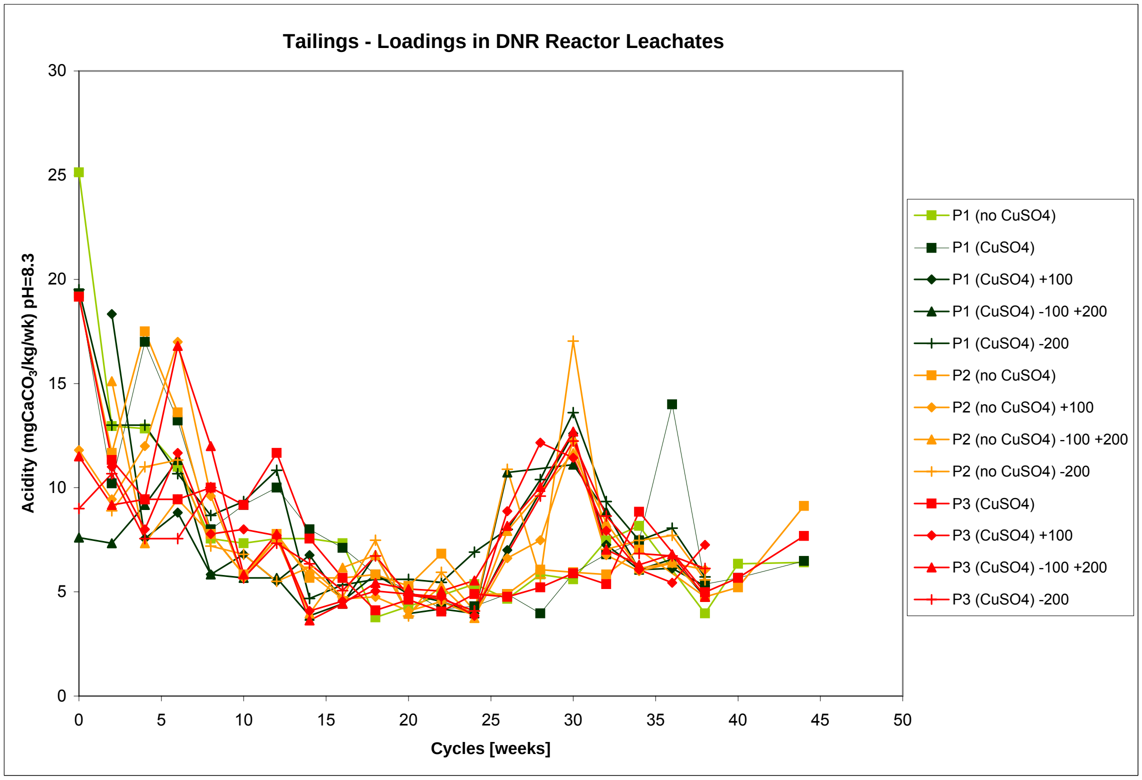
Appendix C.2

MDNR Reactors (Loadings)

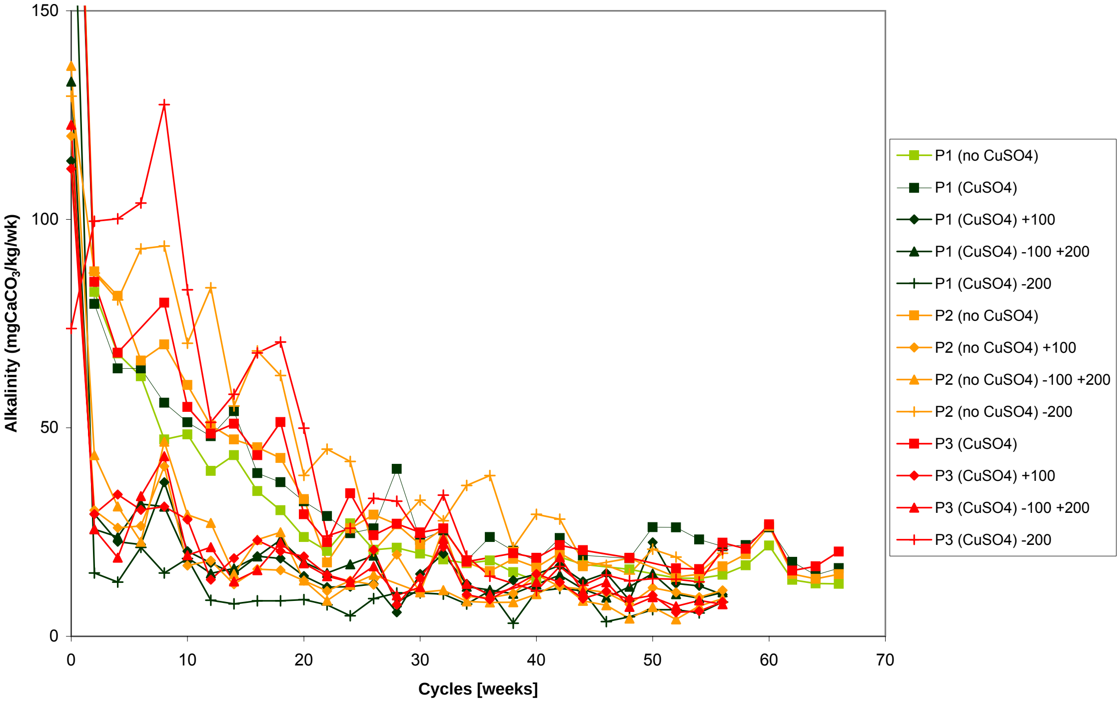
Graph C.2.1



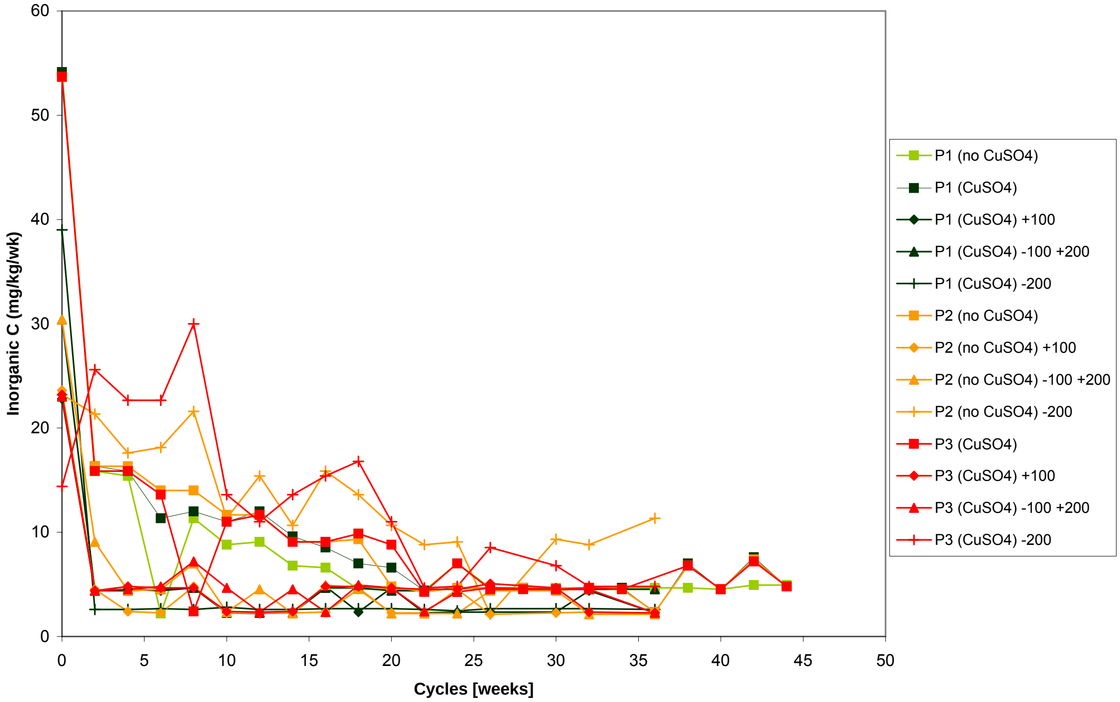
Graph C.2.2



Tailings - Loadings in DNR Reactor Leachates

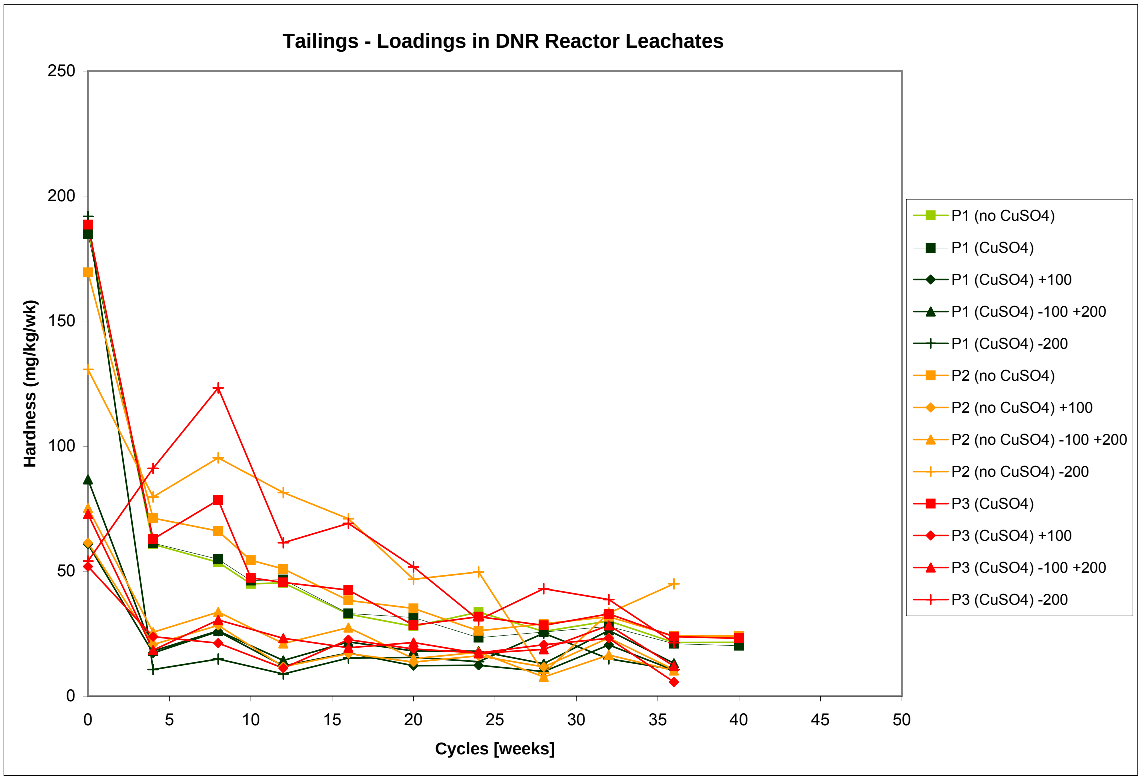


Tailings - Loadings in DNR Reactor Leachates



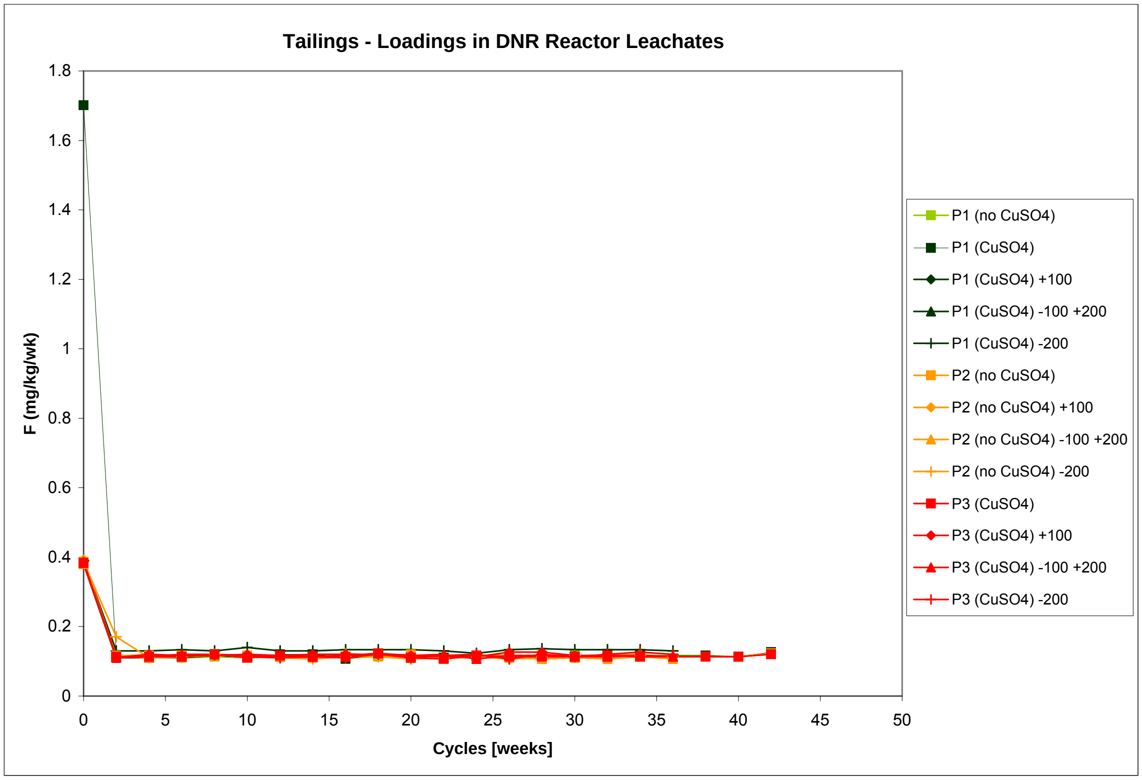
Attachment C.2
Tailings - Concentrations in DNR Reactors

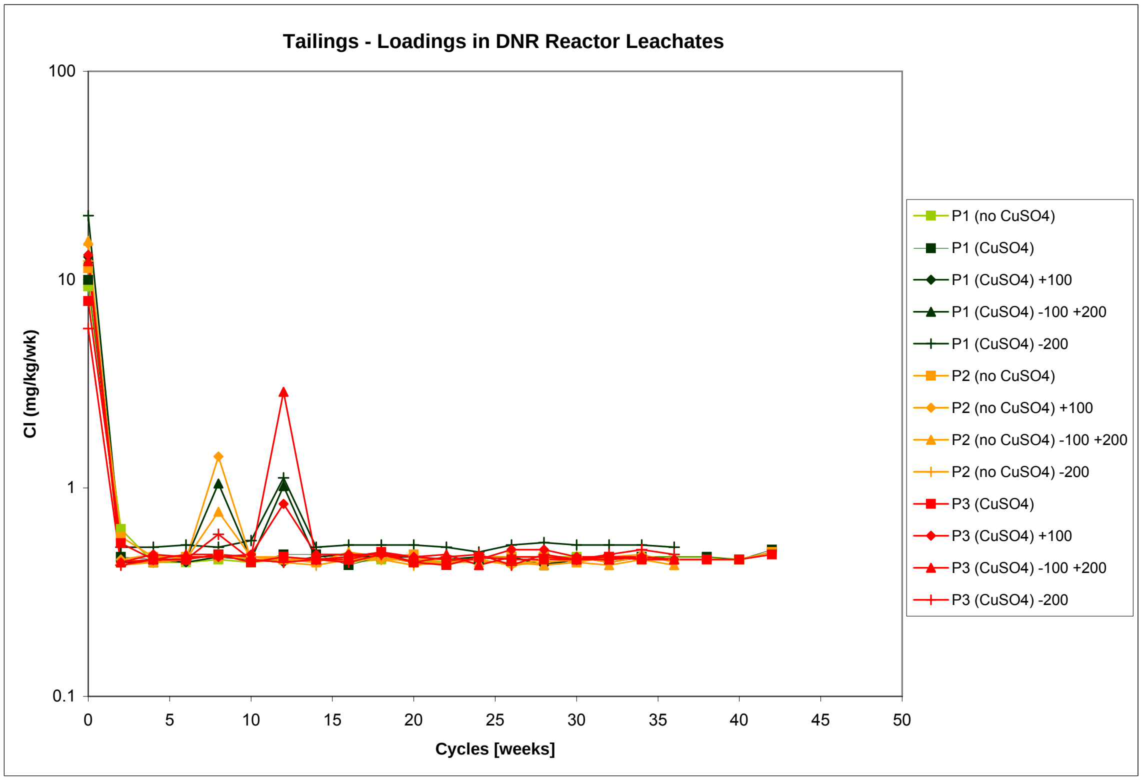
Graph C.2.5

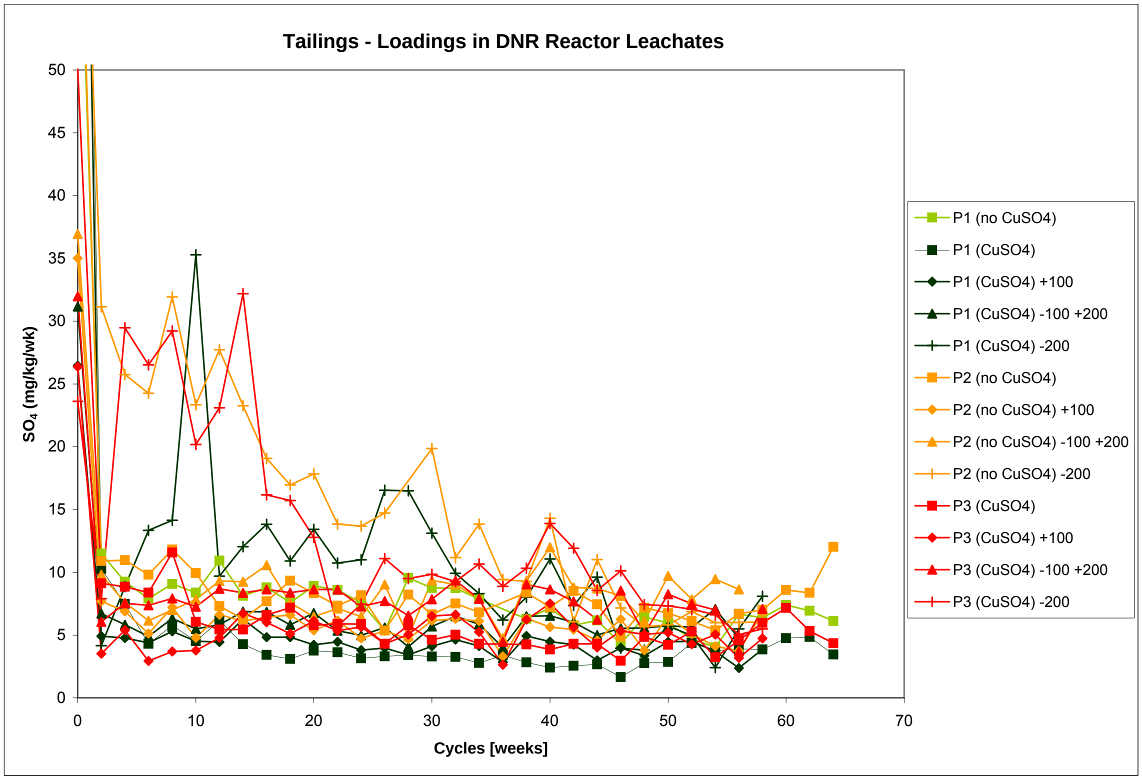


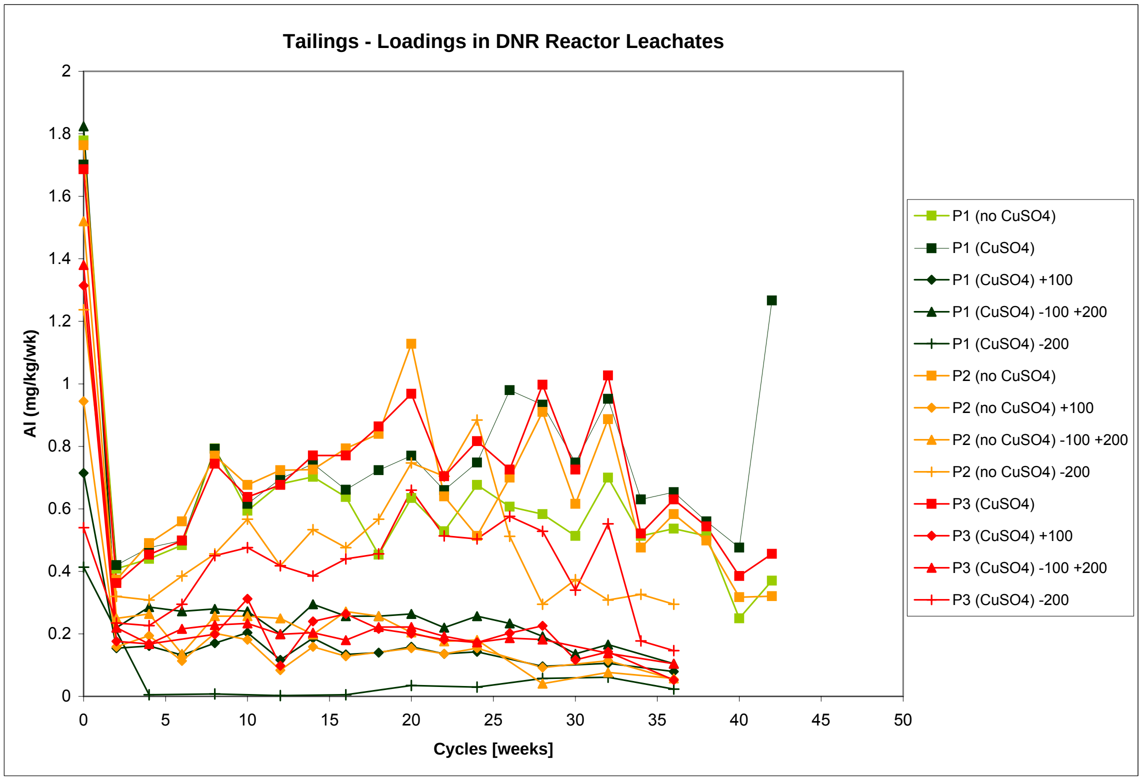
Attachment C.2
Tailings - Concentrations in DNR Reactors

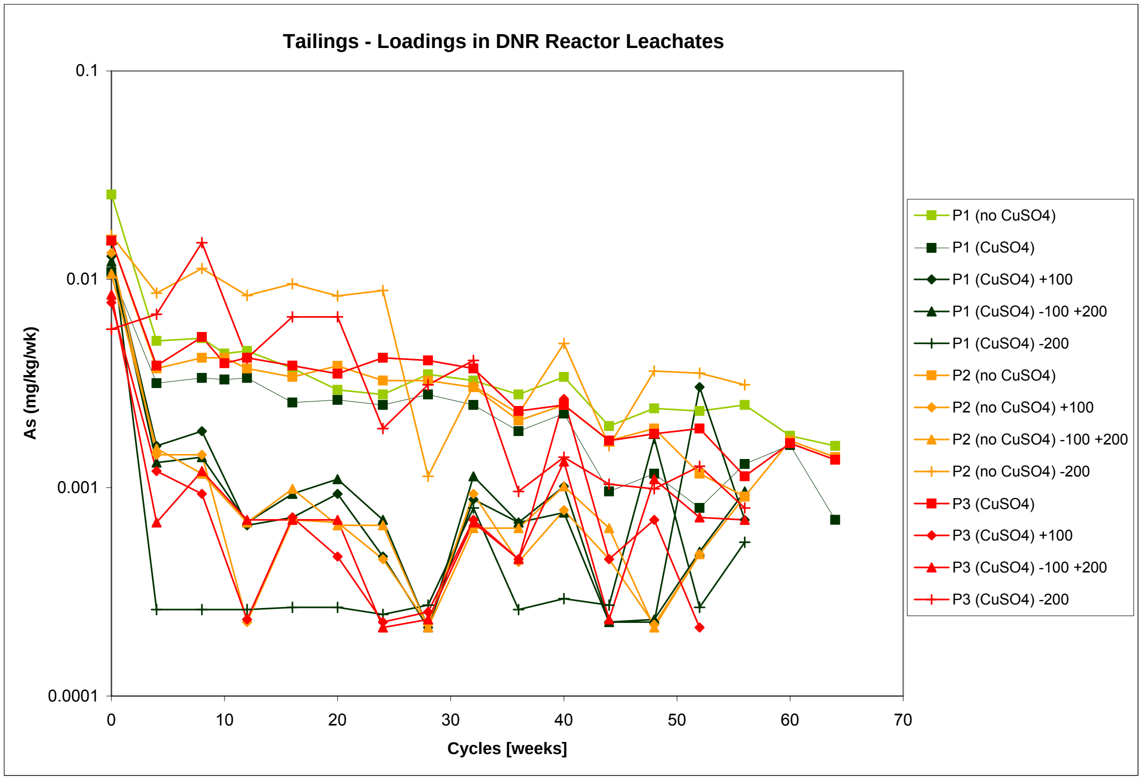
Graph C.2.6

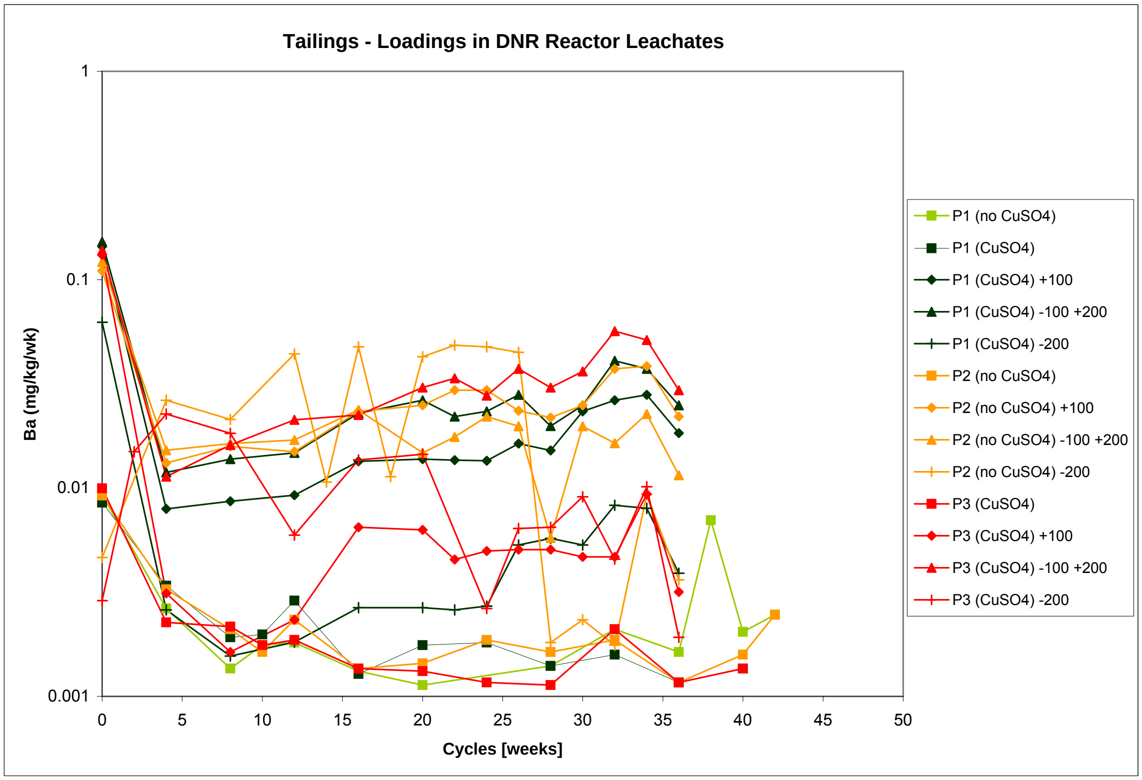


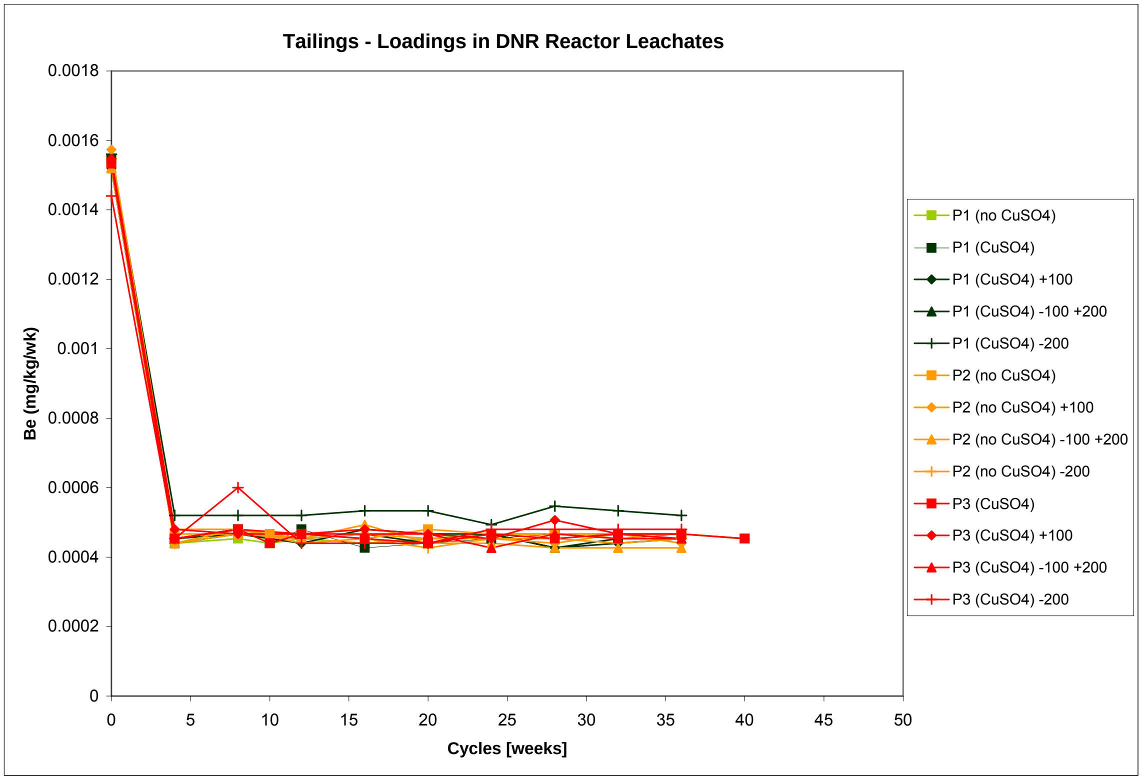

Tailings - Loadings in DNR Reactor Leachates
Cl (mg/kg/wk)
100
10
1
0.1
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
SO4 (mg/kg/wk)
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Al (mg/kg/wk)
0
0.2
0.4
0.6
0.8
1
1.2
1.4
1.6
1.8
2
Cycles [weeks]
0
5
10
15
20
25
30
35
40
45
50
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

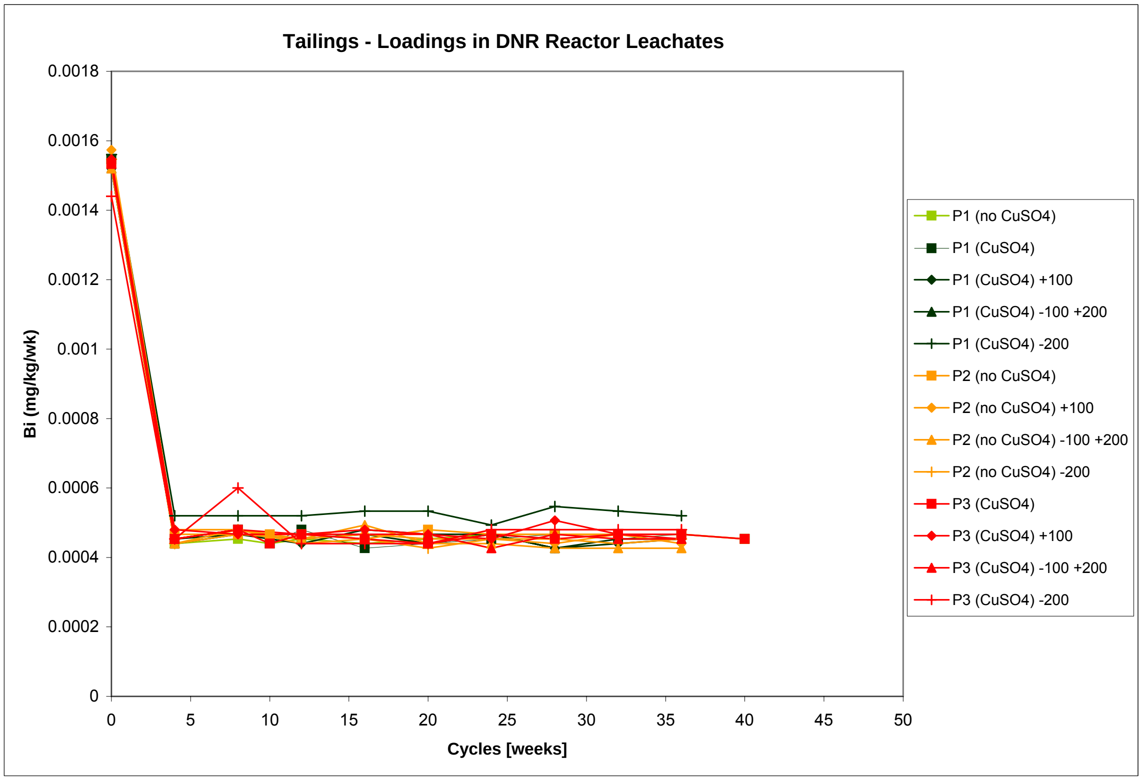

Tailings - Loadings in DNR Reactor Leachates
As (mg/kg/wk)
0.0001
0.001
0.01
0.1
Cycles [weeks]
0
10
20
30
40
50
60
70
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Ba (mg/kg/wk)
1
0.1
0.01
0.001
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Be (mg/kg/wk)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

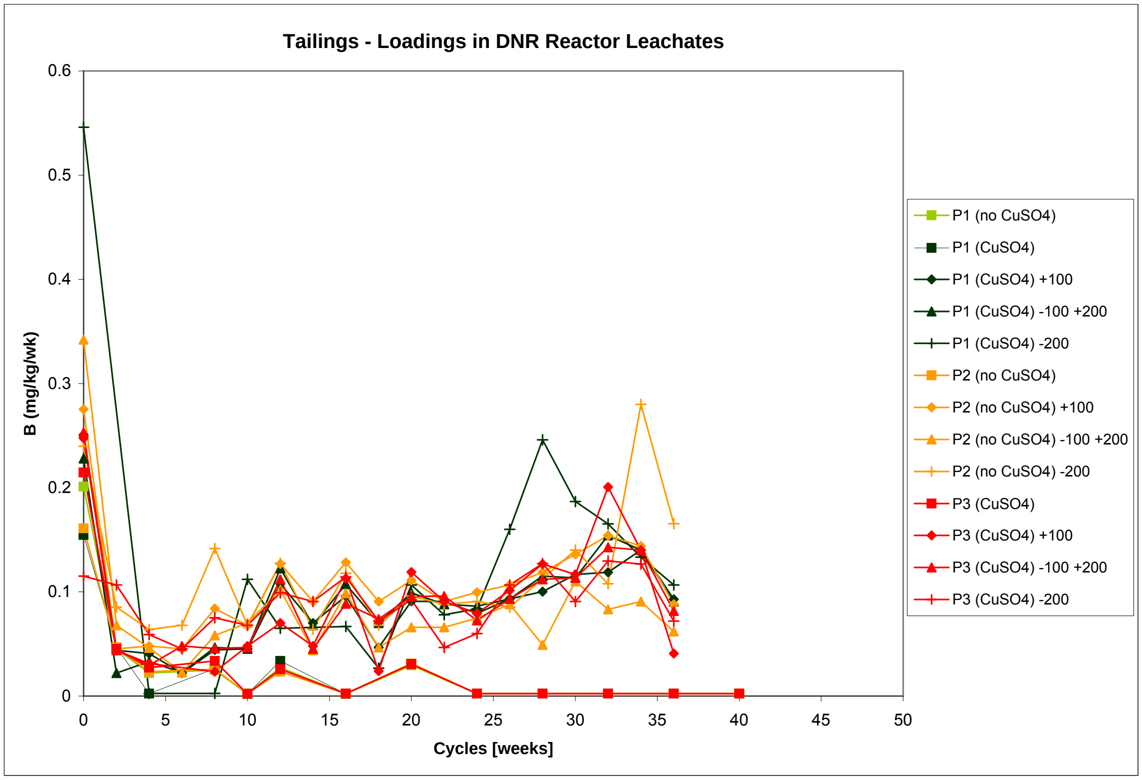
Attachment C.2
Tailings - Concentrations in DNR Reactors

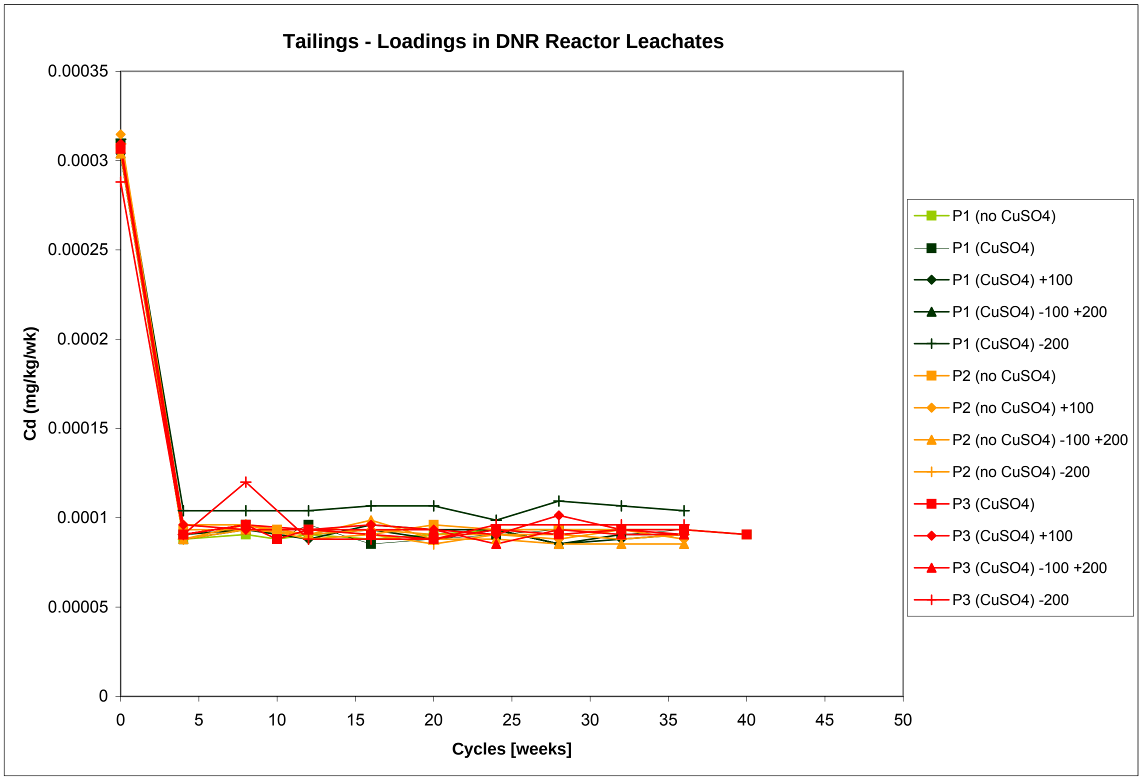
Graph C.2.13

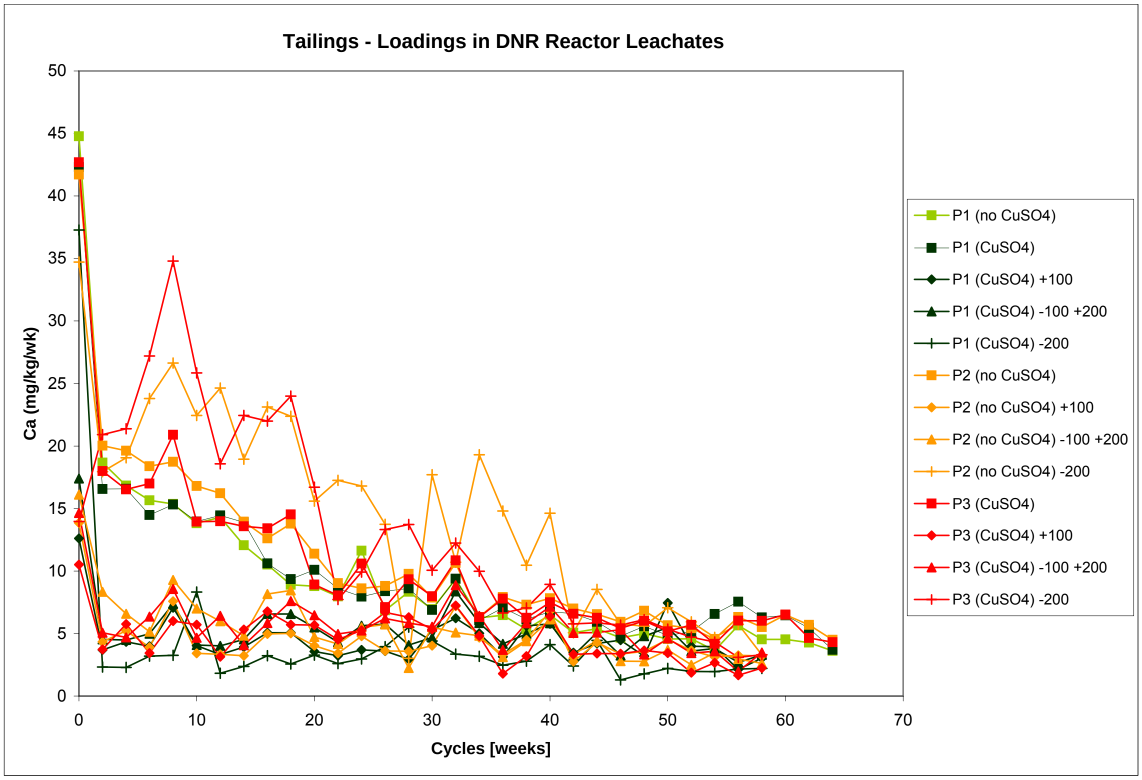


Attachment C.2
Tailings - Concentrations in DNR Reactors

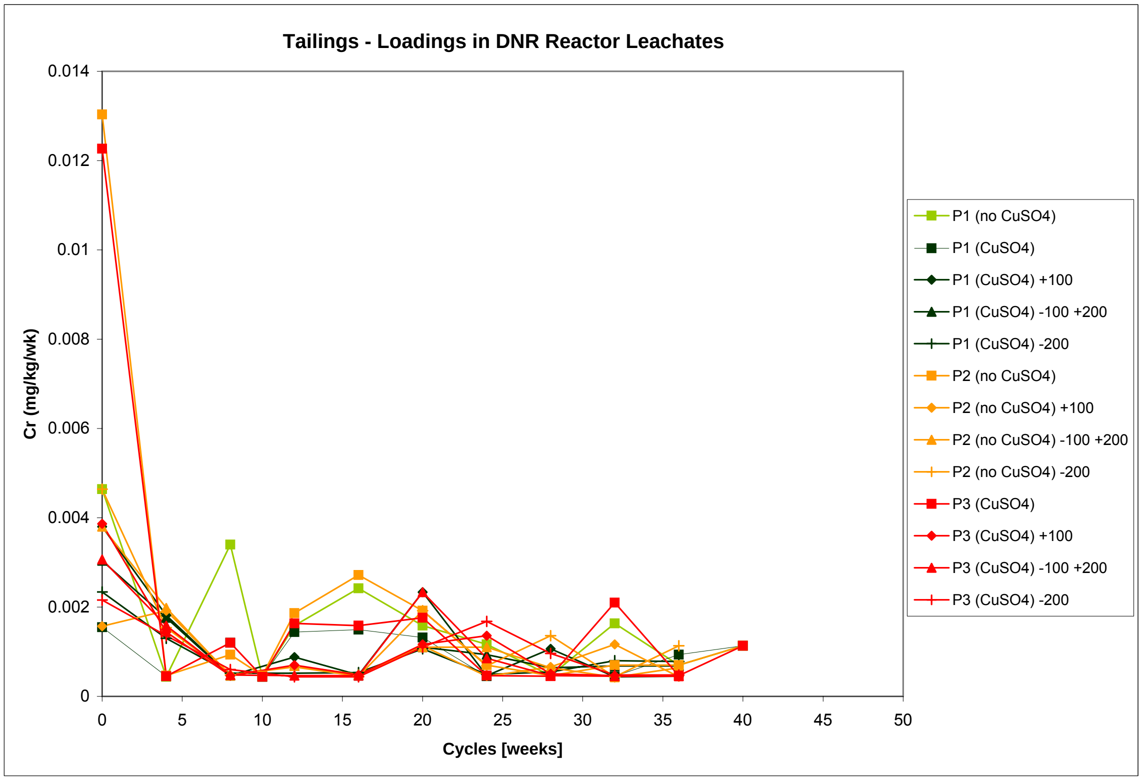
Graph C.2.14



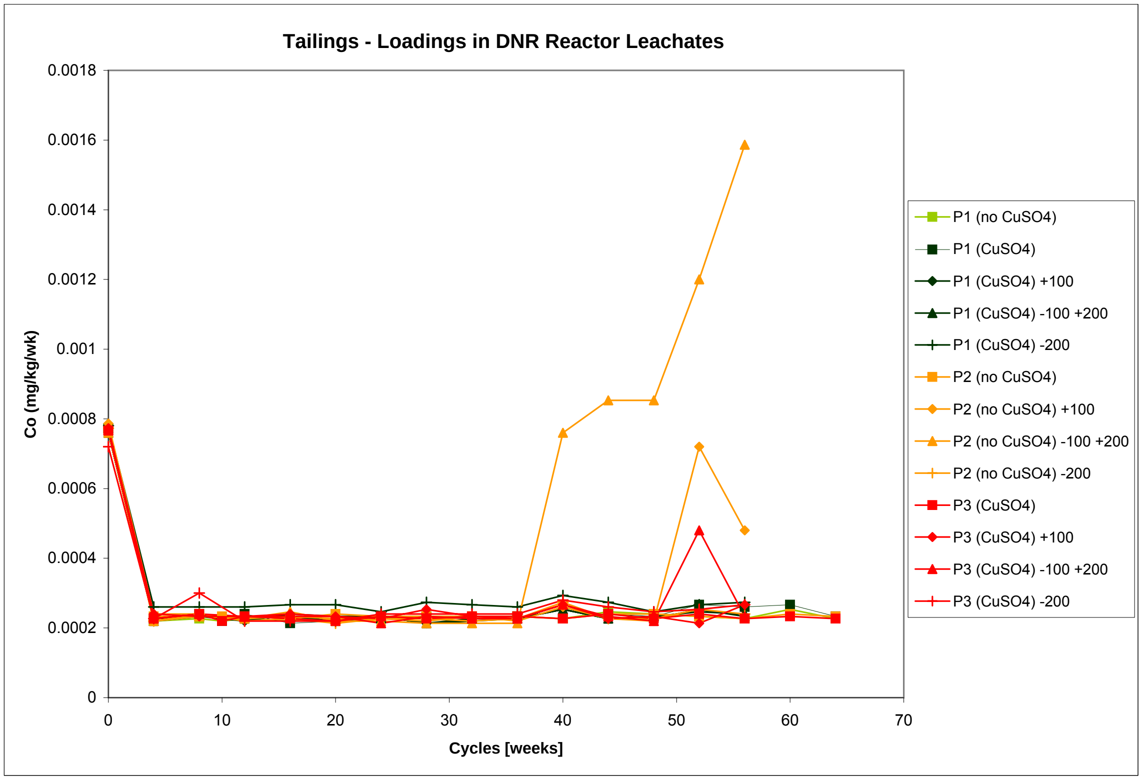

Tailings - Loadings in DNR Reactor Leachates
Cd (mg/kg/wk)
0.00035
0.0003
0.00025
0.0002
0.00015
0.0001
0.00005
0
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Ca (mg/kg/wk)
50
45
40
35
30
25
20
15
10
5
0
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

Graph C.2.17

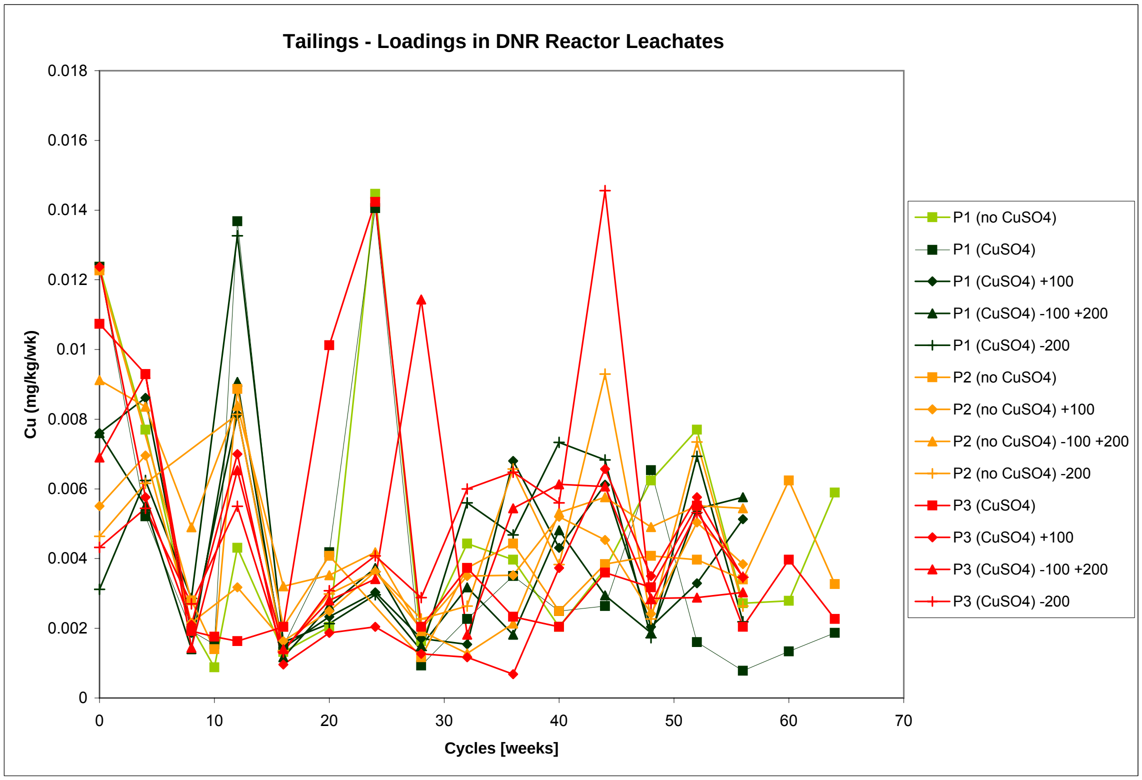


Graph C.2.18



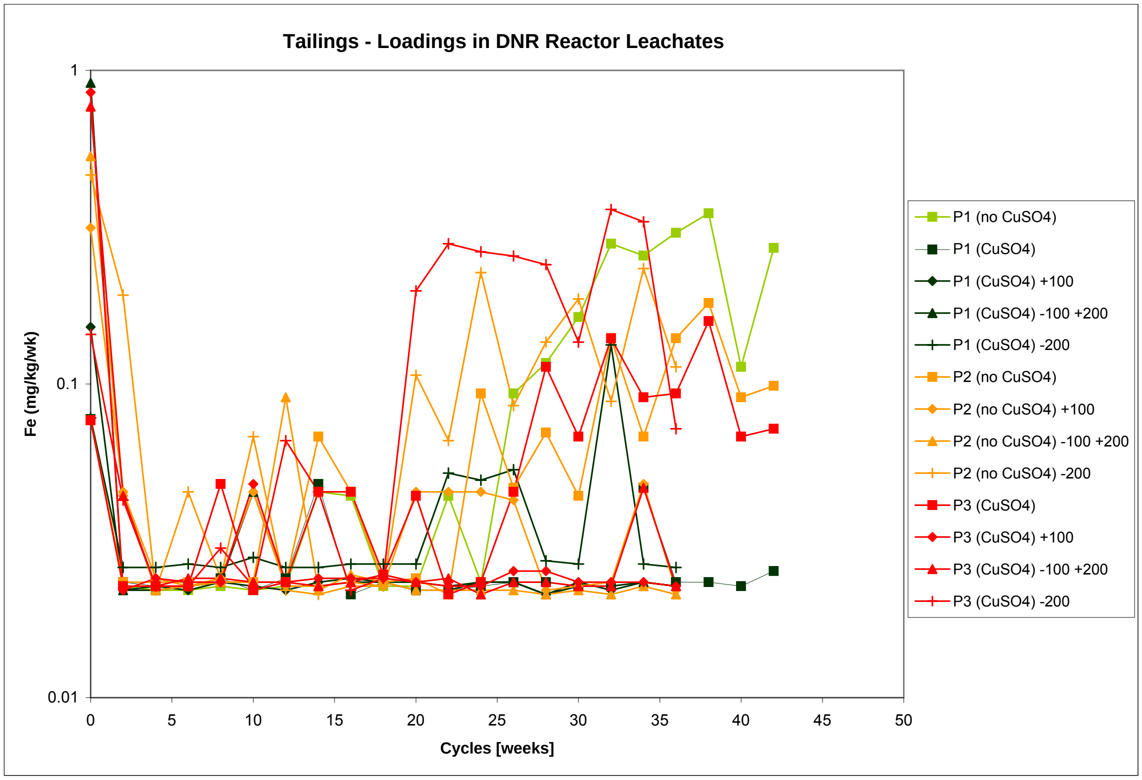
Attachment C.2
Tailings - Concentrations in DNR Reactors

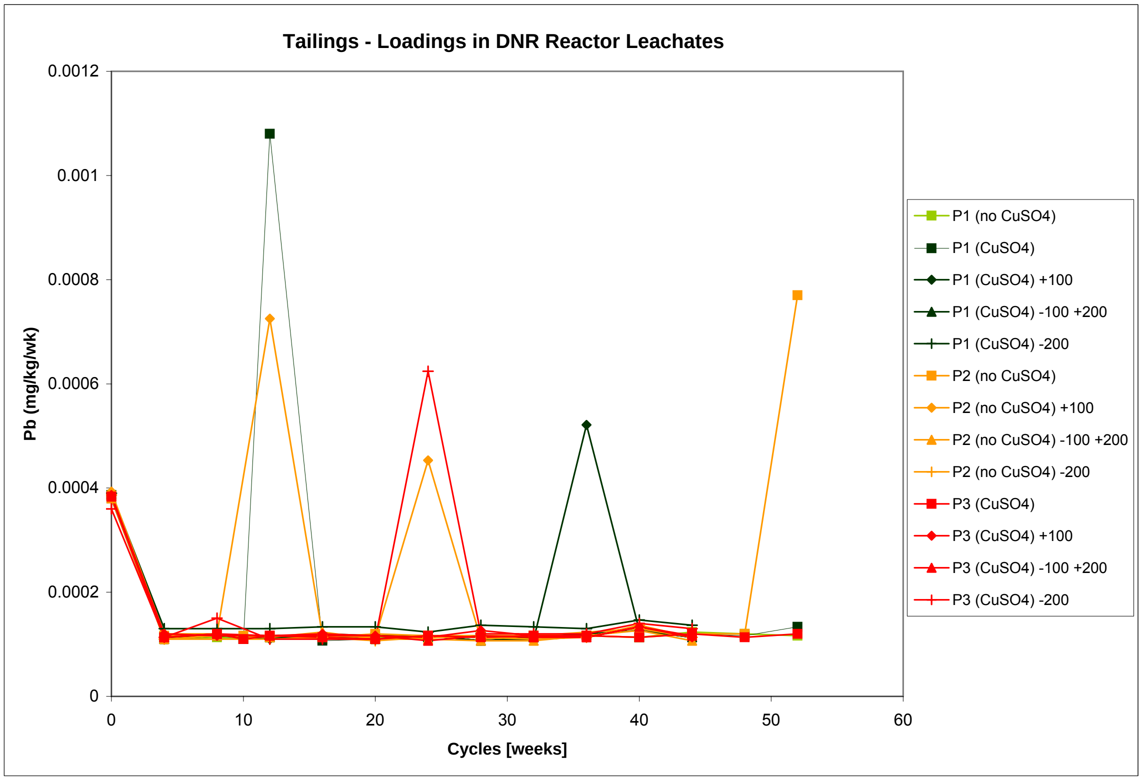
Graph C.2.19

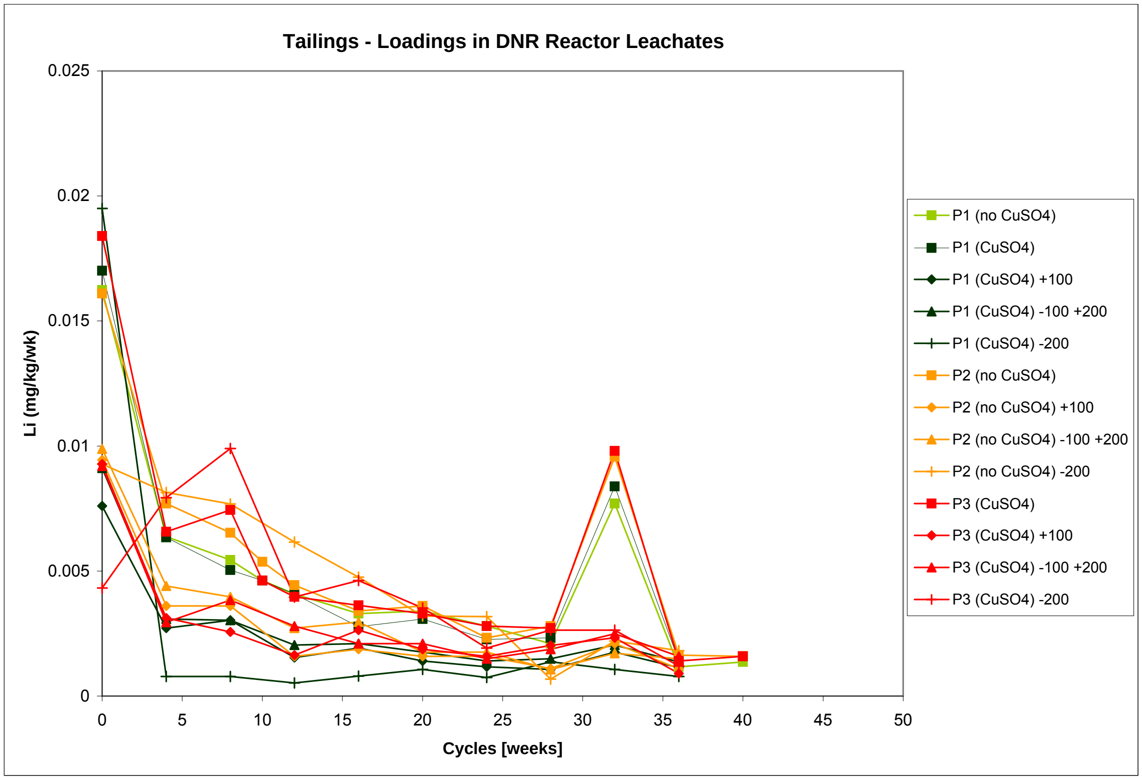


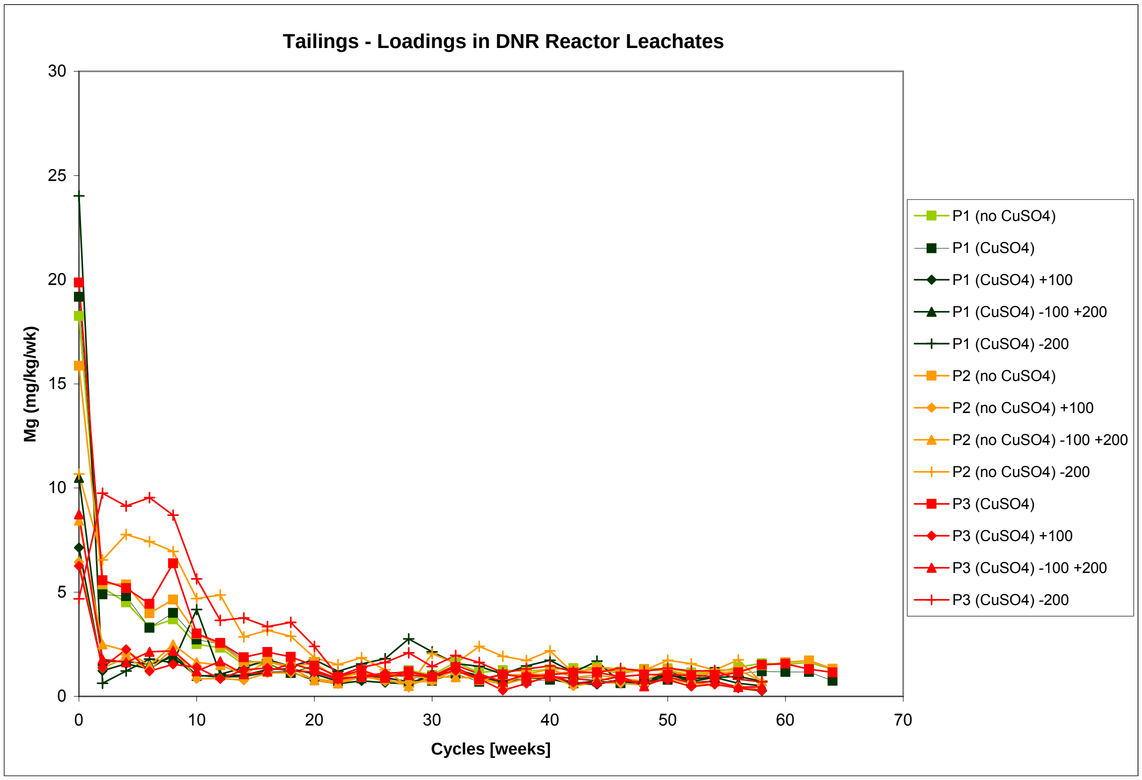
Attachment C.2
Tailings - Concentrations in DNR Reactors

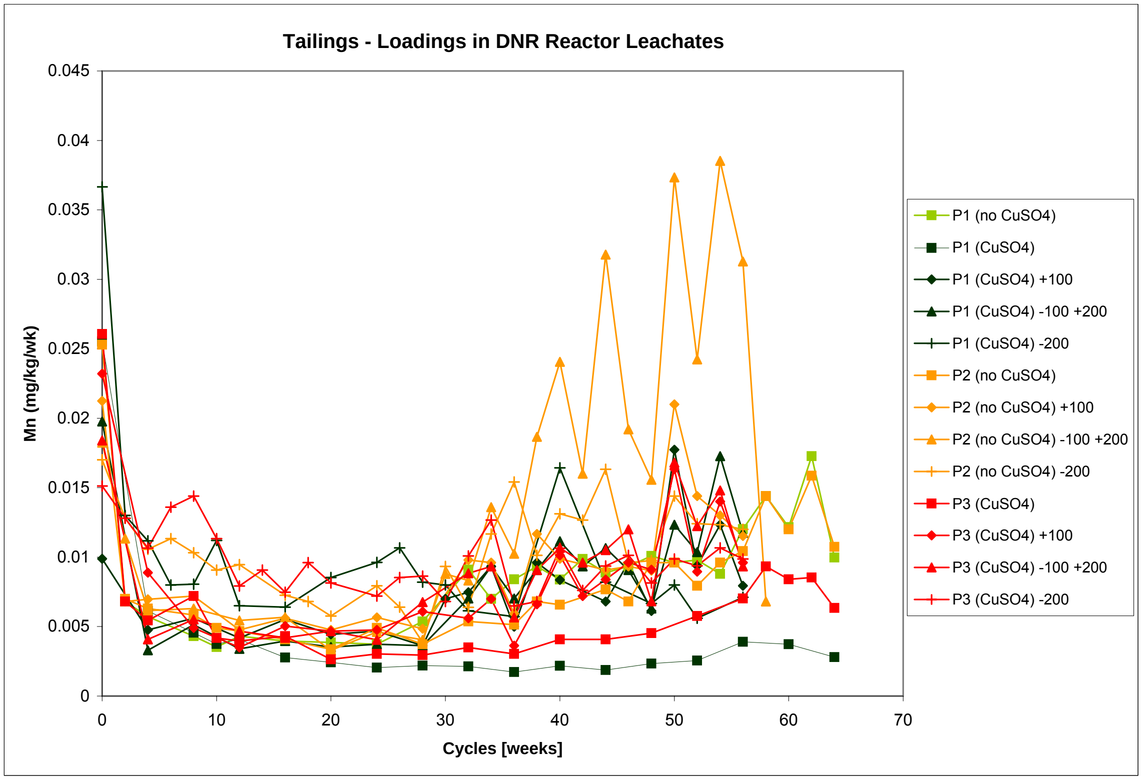
Graph C.2.20

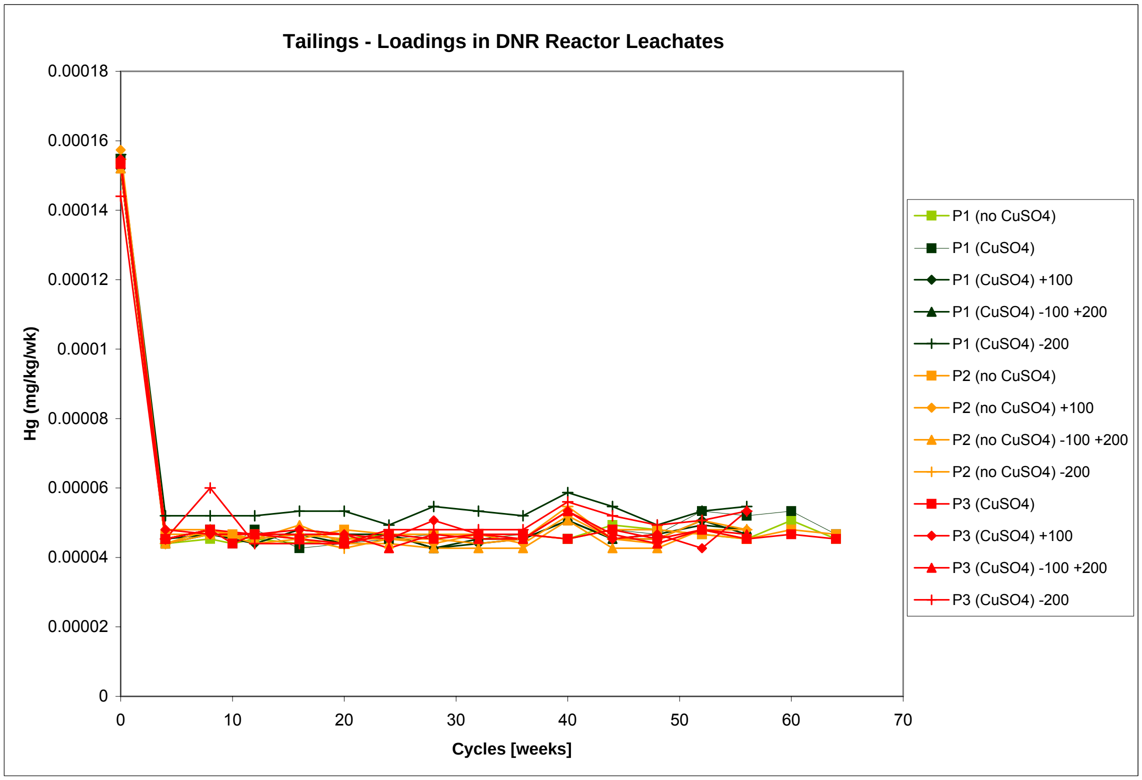


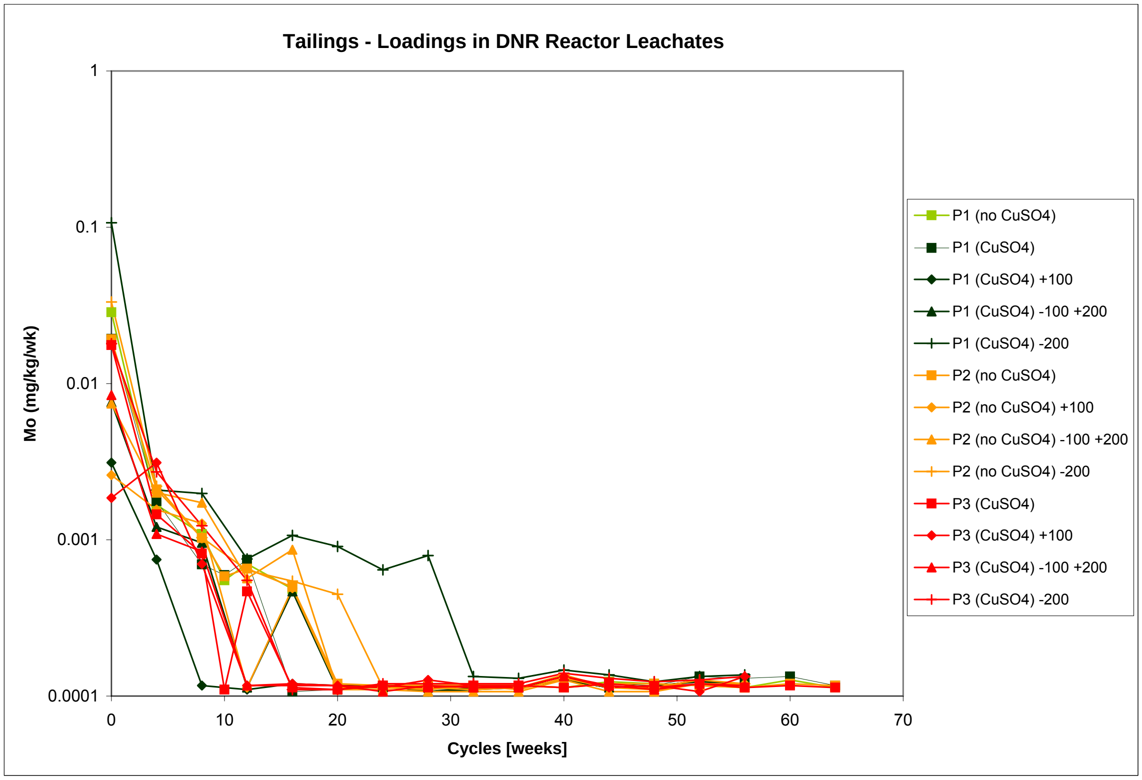

Tailings - Loadings in DNR Reactor Leachates
Pb (mg/kg/wk)
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
10
20
30
40
50
60
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

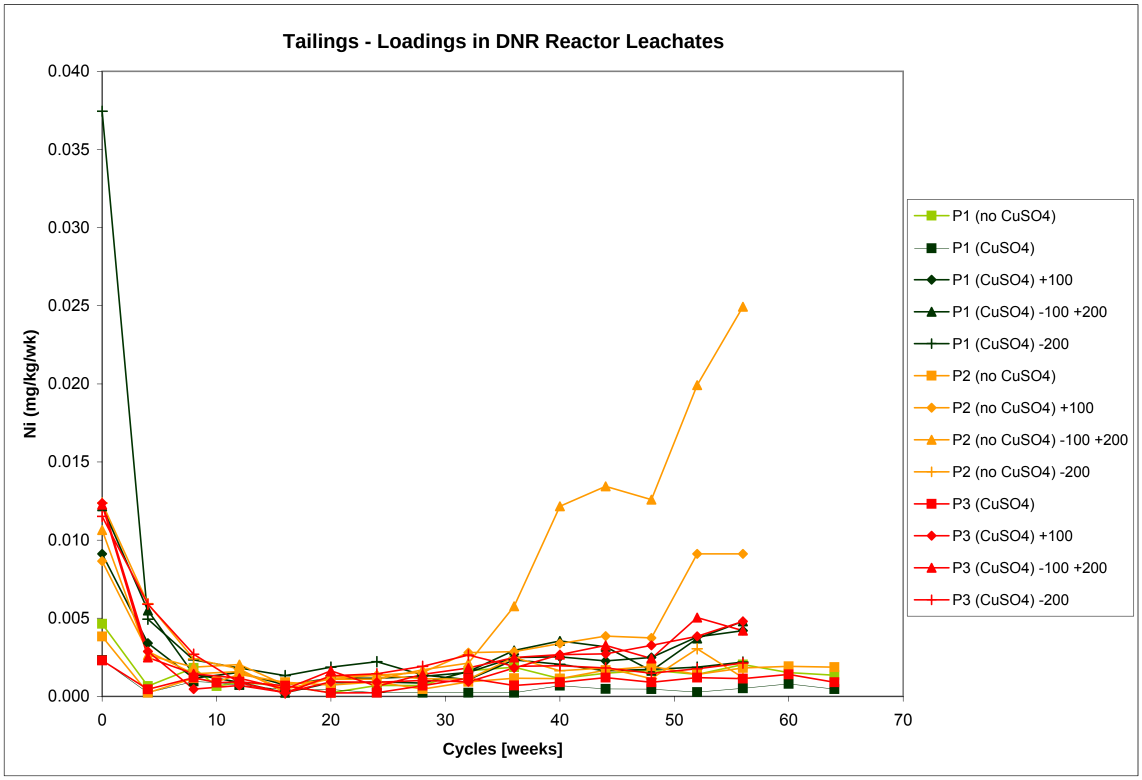

Tailings - Loadings in DNR Reactor Leachates
Li (mg/kg/wk)
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

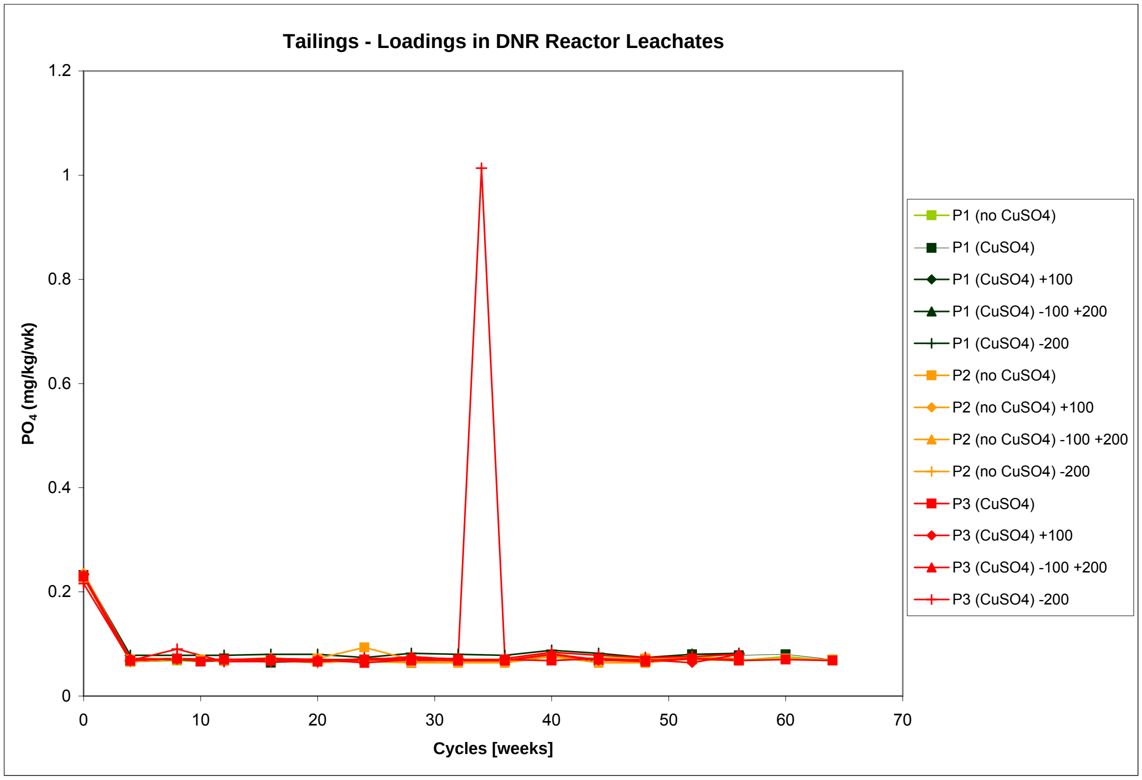

Tailings - Loadings in DNR Reactor Leachates
Mg (mg/kg/wk)
0
5
10
15
20
25
30
Cycles [weeks]
0
10
20
30
40
50
60
70
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

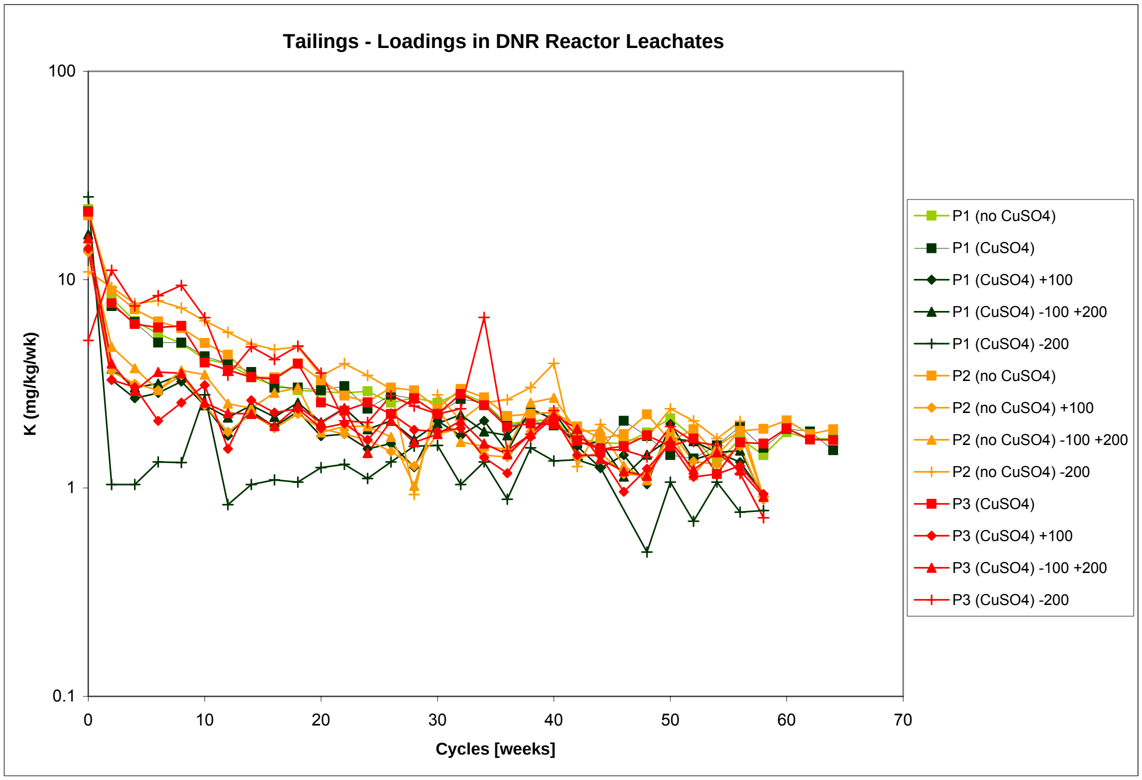

Tailings - Loadings in DNR Reactor Leachates
Mn (mg/kg/wk)
0
0.005
0.01
0.015
0.02
0.025
0.03
0.035
0.04
0.045
Cycles [weeks]
0
10
20
30
40
50
60
70
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

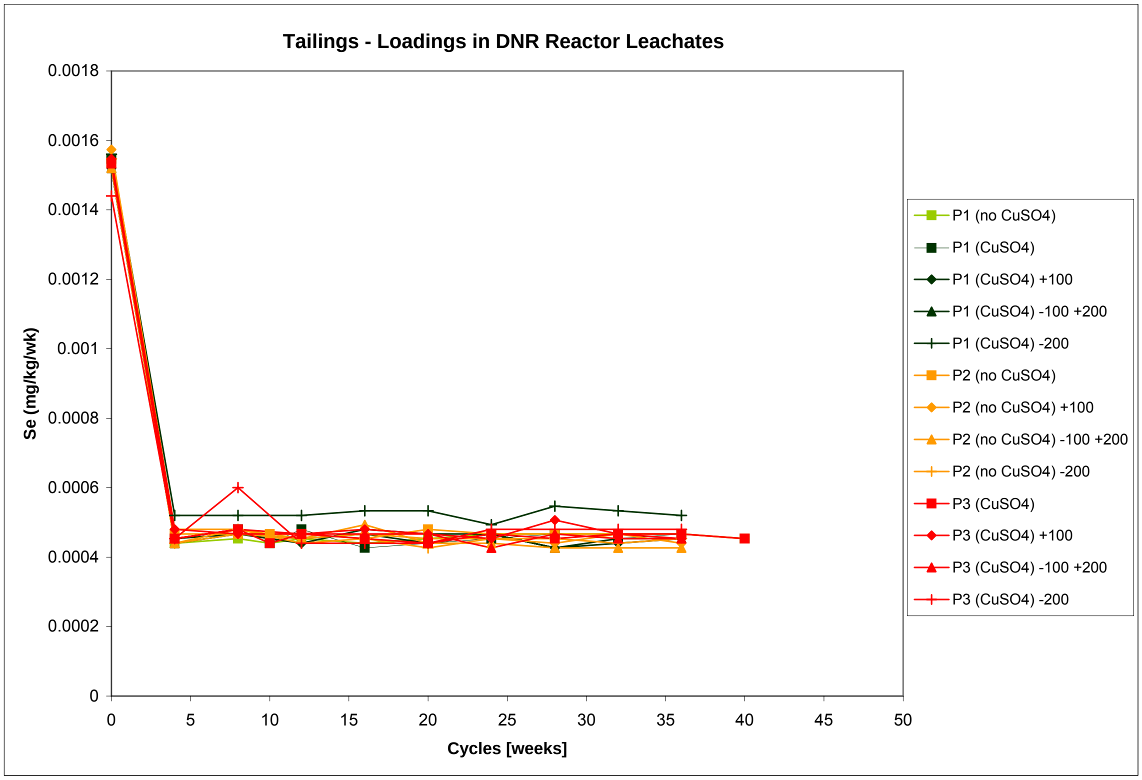

Tailings - Loadings in DNR Reactor Leachates
Hg (mg/kg/wk)
0.00018
0.00016
0.00014
0.00012
0.0001
0.00008
0.00006
0.00004
0.00002
0
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Mo (mg/kg/wk)
1
0.1
0.01
0.001
0.0001
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Ni (mg/kg/wk)
0.040
0.035
0.030
0.025
0.020
0.015
0.010
0.005
0.000
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

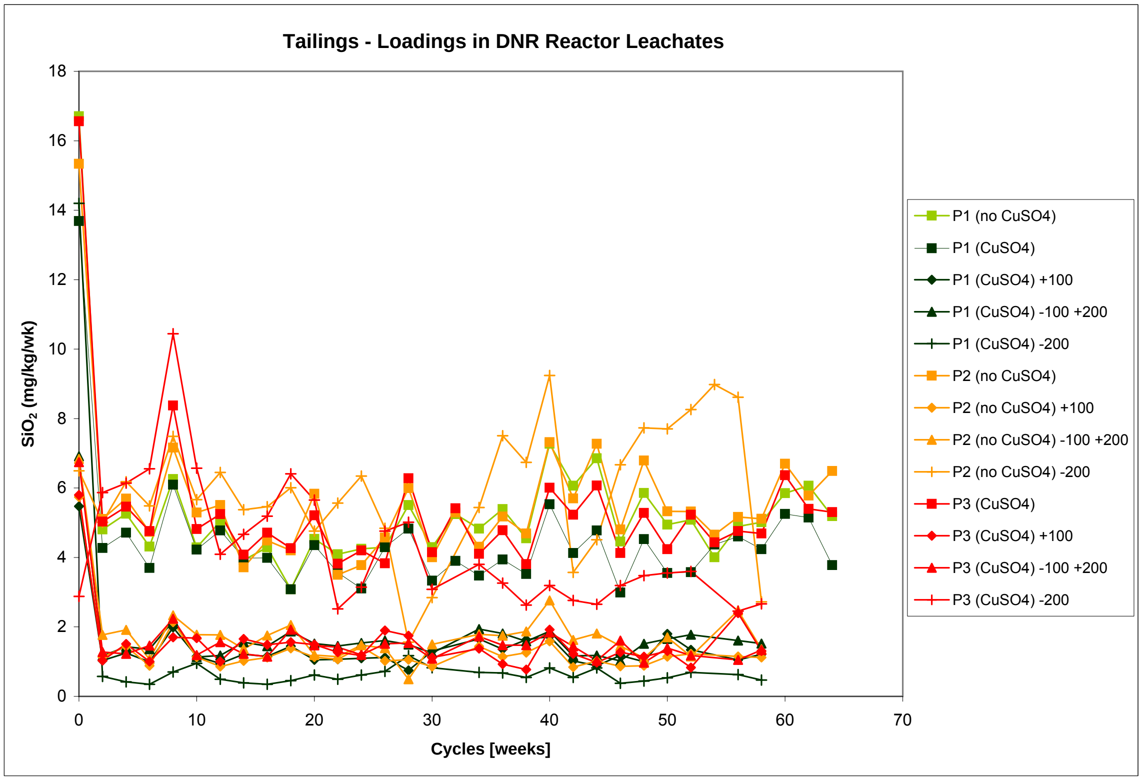

Tailings - Loadings in DNR Reactor Leachates
PO4 (mg/kg/wk)
1.2
1
0.8
0.6
0.4
0.2
0
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
K (mg/kg/wk)
100
10
1
0.1
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200


Tailings - Loadings in DNR Reactor Leachates
Se (mg/kg/wk)
0.0018
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

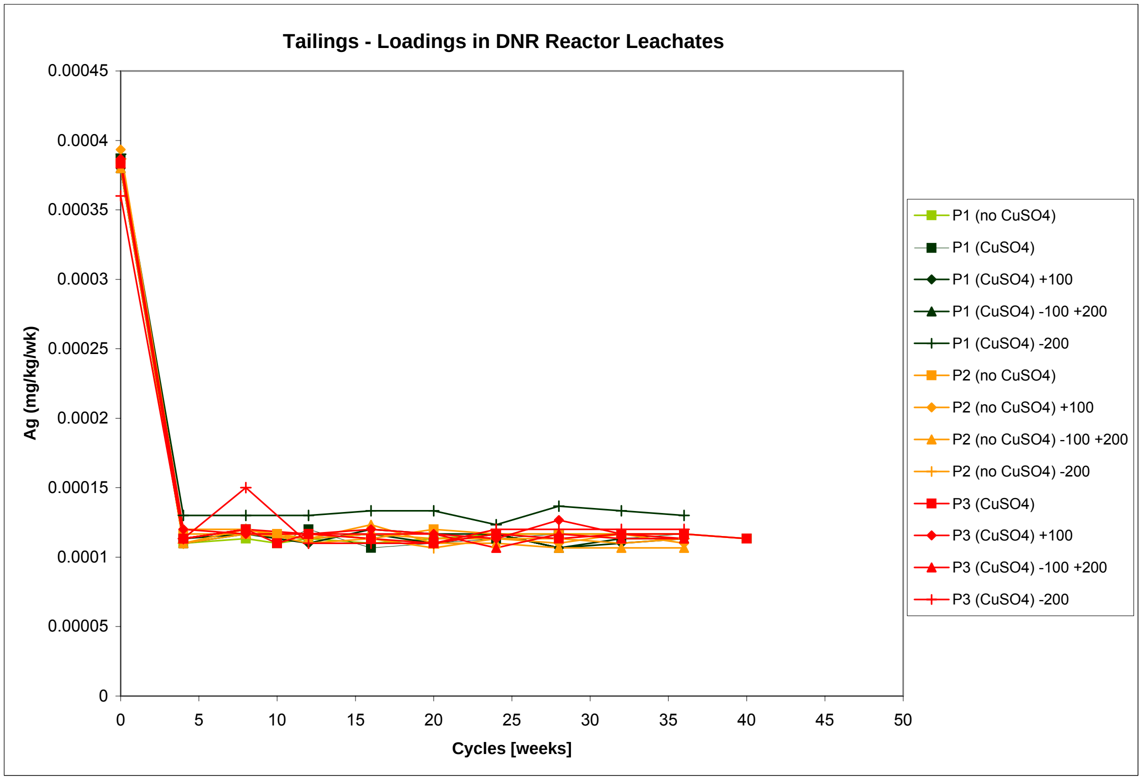
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.31



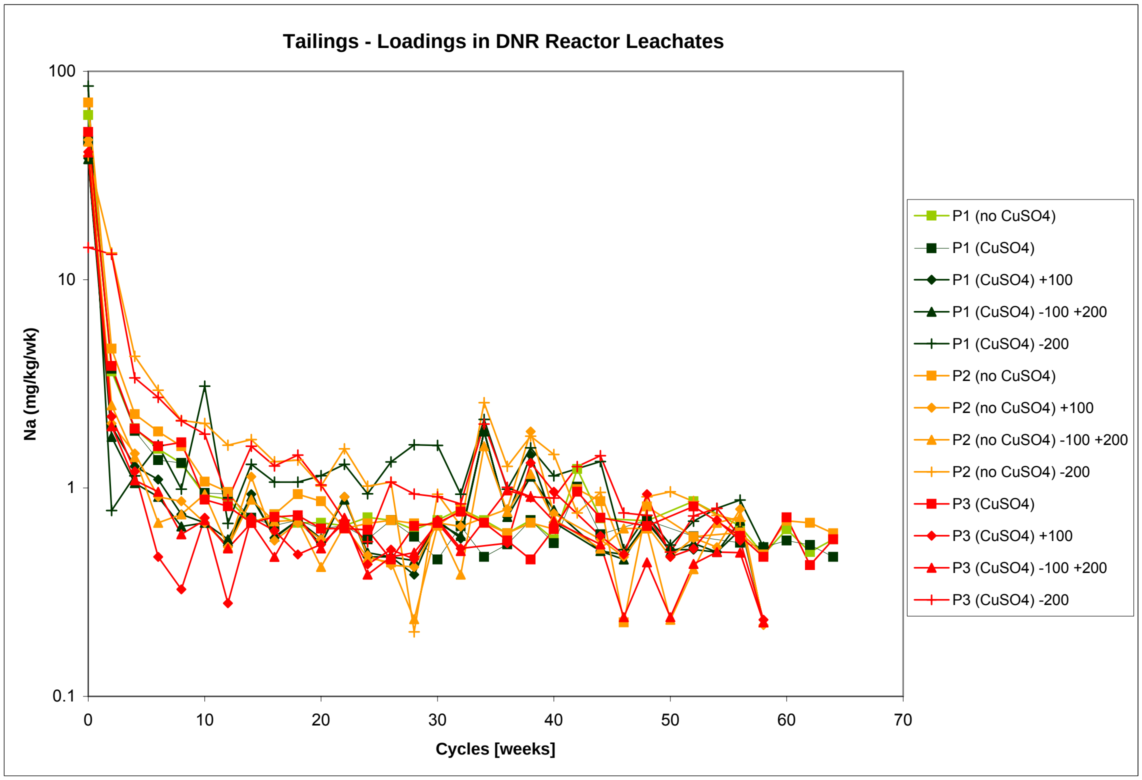
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.32



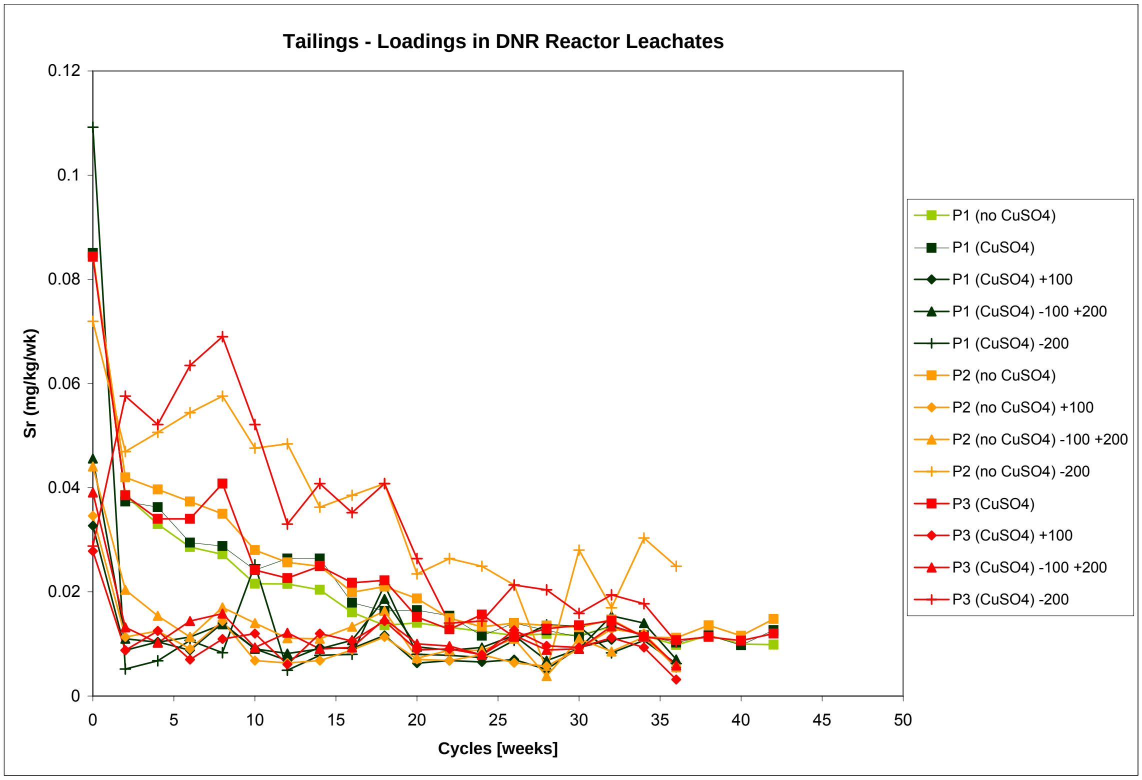
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.33



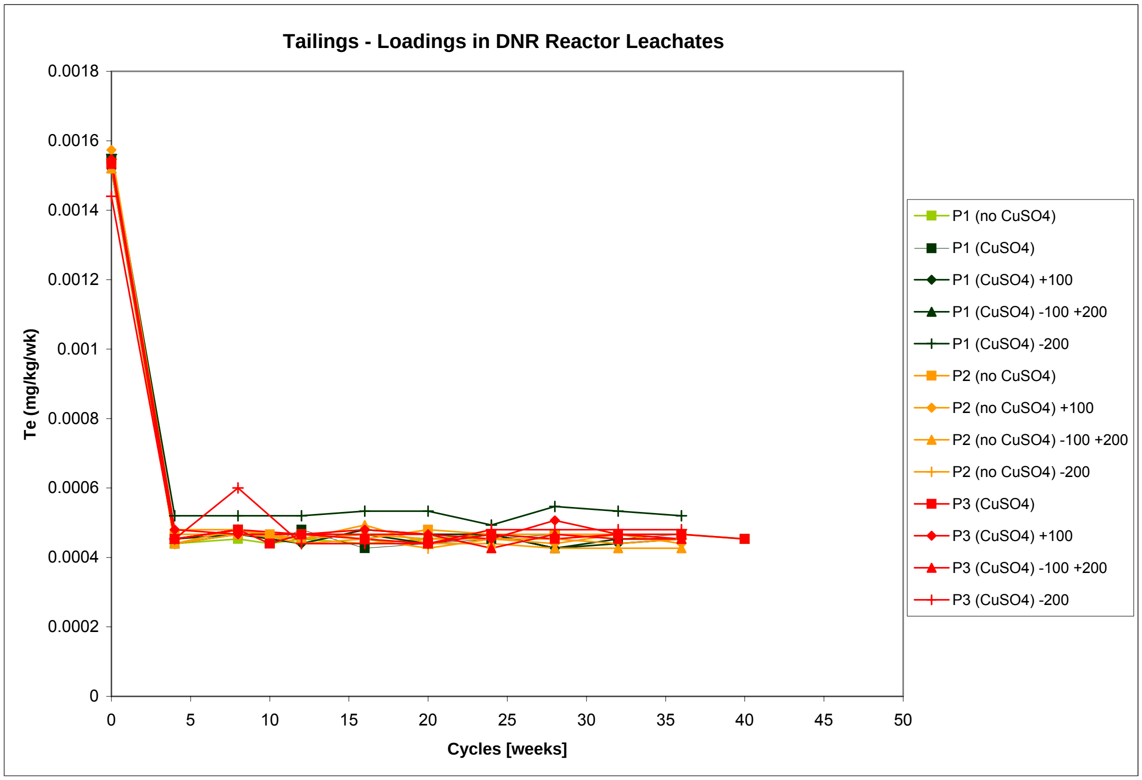
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.34



Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.35



loadings_Lapakko.xls

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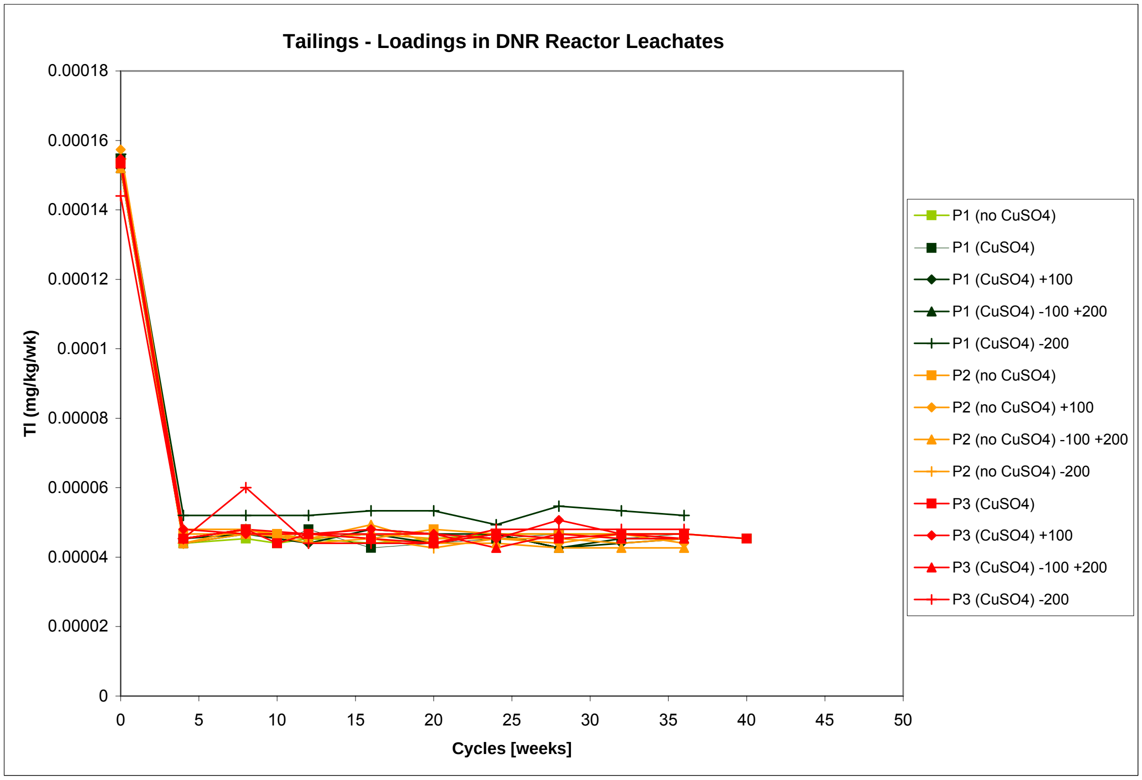
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.36



loadings_Lapakko.xls

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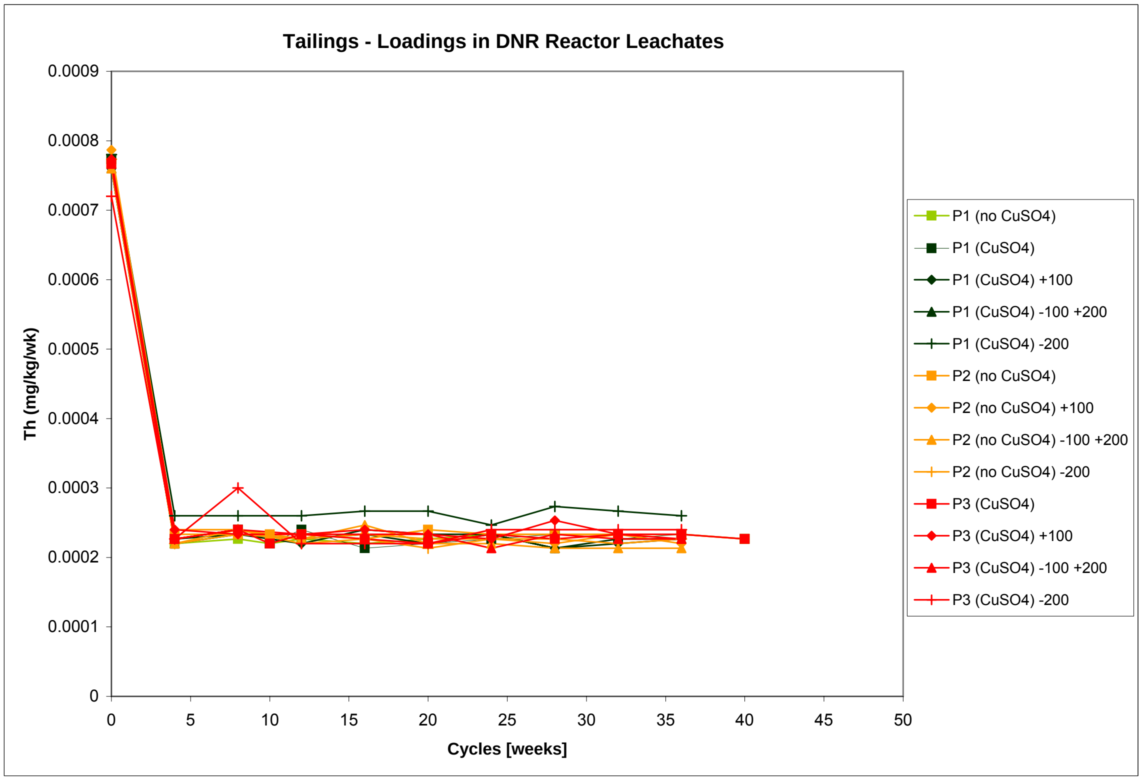
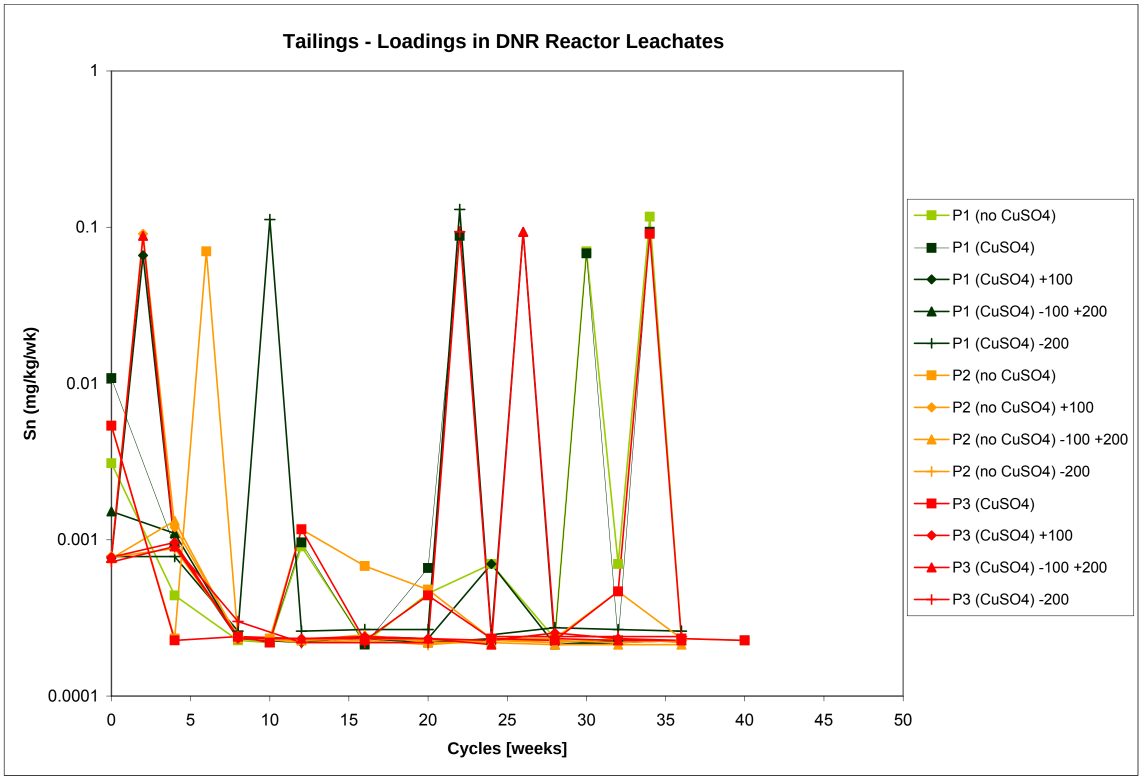
Graph C.2.37

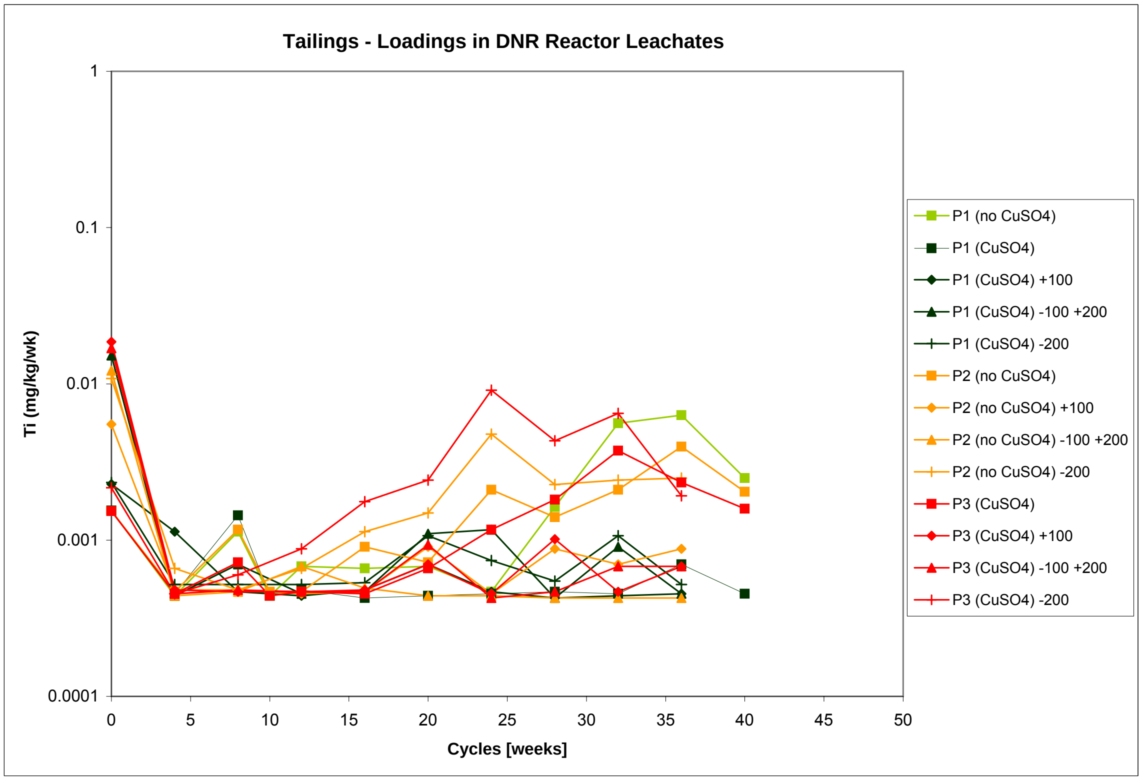


Graph C.2.38



Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.39



loadings_Lapakko.xls

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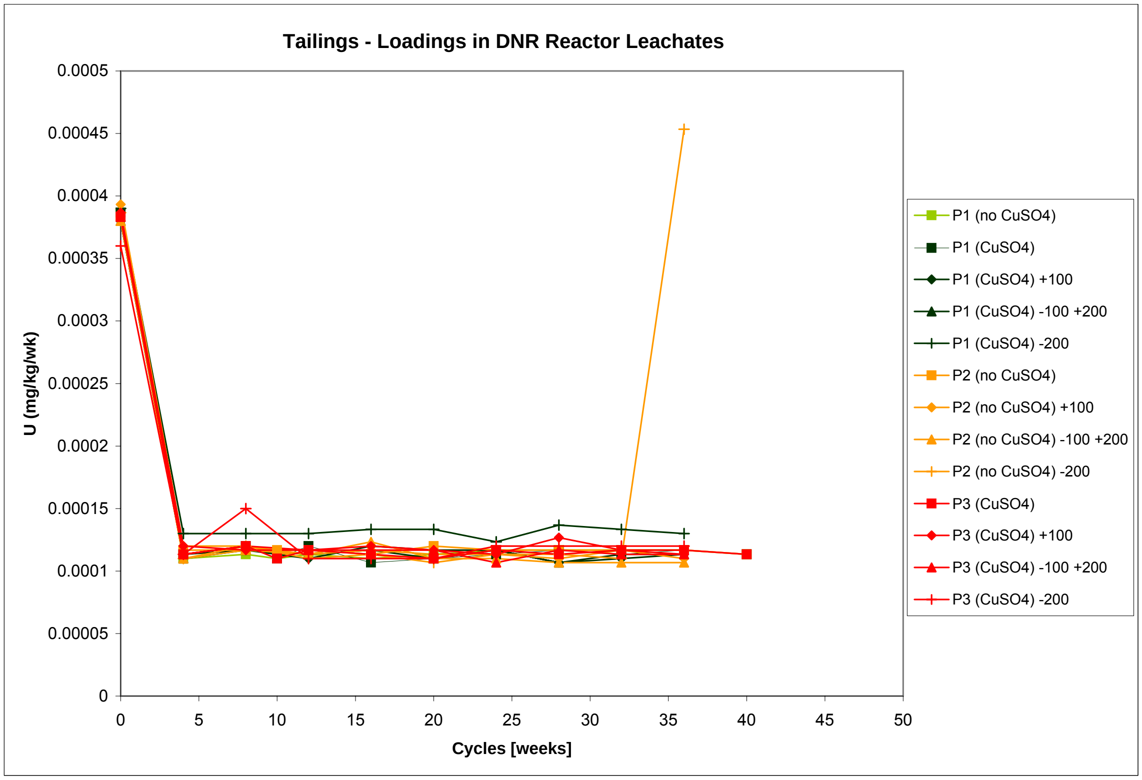
Attachment C.2
Tailings - Concentrations in DNR Reactors

Graph C.2.40



loadings_Lapakko.xls

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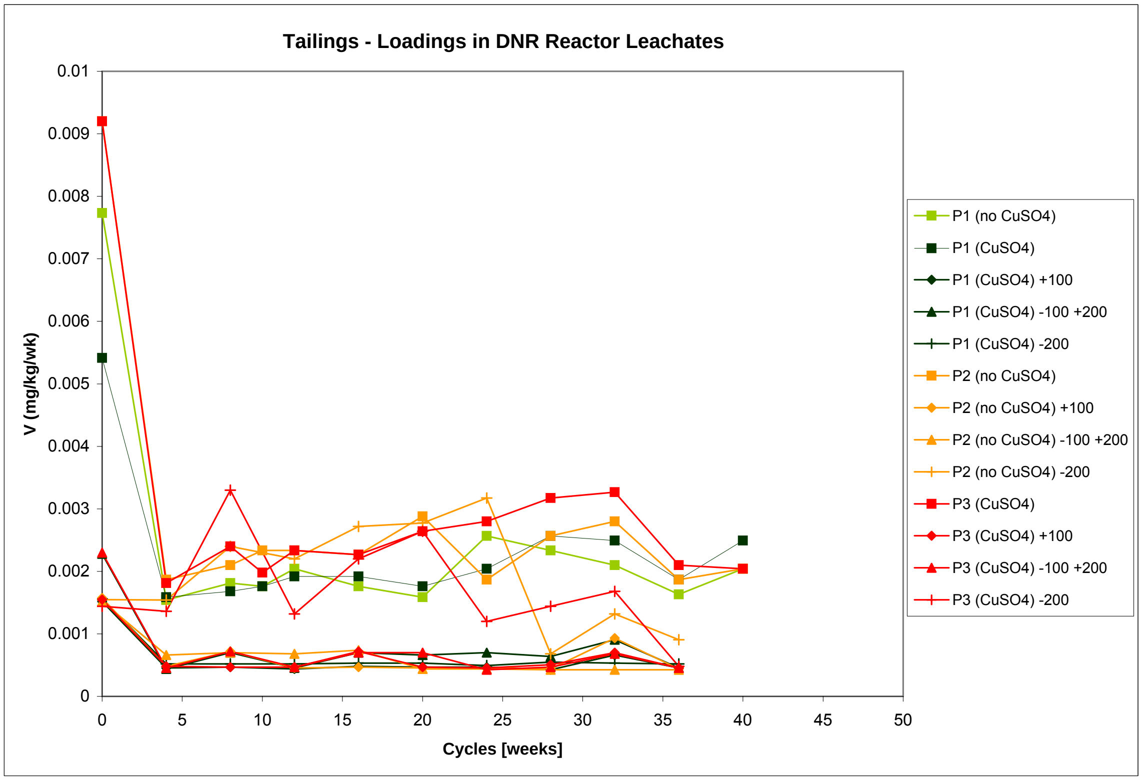
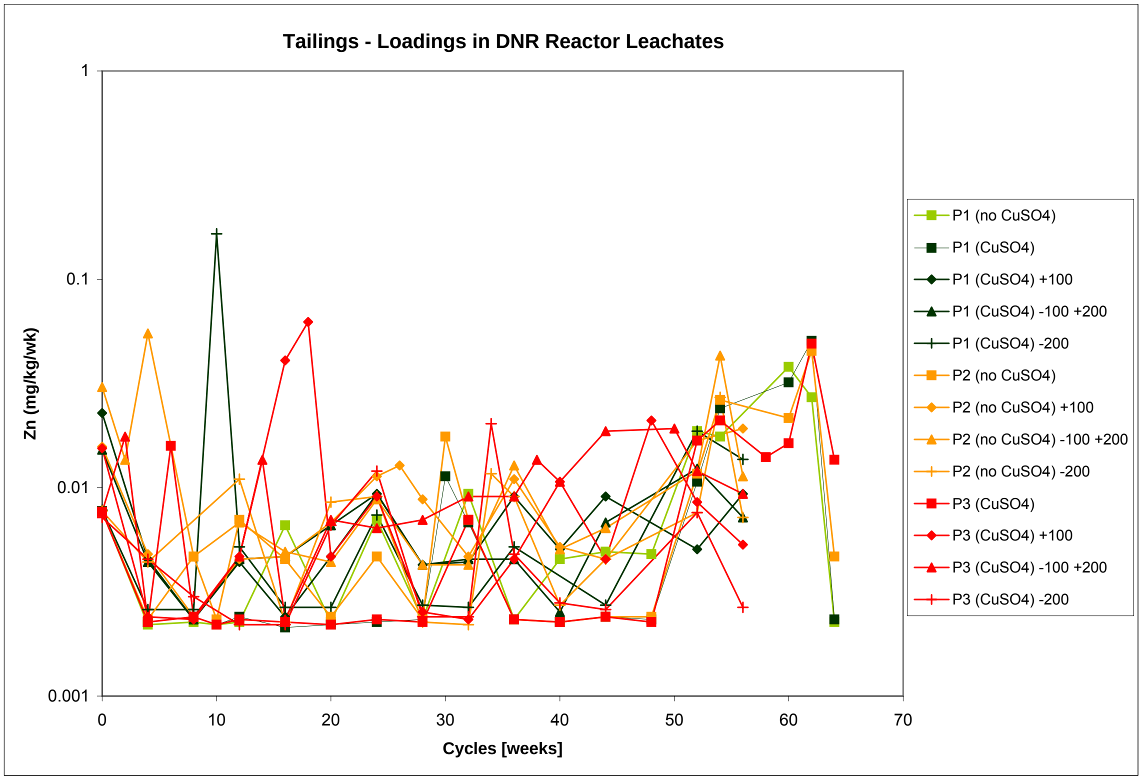
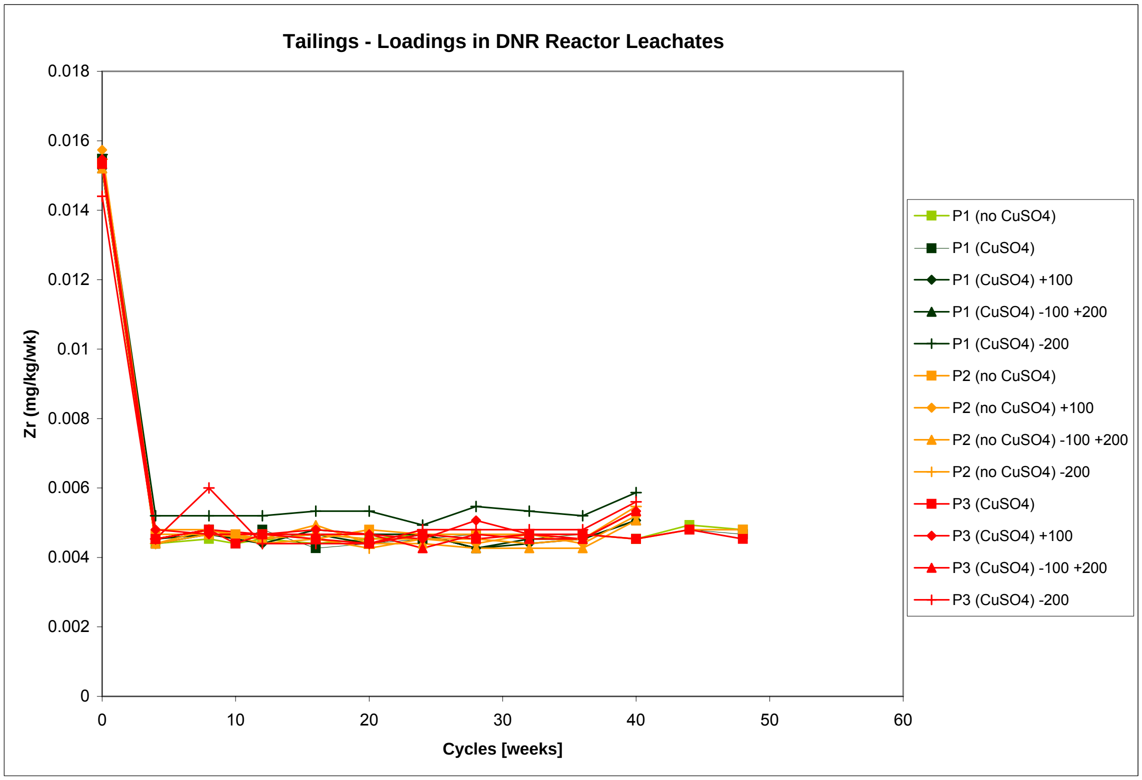
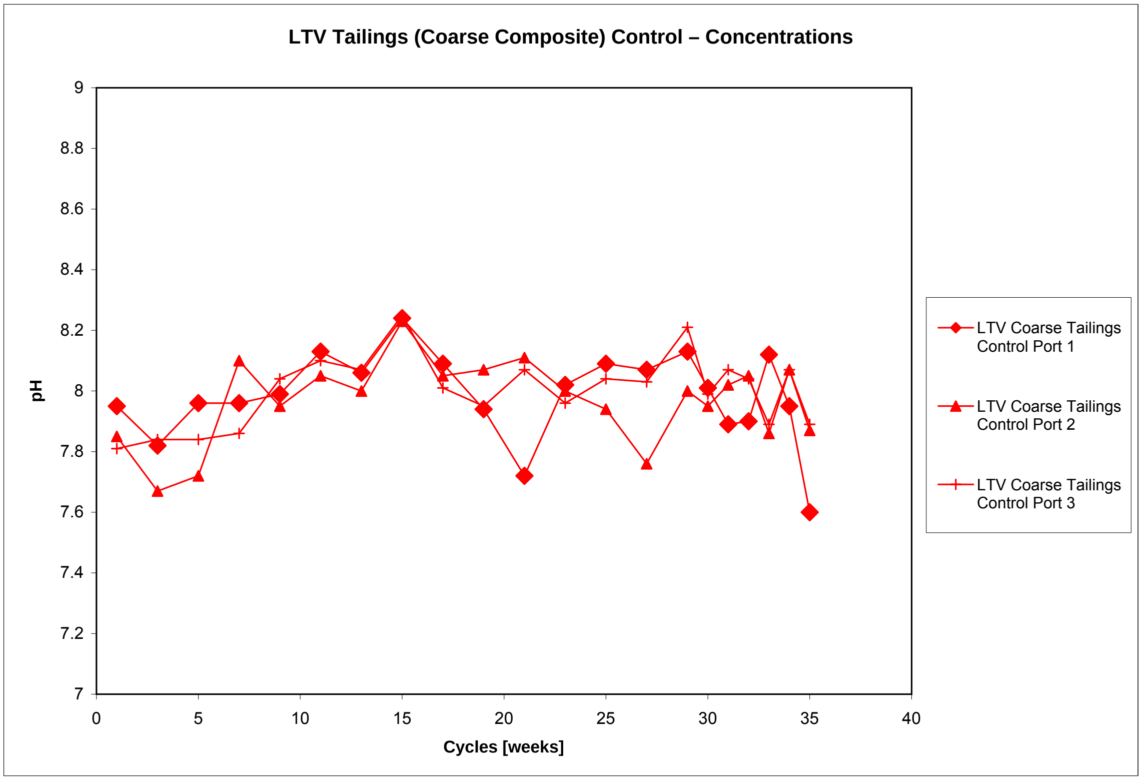

Tailings - Loadings in DNR Reactor Leachates
V (mg/kg/wk)
0.01
0.009
0.008
0.007
0.006
0.005
0.004
0.003
0.002
0.001
0
0
5
10
15
20
25
30
35
40
45
50
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

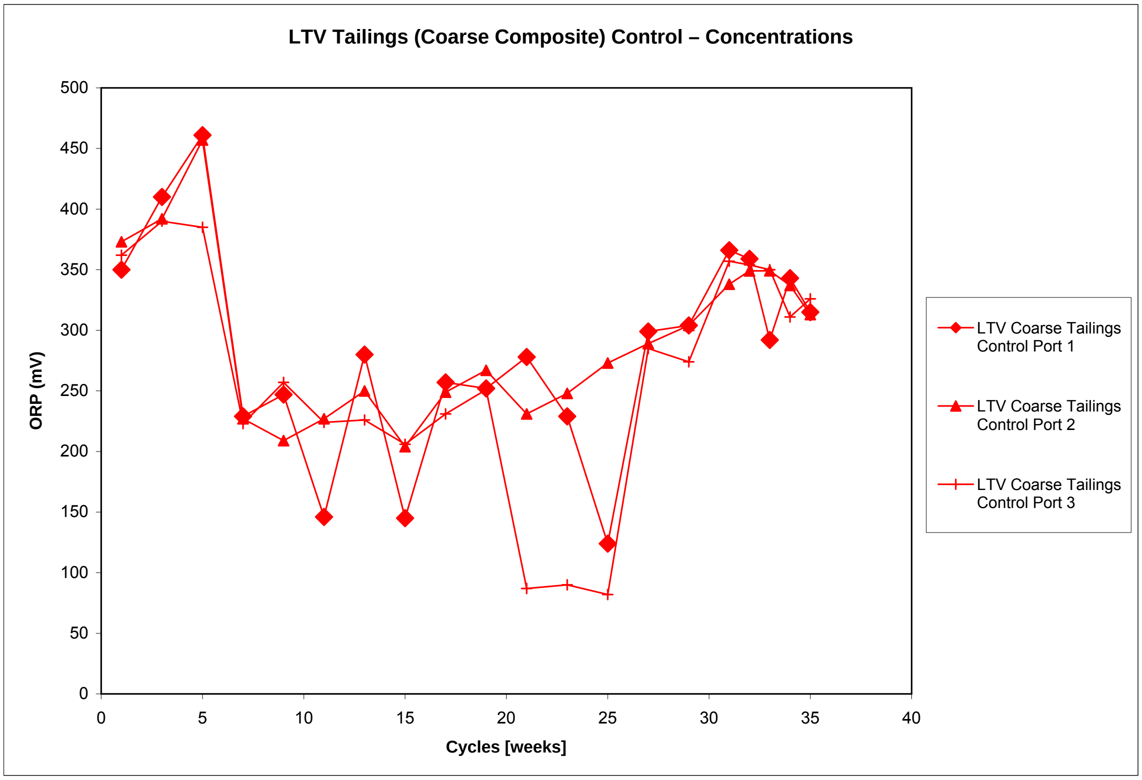

Tailings - Loadings in DNR Reactor Leachates
Zn (mg/kg/wk)
1
0.1
0.01
0.001
0
10
20
30
40
50
60
70
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

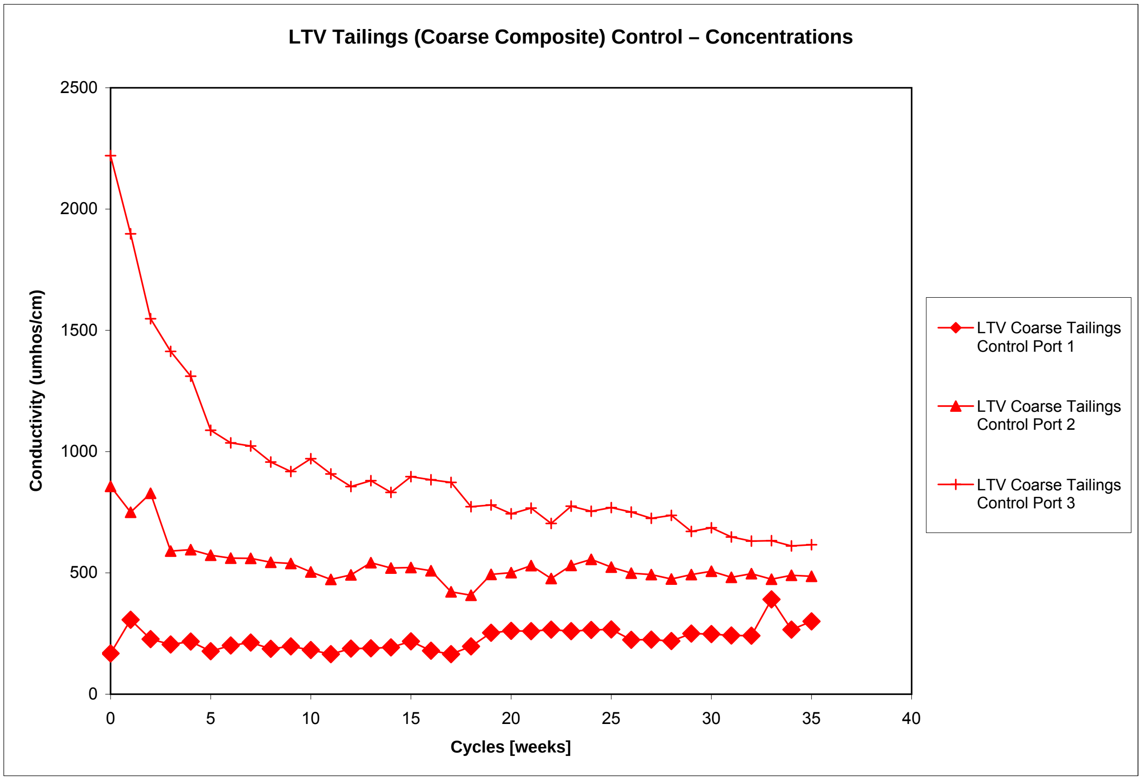

Tailings - Loadings in DNR Reactor Leachates
Zr (mg/kg/wk)
0.018
0.016
0.014
0.012
0.01
0.008
0.006
0.004
0.002
0
0
10
20
30
40
50
60
Cycles [weeks]
P1 (no CuSO4)
P1 (CuSO4)
P1 (CuSO4) +100
P1 (CuSO4) -100 +200
P1 (CuSO4) -200
P2 (no CuSO4)
P2 (no CuSO4) +100
P2 (no CuSO4) -100 +200
P2 (no CuSO4) -200
P3 (CuSO4)
P3 (CuSO4) +100
P3 (CuSO4) -100 +200
P3 (CuSO4) -200

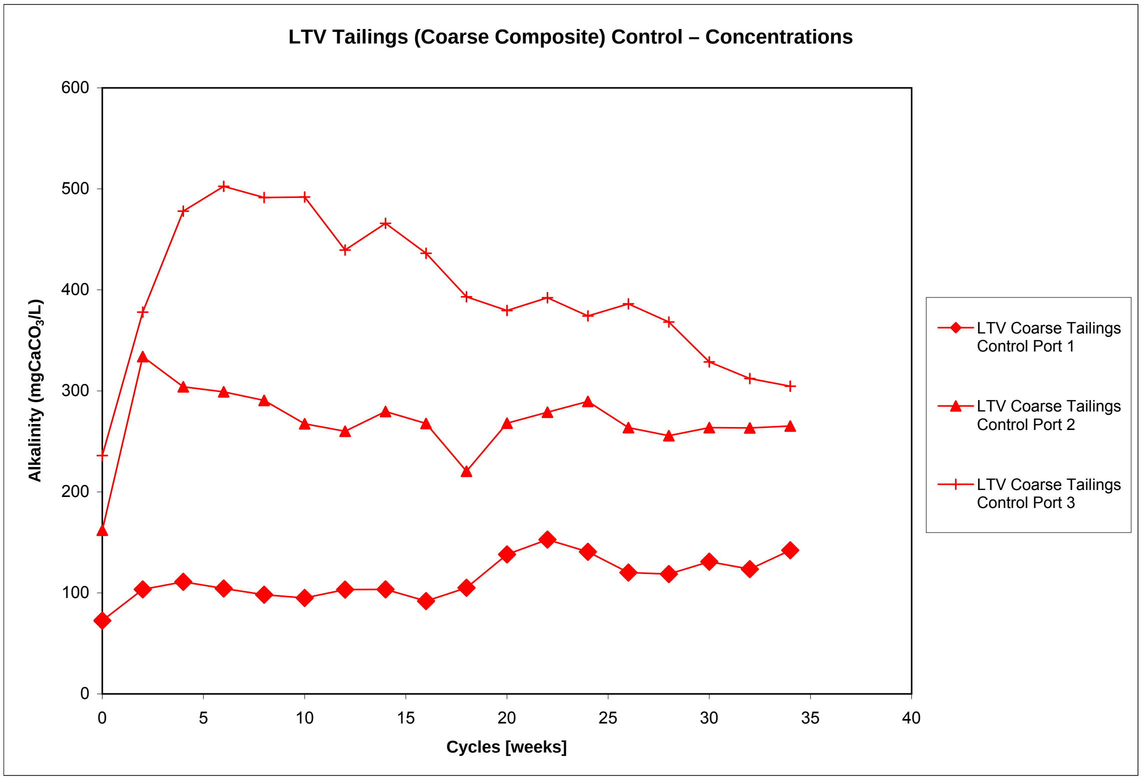
Appendix C.3

LTVSMC Contact Experiment

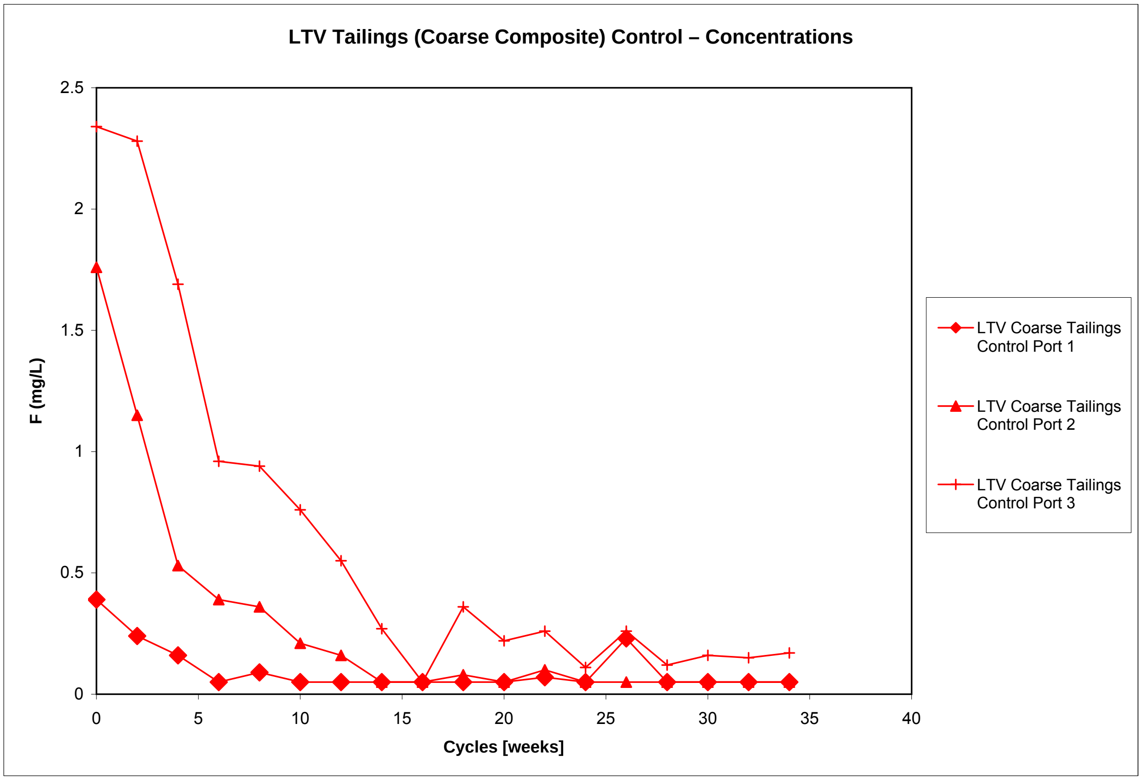

LTV Tailings (Coarse Composite) Control – Concentrations
pH
9
8.8
8.6
8.4
8.2
8
7.8
7.6
7.4
7.2
7
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3


LTV Tailings (Coarse Composite) Control – Concentrations
ORP (mV)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3

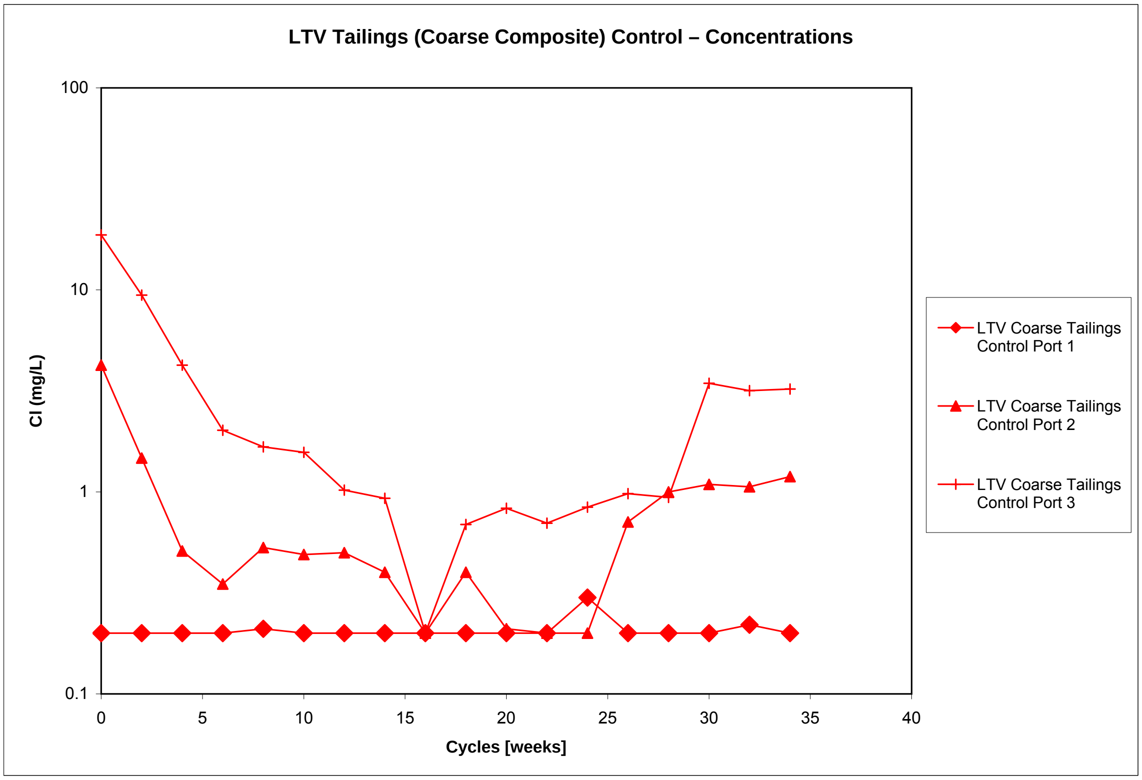

LTV Tailings (Coarse Composite) Control – Concentrations
Conductivity (umhos/cm)
2500
2000
1500
1000
500
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3


LTV Tailings (Coarse Composite) Control – Concentrations
Alkalinity (mgCaCO3/L)
600
500
400
300
200
100
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3

Graph C.3.5

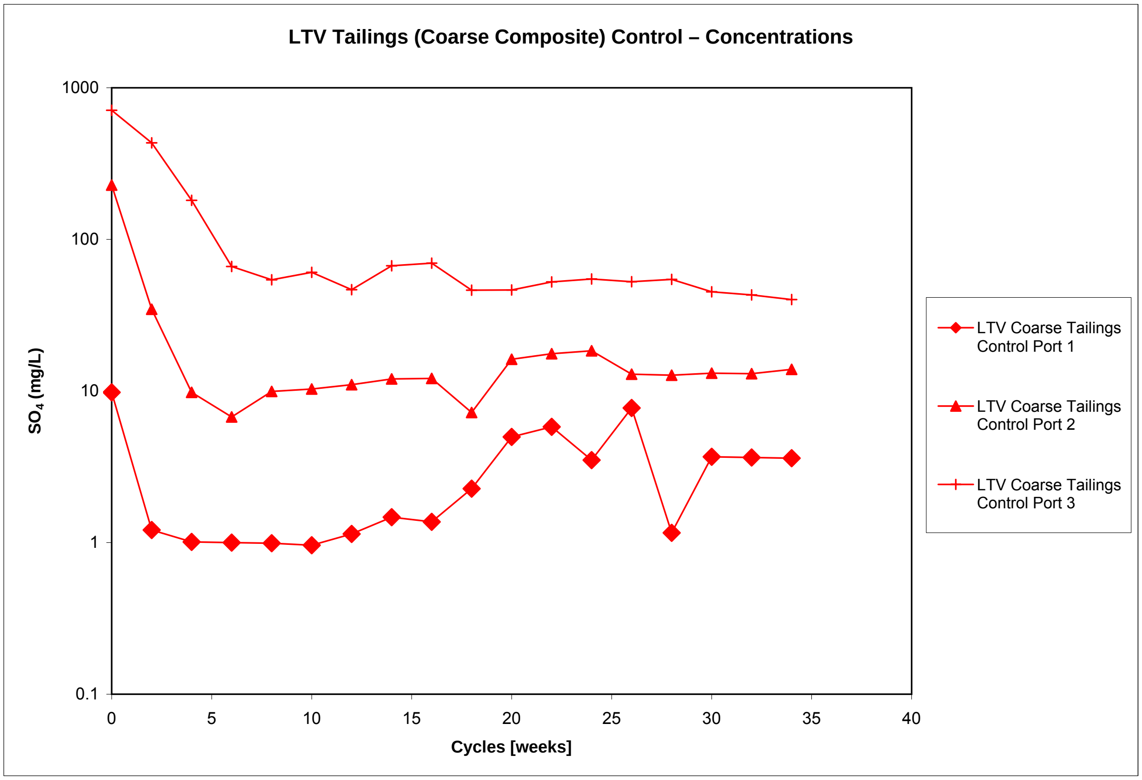

LTV Tailings (Coarse Composite) Control – Concentrations

Graph C.3.6


LTV Tailings (Coarse Composite) Control – Concentrations

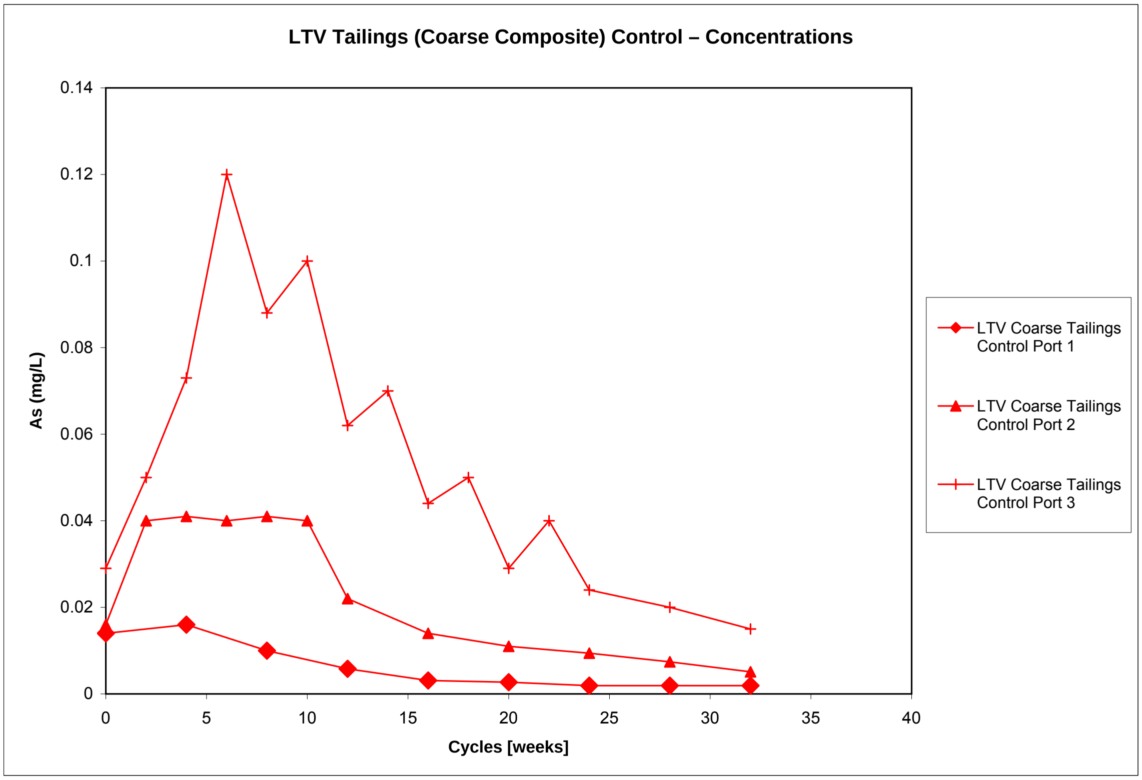
Appendix C.3
LTVSMC Contact Experiment

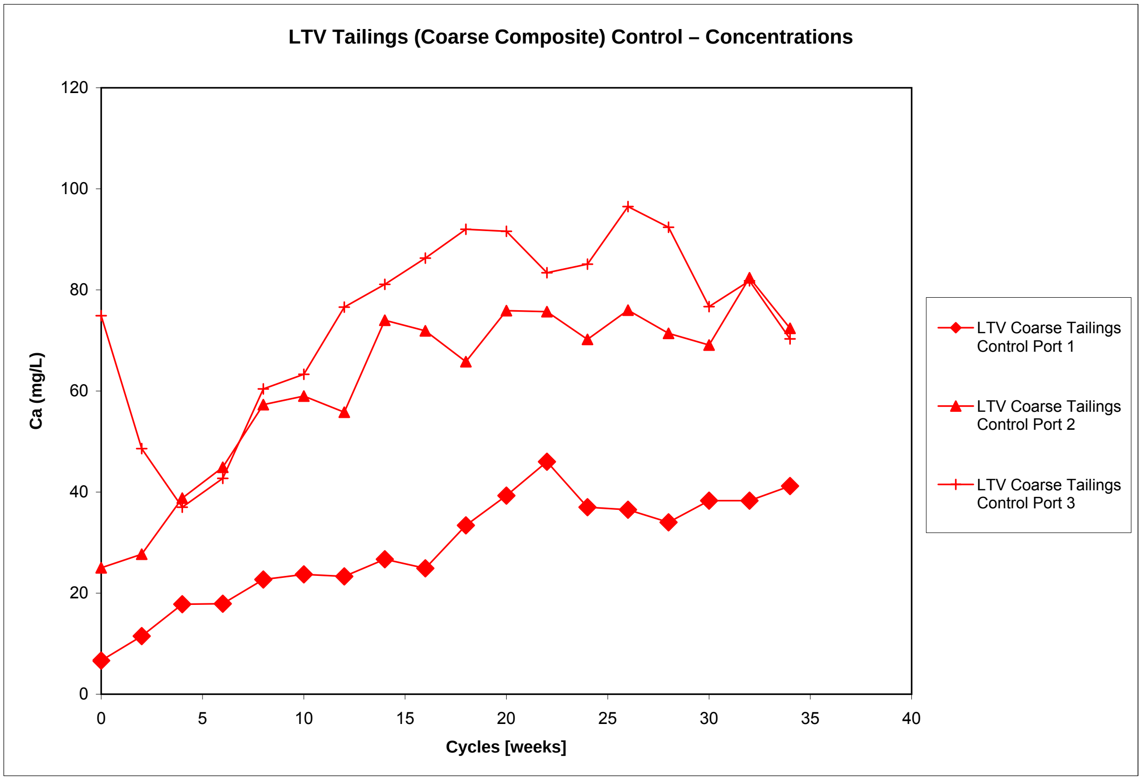
Graph C.3.7

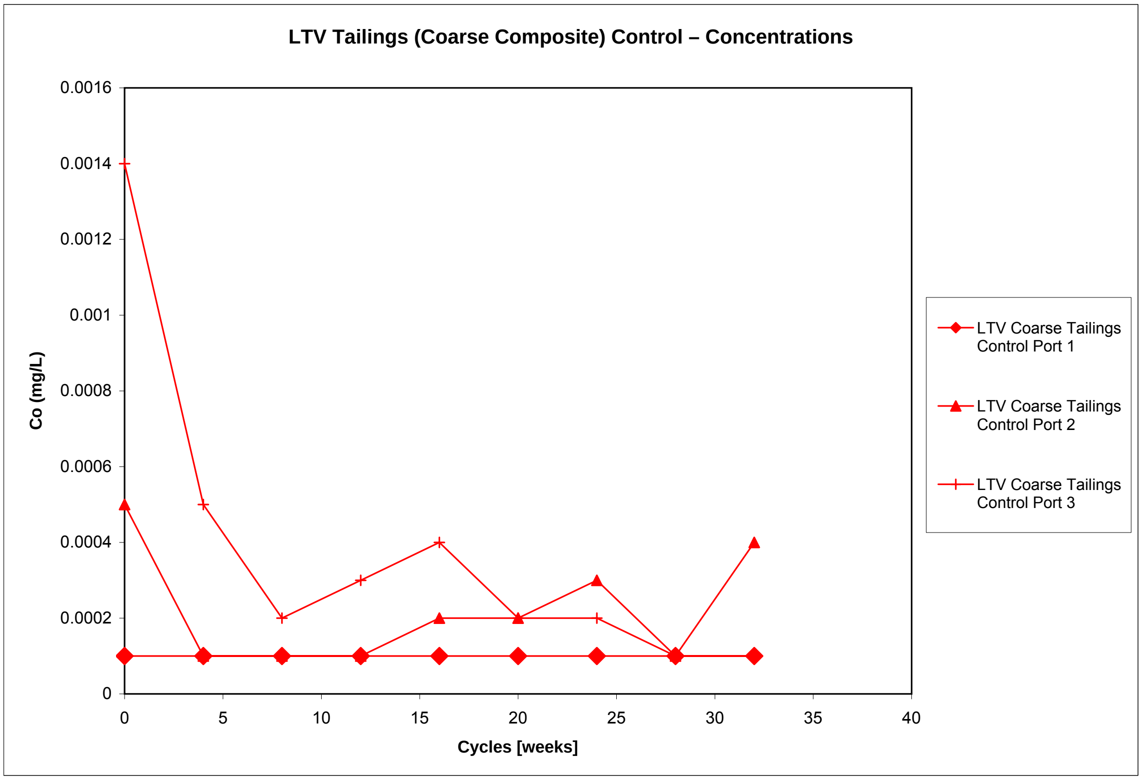

LTV Tailings (Coarse Composite) Control – Concentrations

Appendix C.3
LTVSMC Contact Experiment

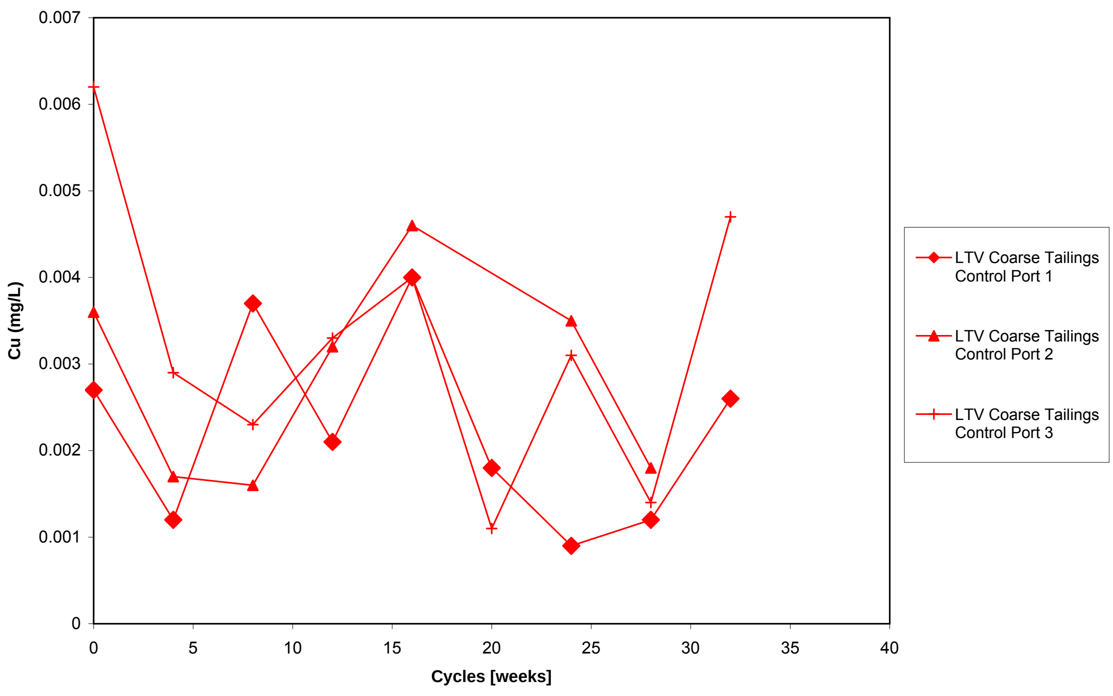
Graph C.3.8


LTV Tailings (Coarse Composite) Control – Concentrations

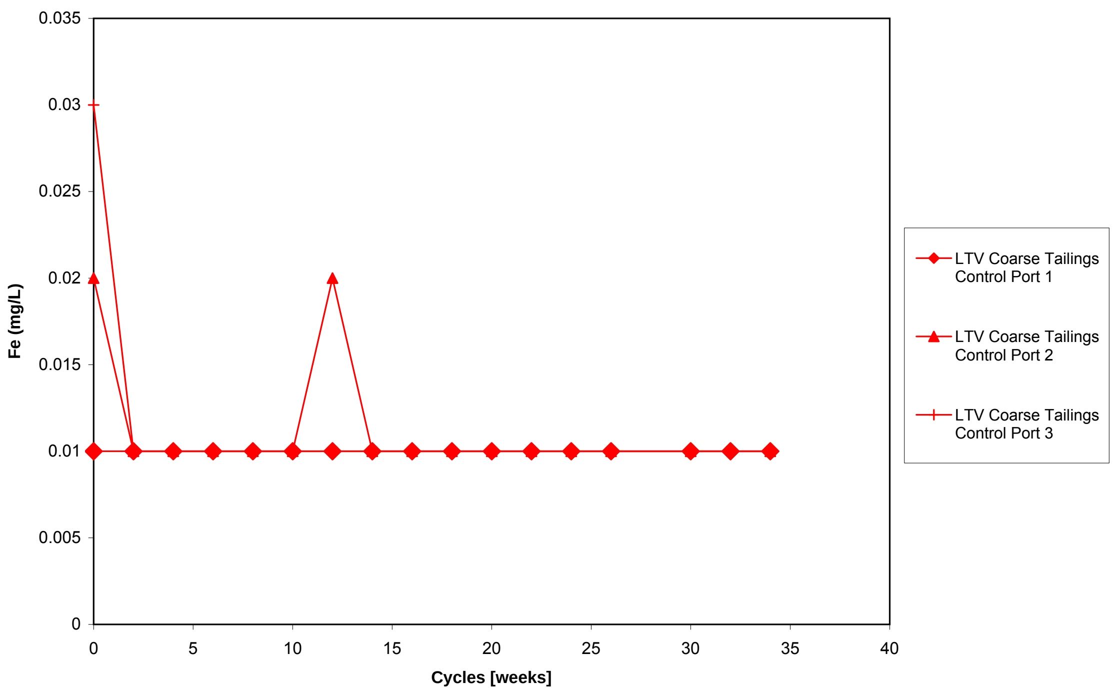

LTV Tailings (Coarse Composite) Control – Concentrations
120
100
80
60
40
20
0
Ca (mg/L)
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3

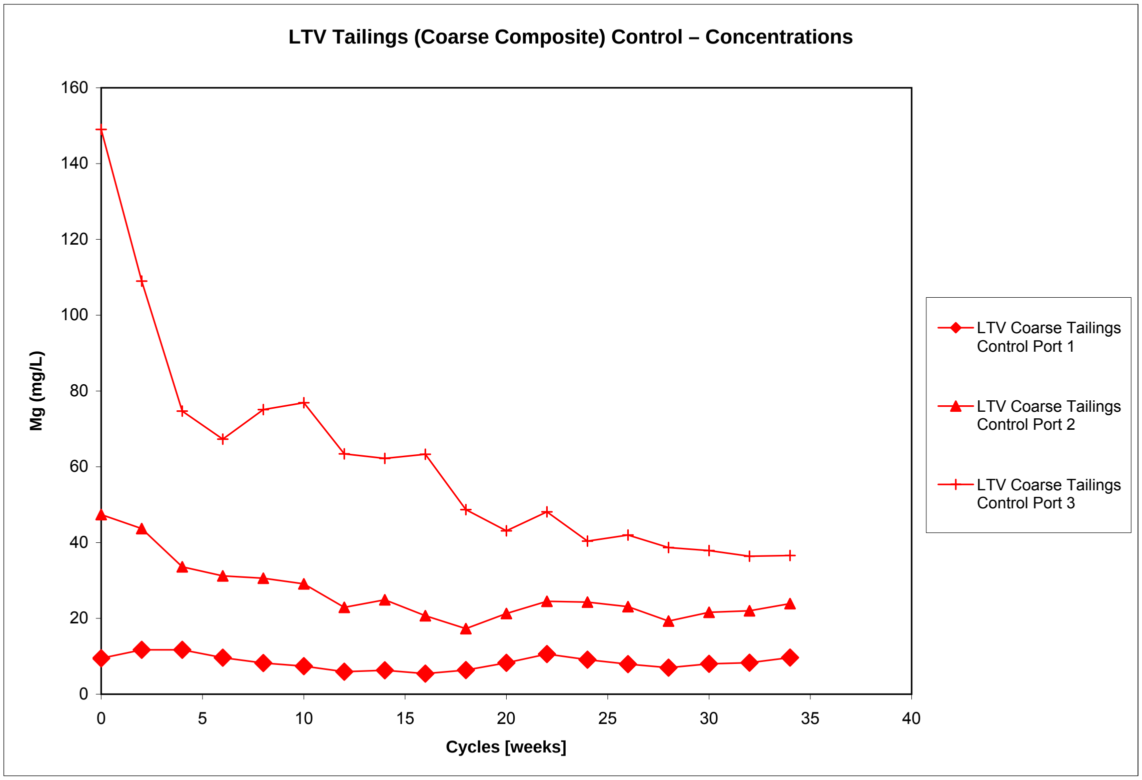

LTV Tailings (Coarse Composite) Control – Concentrations
0.0016
0.0014
0.0012
0.001
0.0008
0.0006
0.0004
0.0002
0
Co (mg/L)
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3

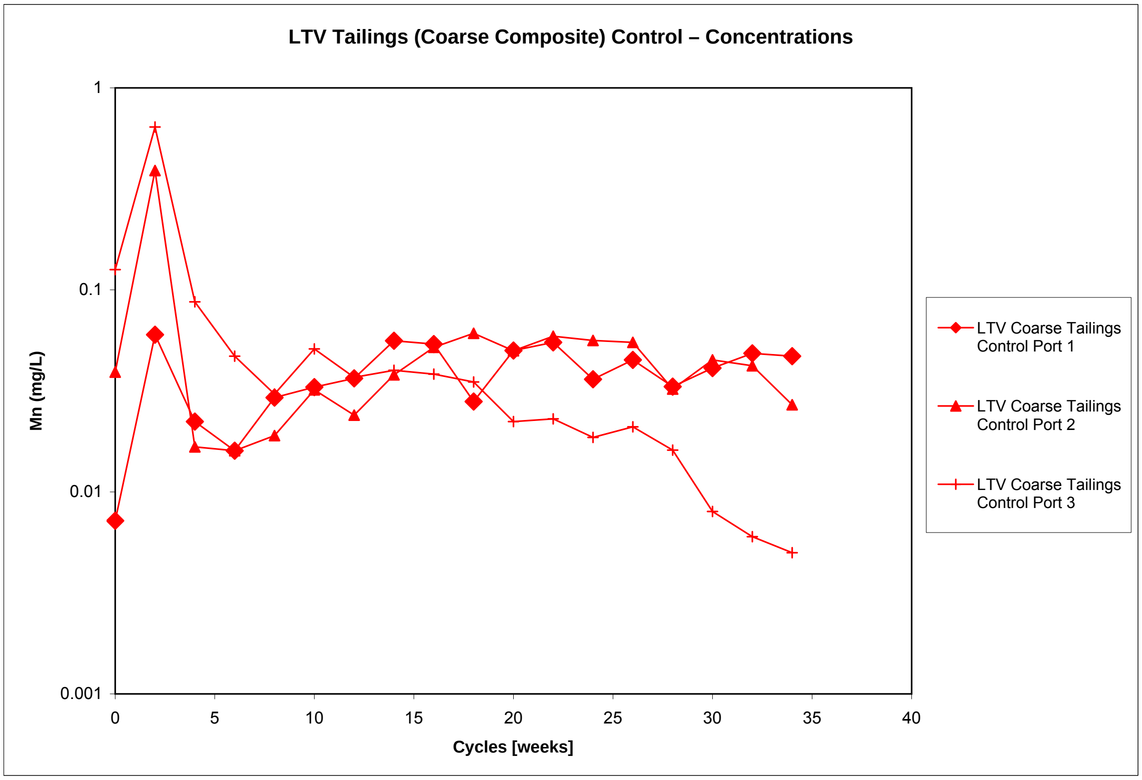
LTV Tailings (Coarse Composite) Control – Concentrations

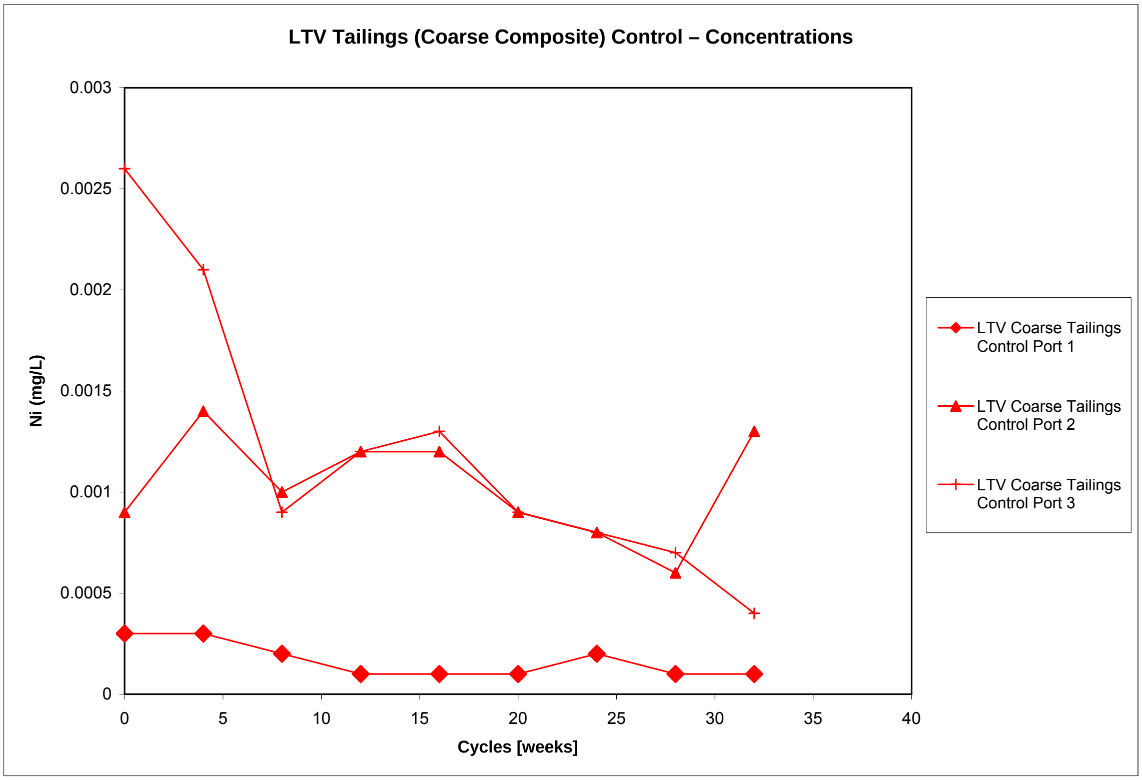


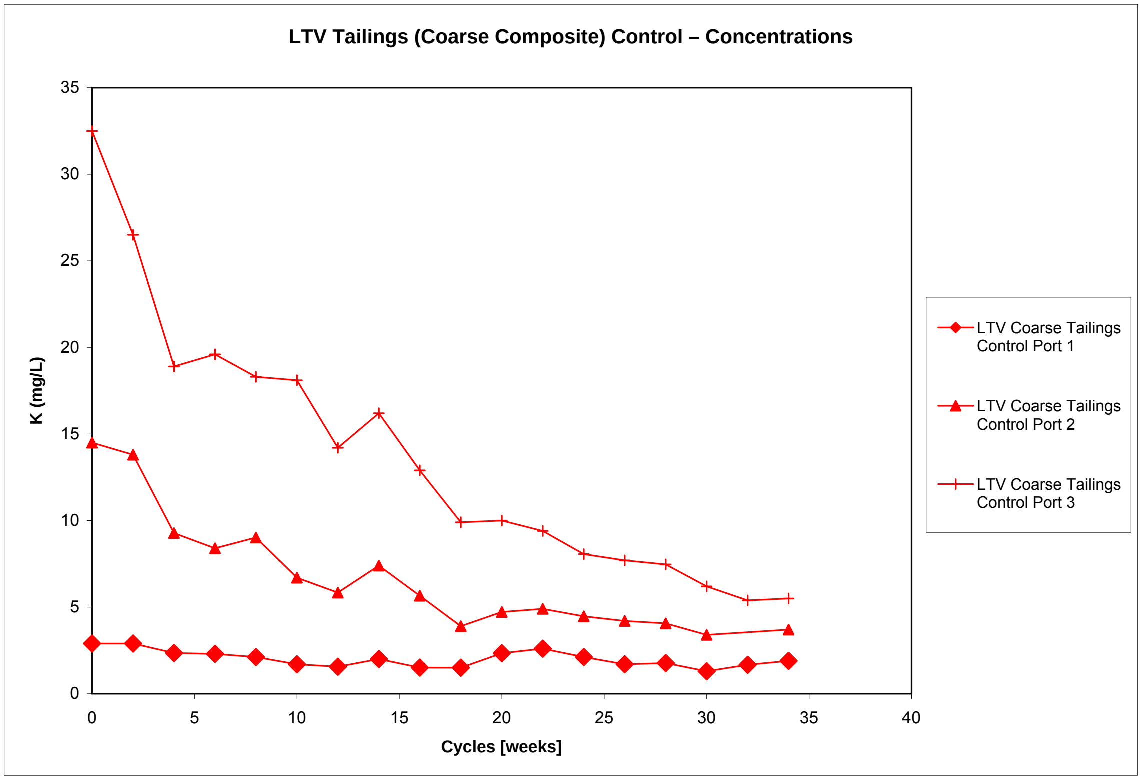
LTV Tailings (Coarse Composite) Control – Concentrations



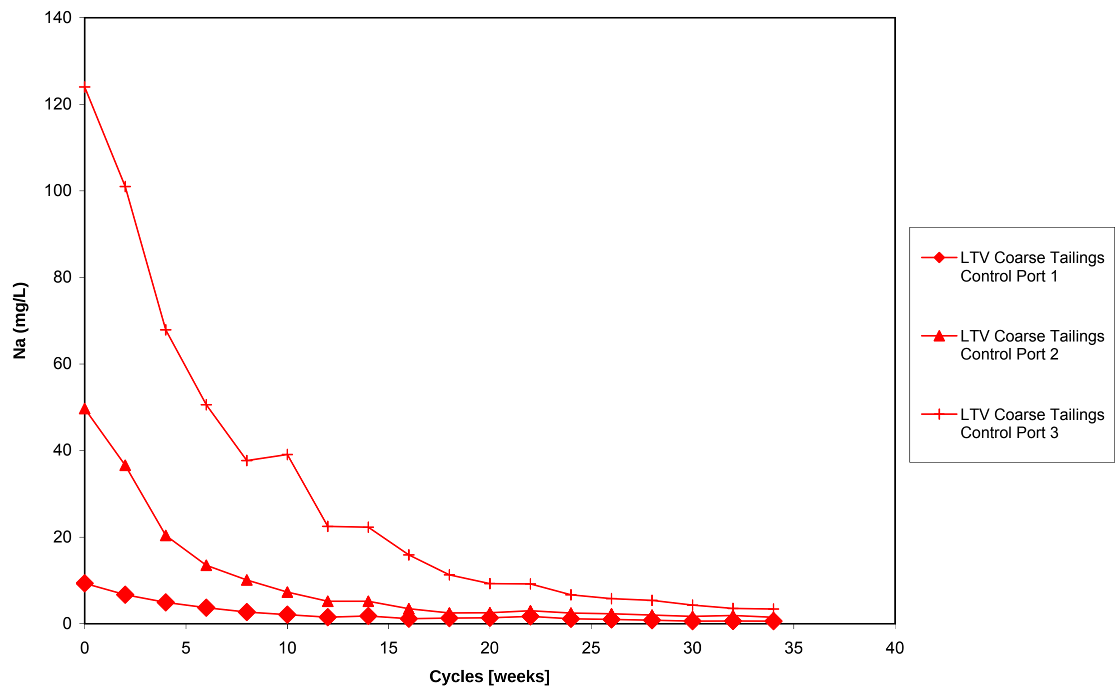

LTV Tailings (Coarse Composite) Control – Concentrations
Mg (mg/L)
0
20
40
60
80
100
120
140
160
Cycles [weeks]
0
5
10
15
20
25
30
35
40
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3


LTV Tailings (Coarse Composite) Control – Concentrations
Mn (mg/L)
0.001
0.01
0.1
1
Cycles [weeks]
0
5
10
15
20
25
30
35
40
LTV Coarse Tailings Control Port 1
LTV Coarse Tailings Control Port 2
LTV Coarse Tailings Control Port 3

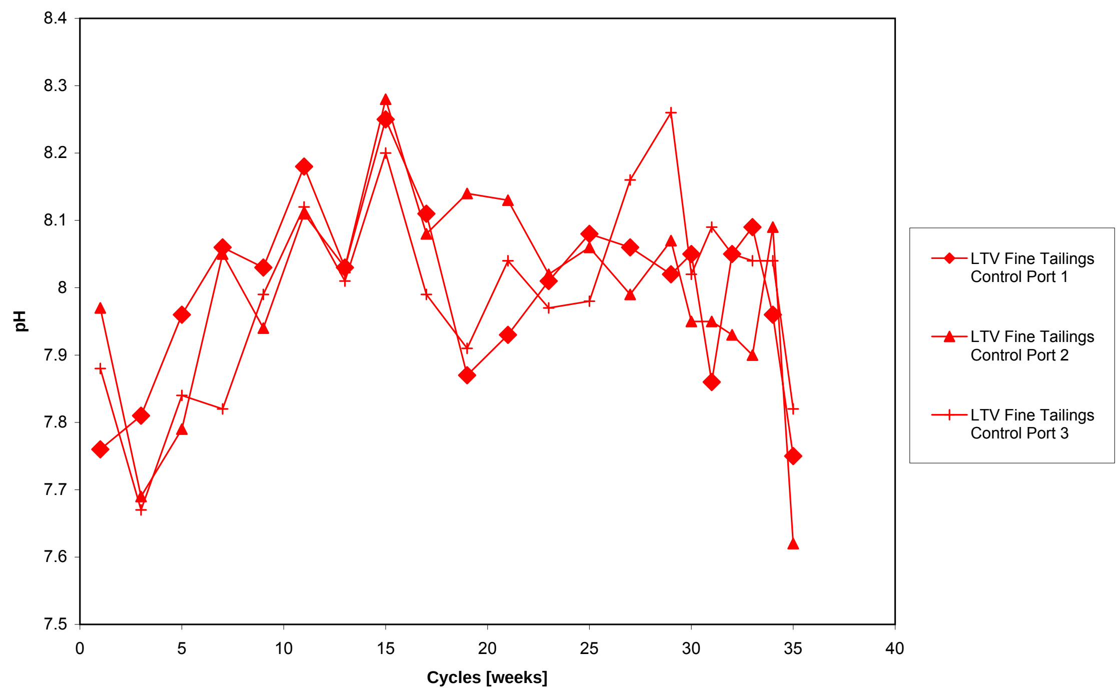

LTV Tailings (Coarse Composite) Control – Concentrations

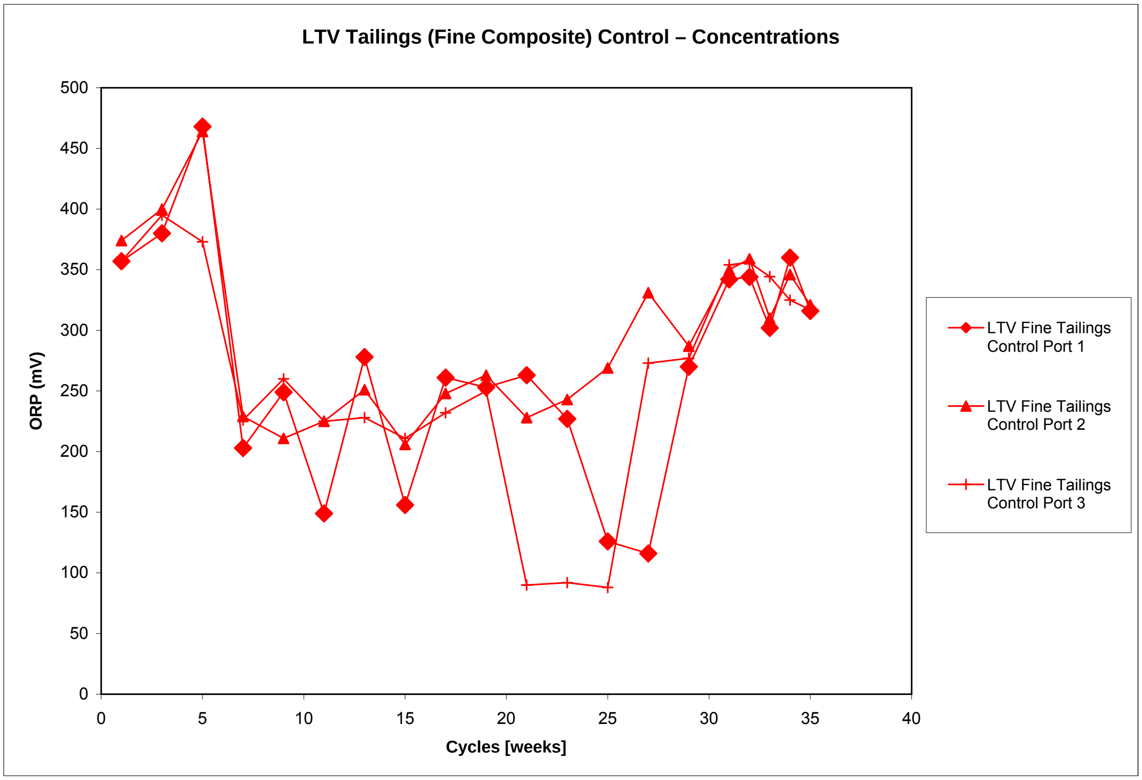

LTV Tailings (Coarse Composite) Control – Concentrations

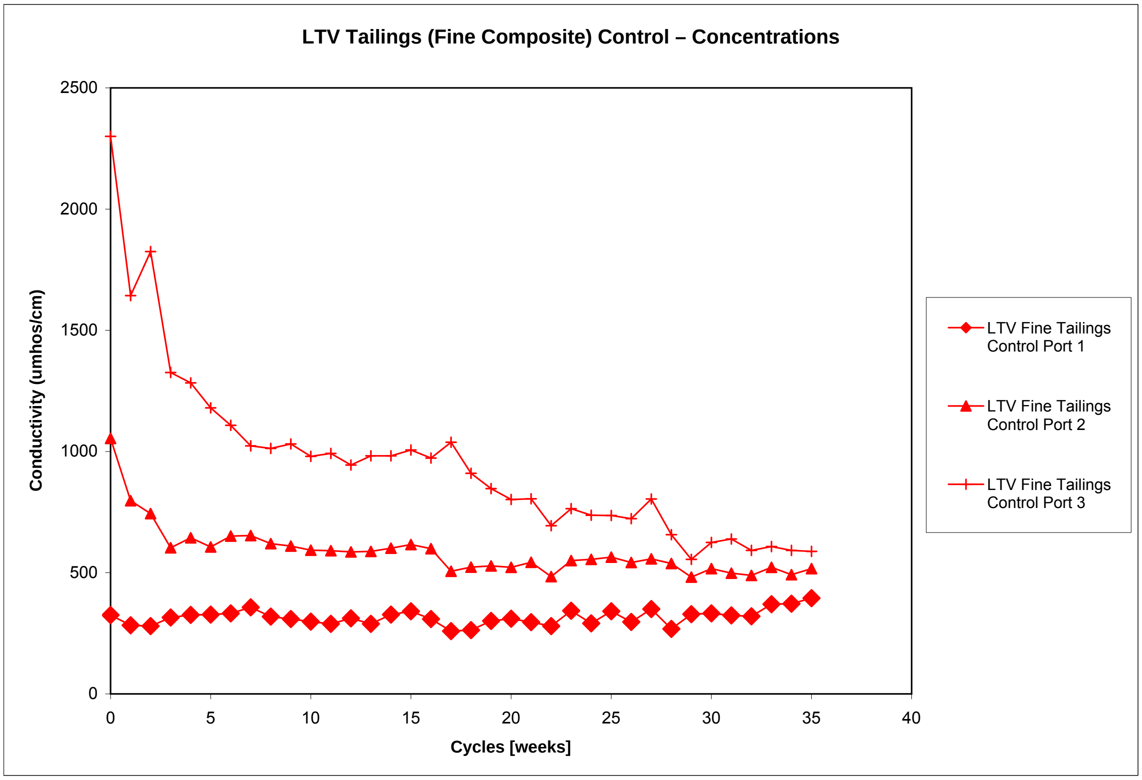
LTV Tailings (Coarse Composite) Control – Concentrations

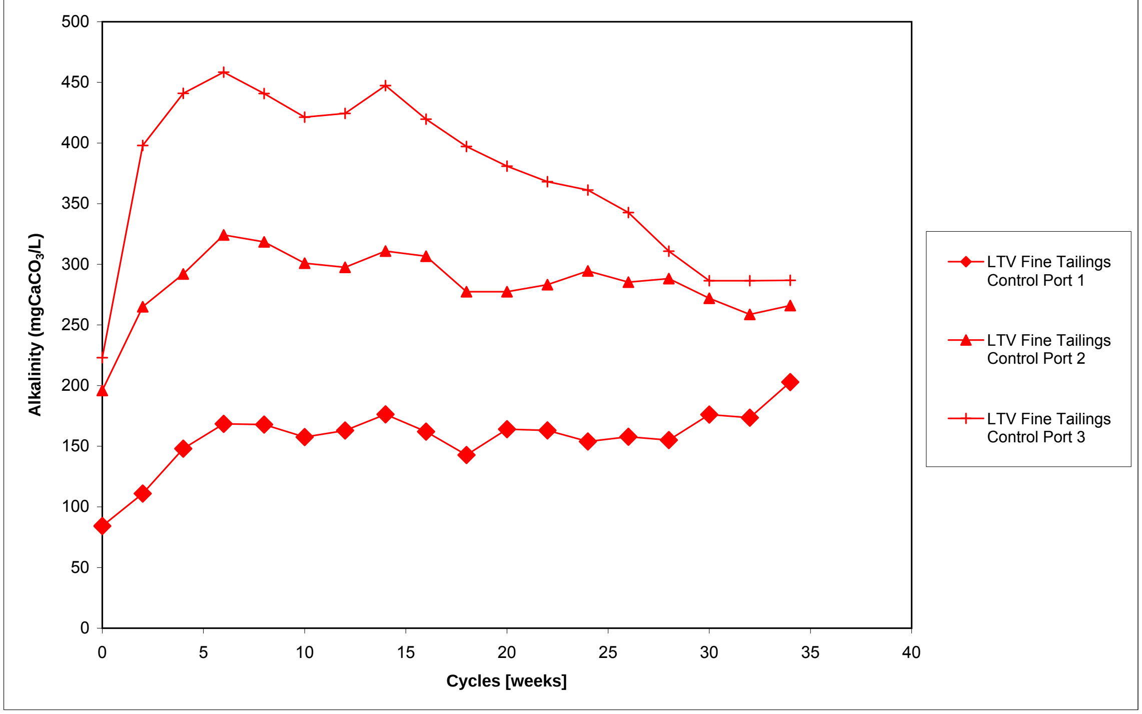


LTV Tailings (Fine Composite) Control – Concentrations

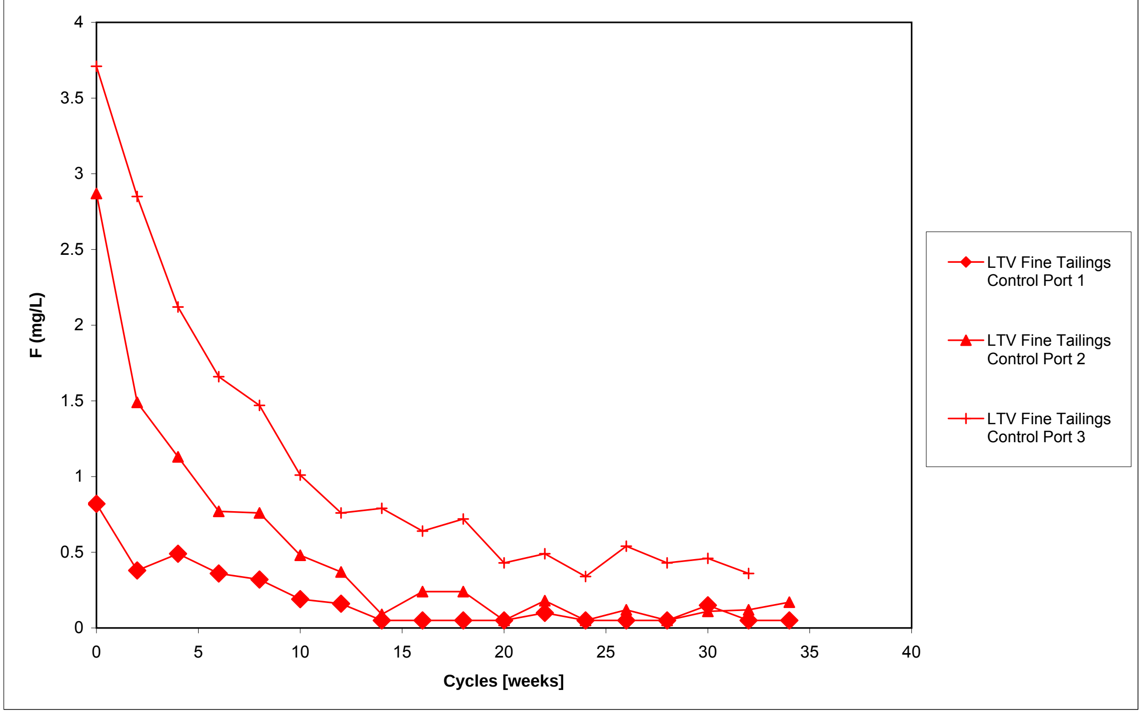



LTV Tailings (Fine Composite) Control – Concentrations
ORP (mV)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

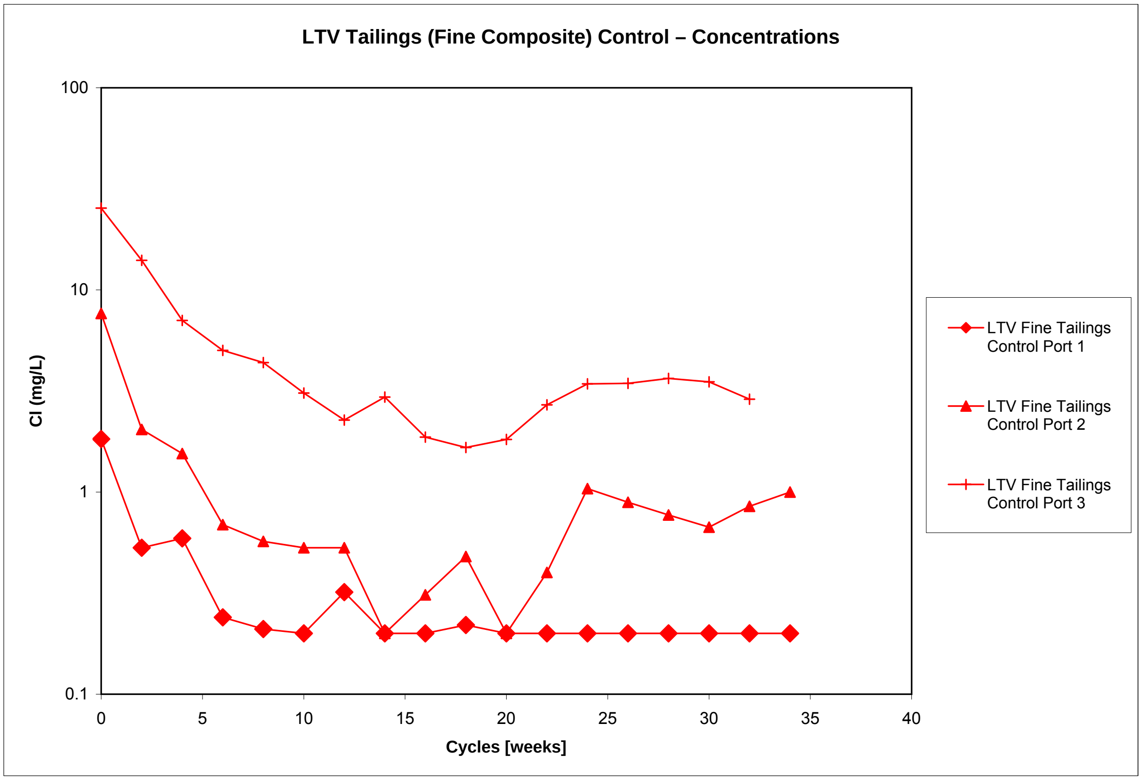

LTV Tailings (Fine Composite) Control – Concentrations
Conductivity (umhos/cm)
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

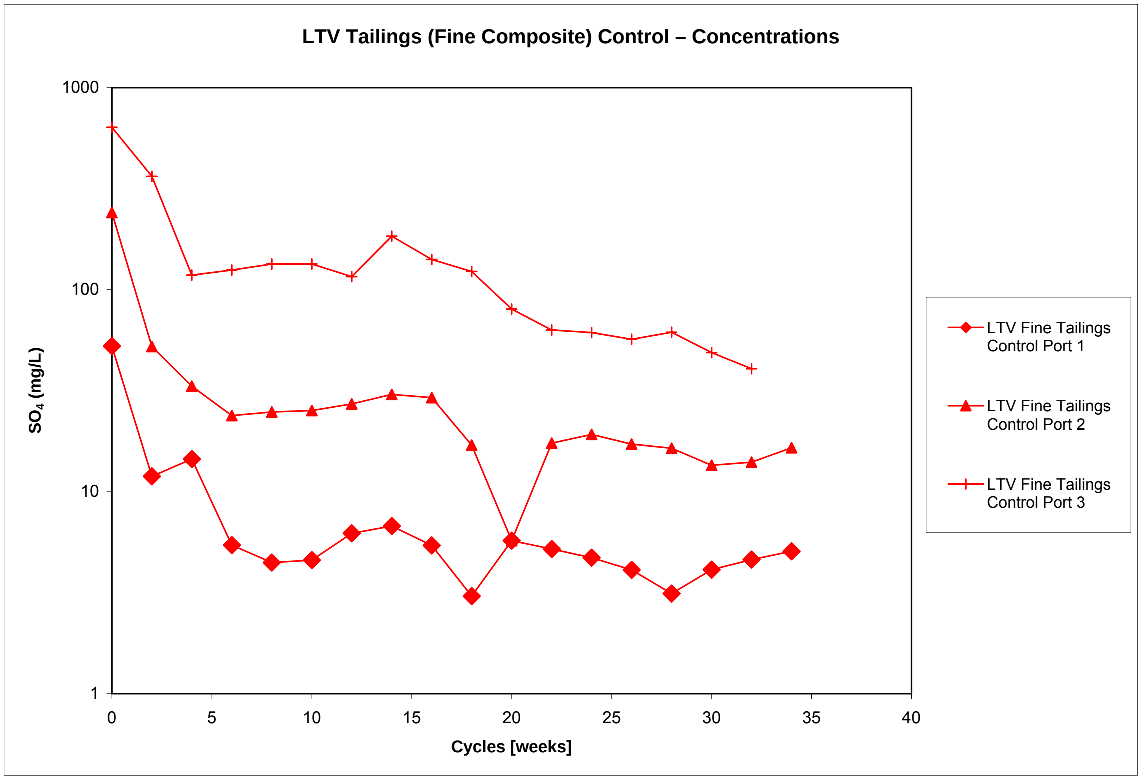


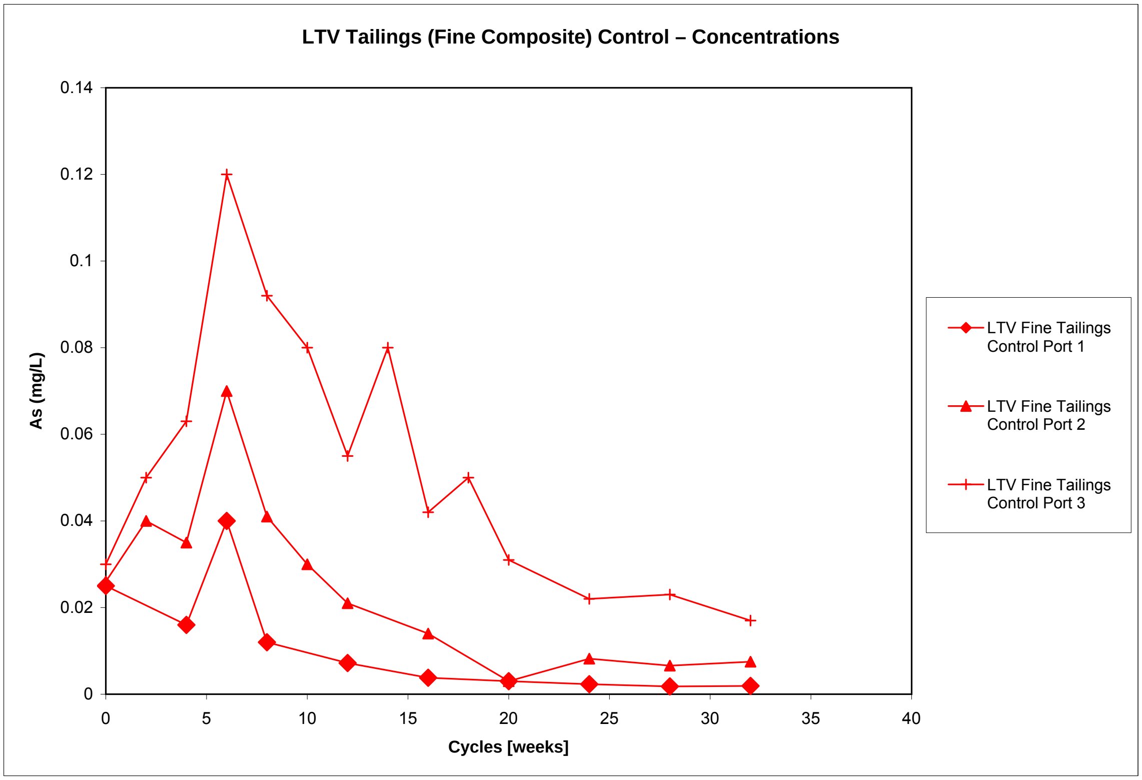
LTV Tailings (Fine Composite) Control – Concentrations

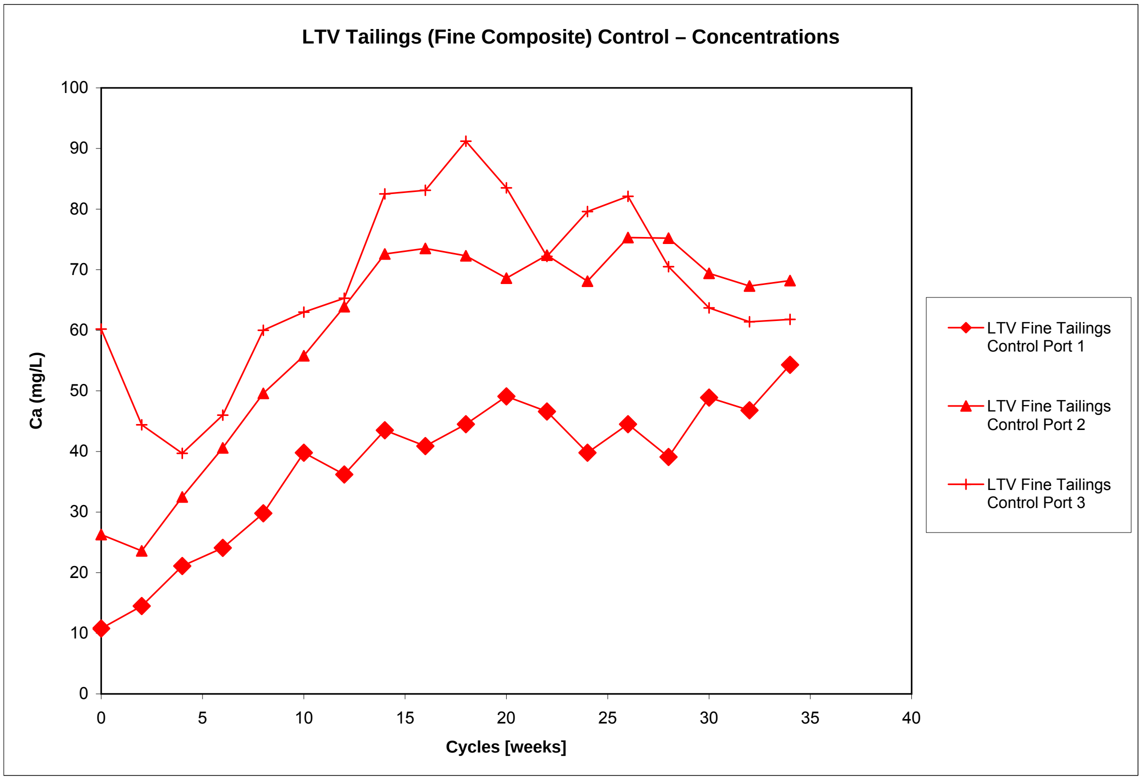


LTV Tailings (Fine Composite) Control – Concentrations

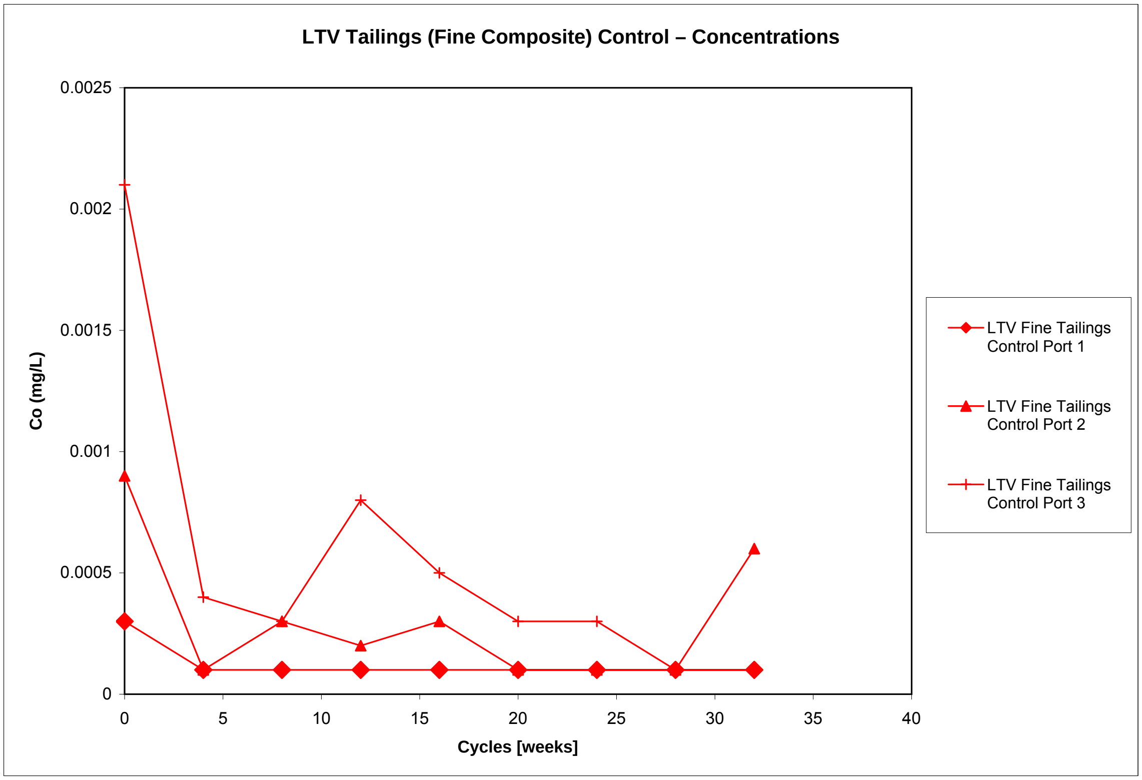

LTV Tailings (Fine Composite) Control – Concentrations
Cl (mg/L)
100
10
1
0.1
0
5
10
15
20
25
30
35
40
Cycles [weeks]
◆ LTV Fine Tailings Control Port 1
▲ LTV Fine Tailings Control Port 2
+ LTV Fine Tailings Control Port 3


LTV Tailings (Fine Composite) Control – Concentrations
SO4 (mg/L)
1000
100
10
1
0
5
10
15
20
25
30
35
40
Cycles [weeks]
◆ LTV Fine Tailings Control Port 1
▲ LTV Fine Tailings Control Port 2
+ LTV Fine Tailings Control Port 3

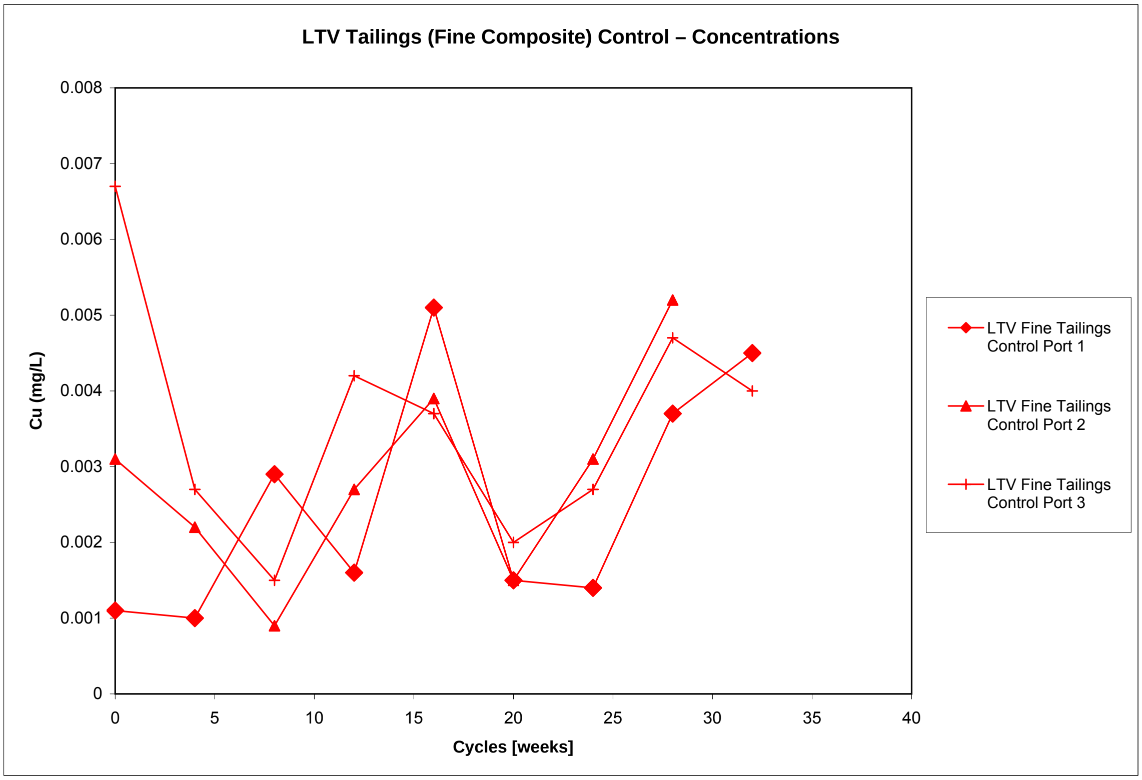

LTV Tailings (Fine Composite) Control – Concentrations
As (mg/L)
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

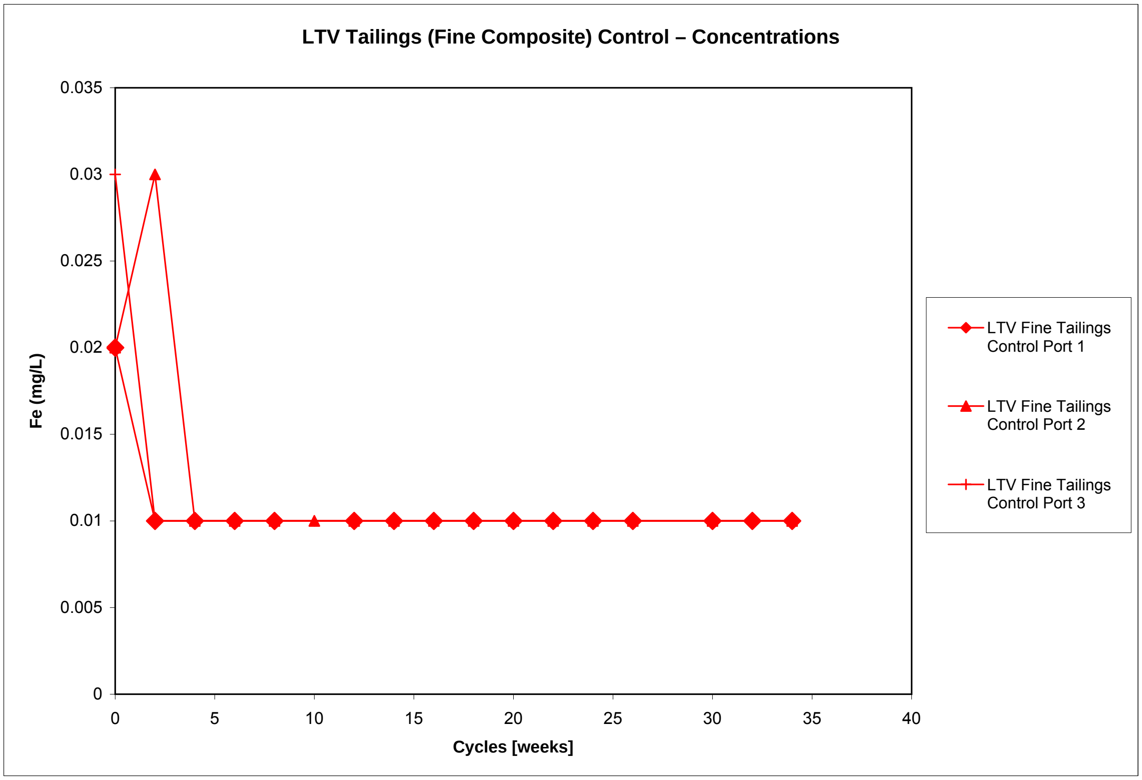

LTV Tailings (Fine Composite) Control – Concentrations
Ca (mg/L)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

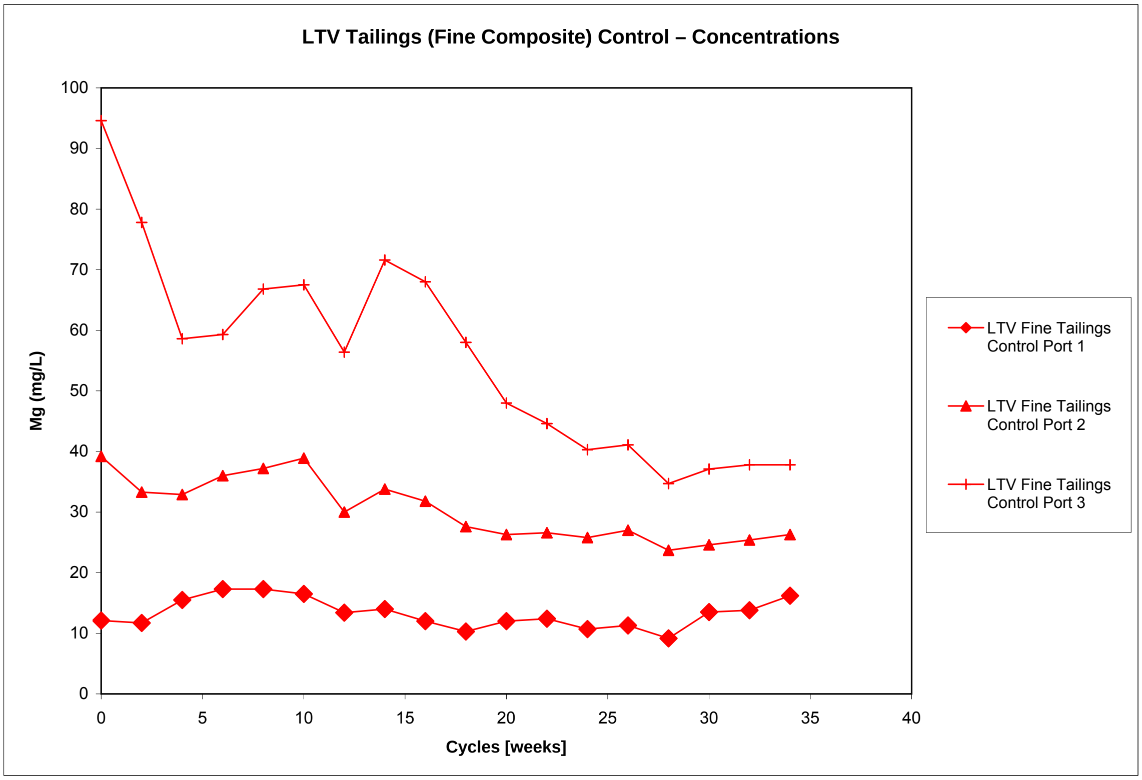
Graph C.3.27

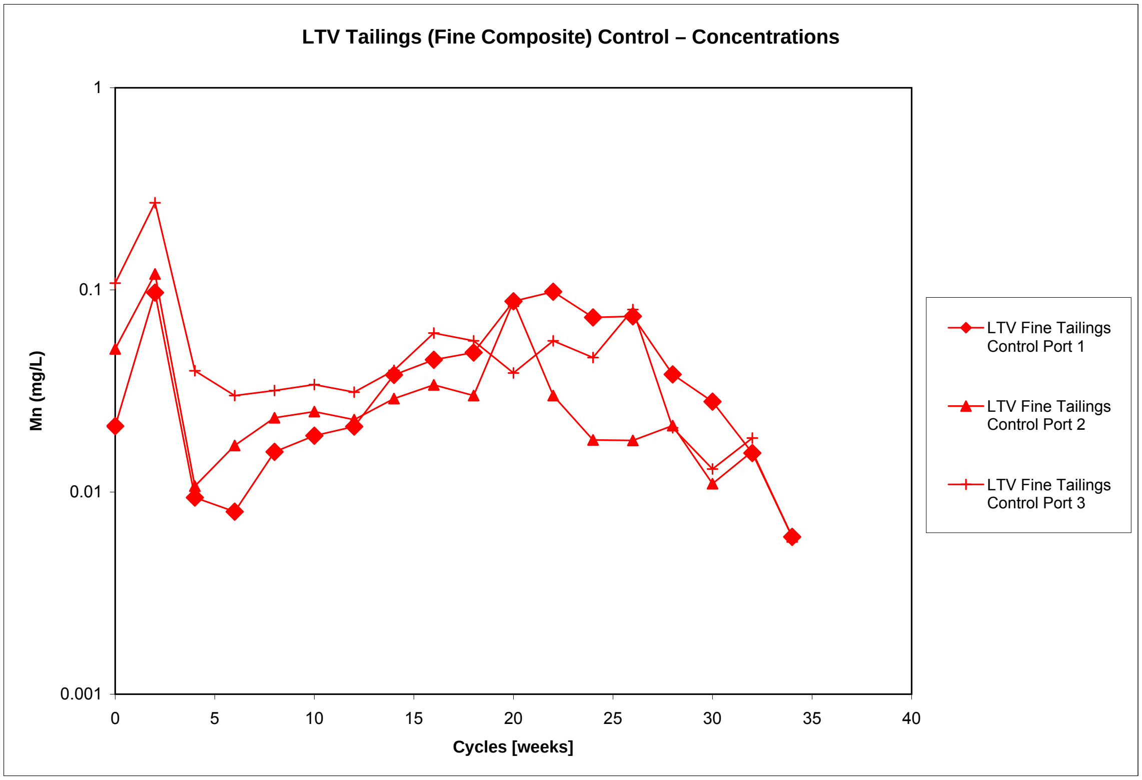

LTV Tailings (Fine Composite) Control – Concentrations

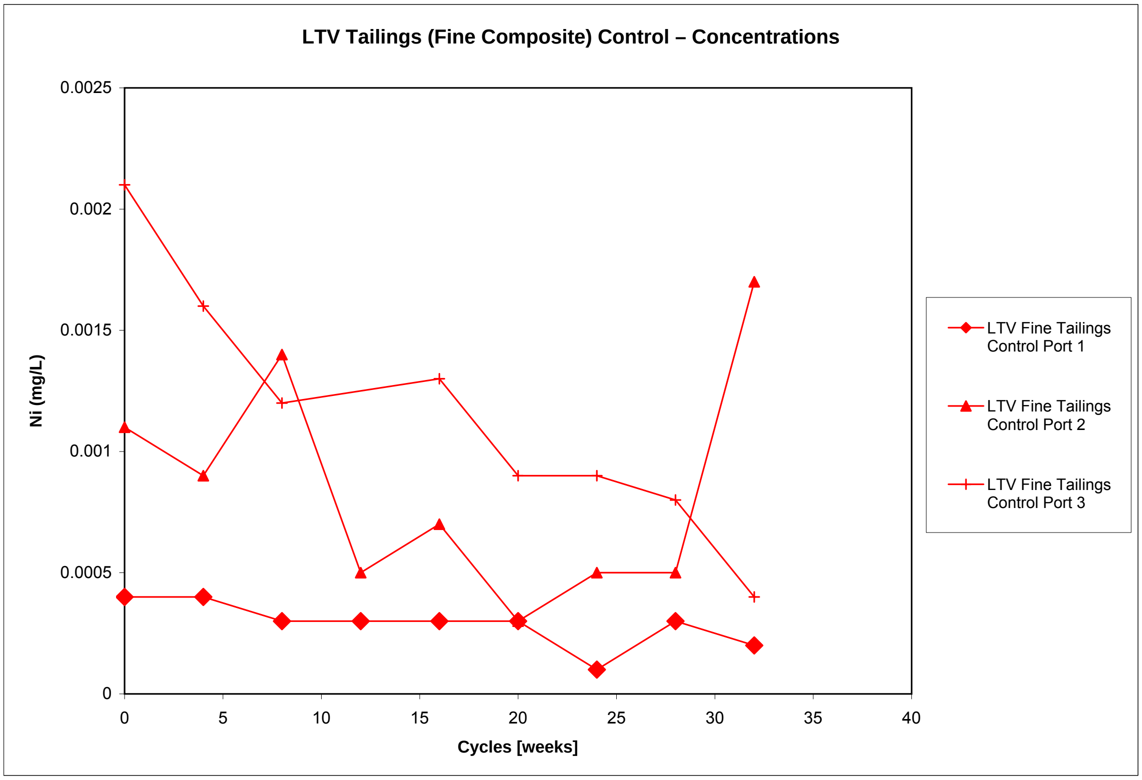
Graph C.3.28

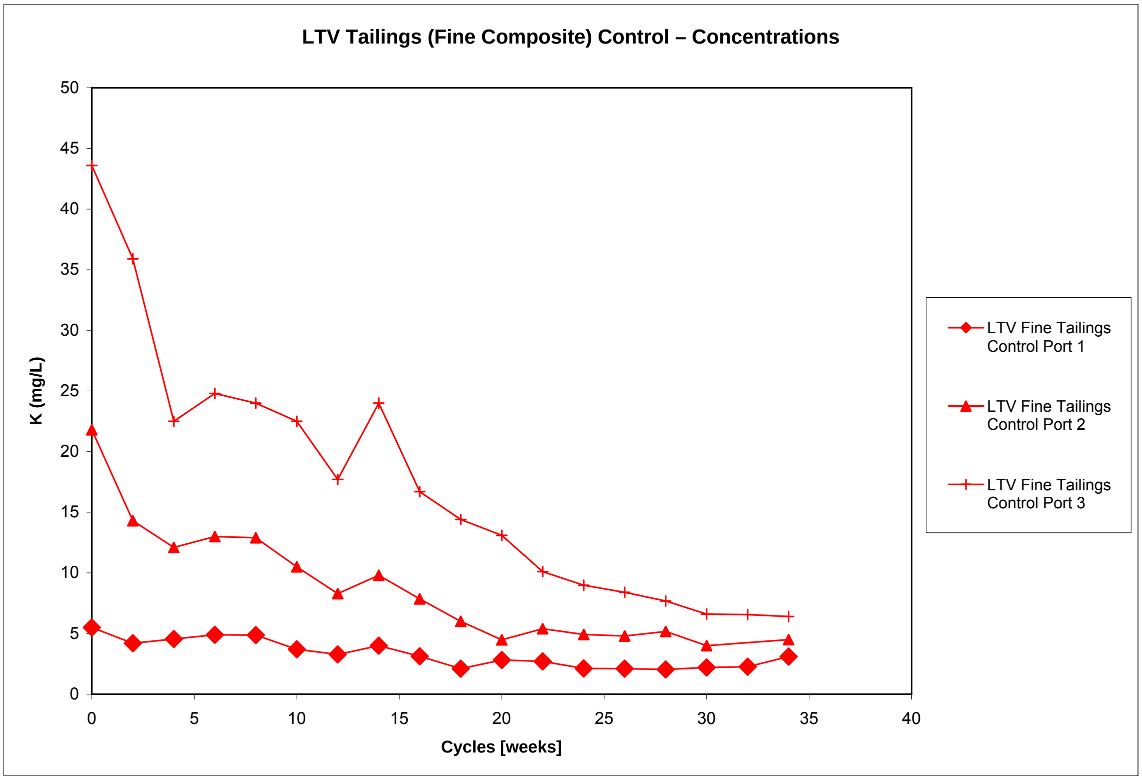

LTV Tailings (Fine Composite) Control – Concentrations

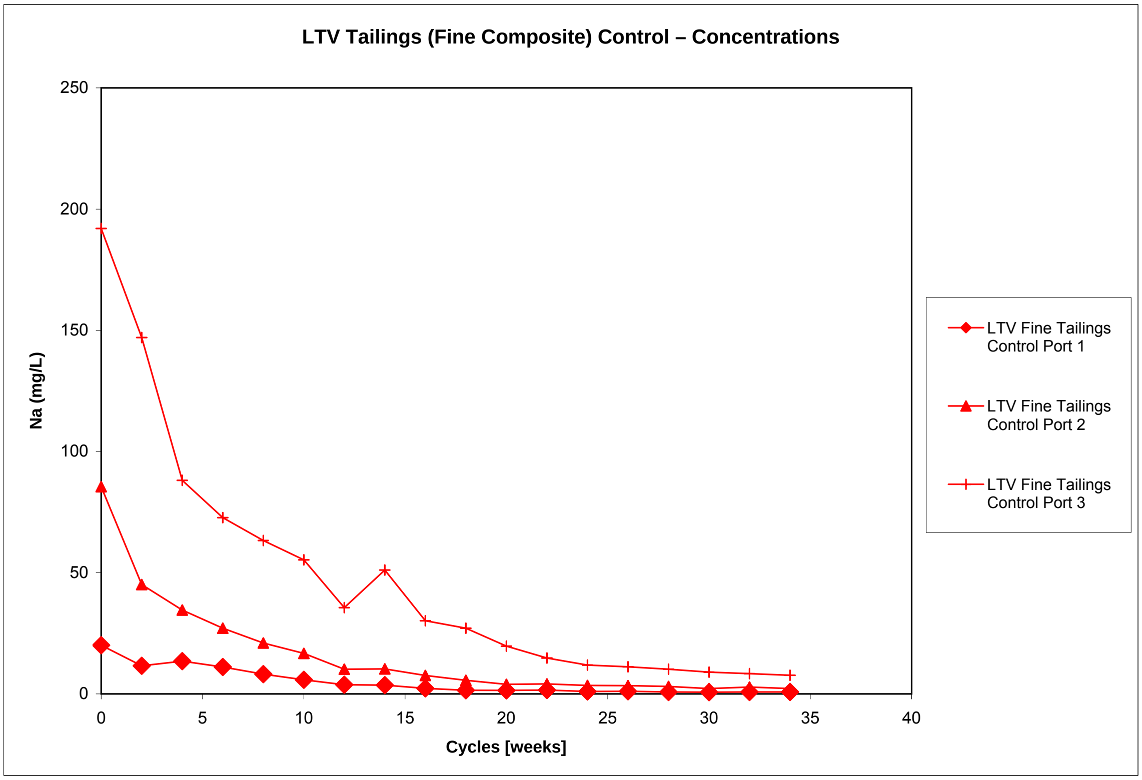

LTV Tailings (Fine Composite) Control – Concentrations
Fe (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3


LTV Tailings (Fine Composite) Control – Concentrations
Mg (mg/L)
100
90
80
70
60
50
40
30
20
10
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3


LTV Tailings (Fine Composite) Control – Concentrations
Mn (mg/L)
1
0.1
0.01
0.001
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

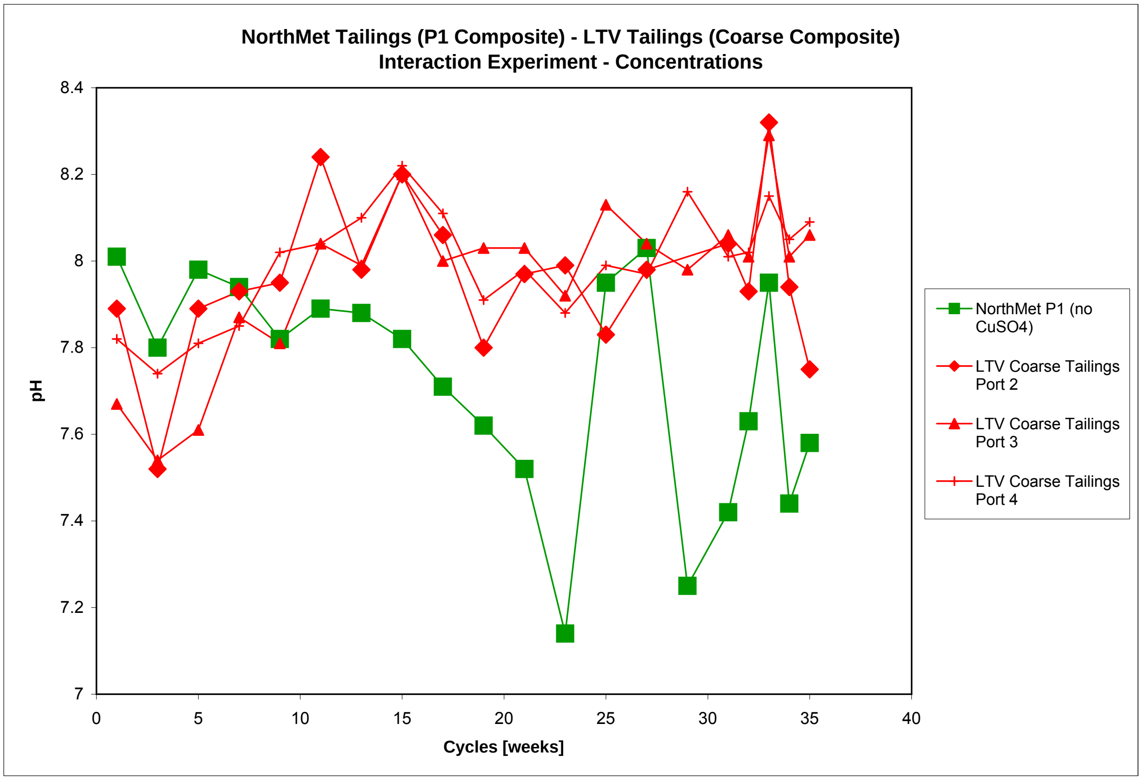

LTV Tailings (Fine Composite) Control – Concentrations
Ni (mg/L)
0.0025
0.002
0.0015
0.001
0.0005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3


LTV Tailings (Fine Composite) Control – Concentrations
K (mg/L)
50
45
40
35
30
25
20
15
10
5
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3


LTV Tailings (Fine Composite) Control – Concentrations
Na (mg/L)
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
LTV Fine Tailings Control Port 1
LTV Fine Tailings Control Port 2
LTV Fine Tailings Control Port 3

Appendix C.3
LTVSMC Contact Experiment

Graph C.3.35



LTV_combined.xls

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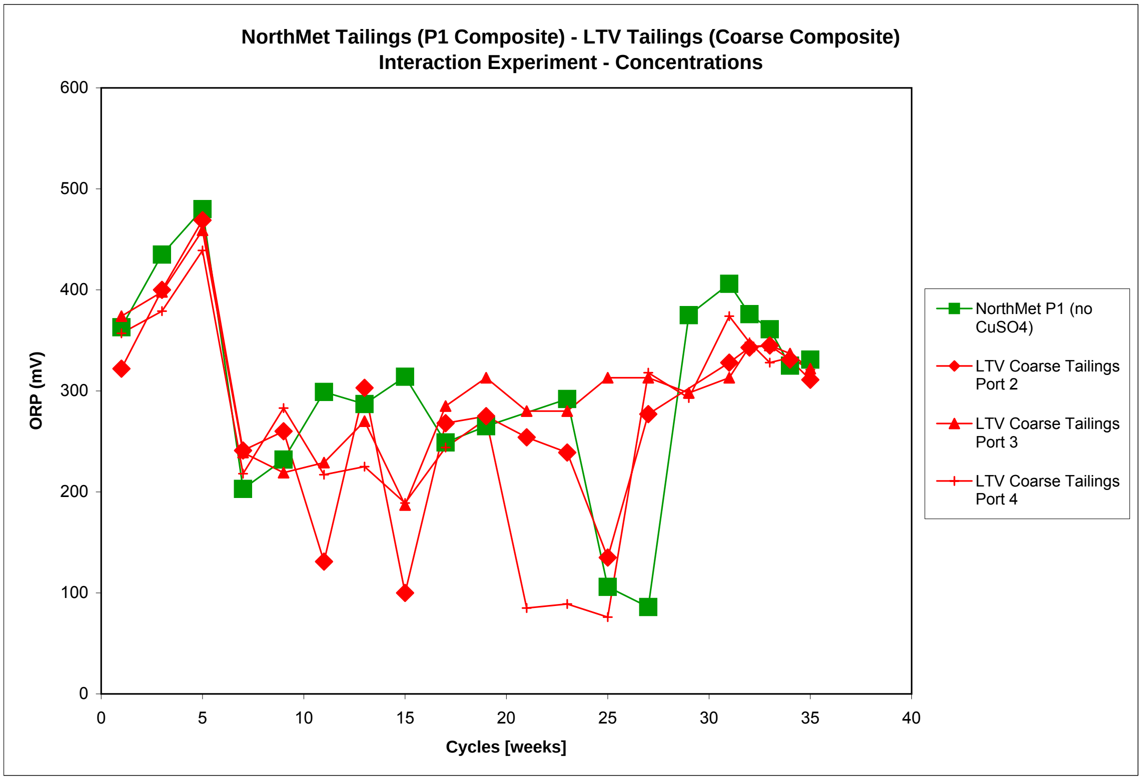
Appendix C.3
LTVSMC Contact Experiment

Graph C.3.36



LTV_combined.xls

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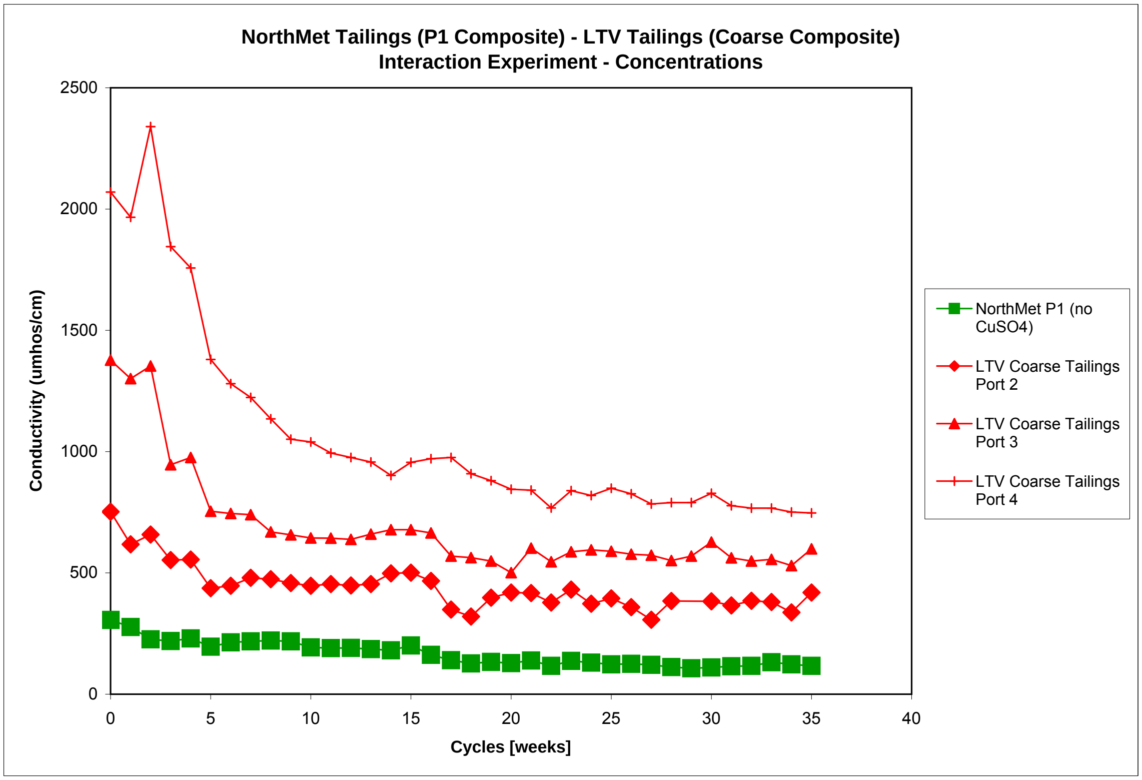
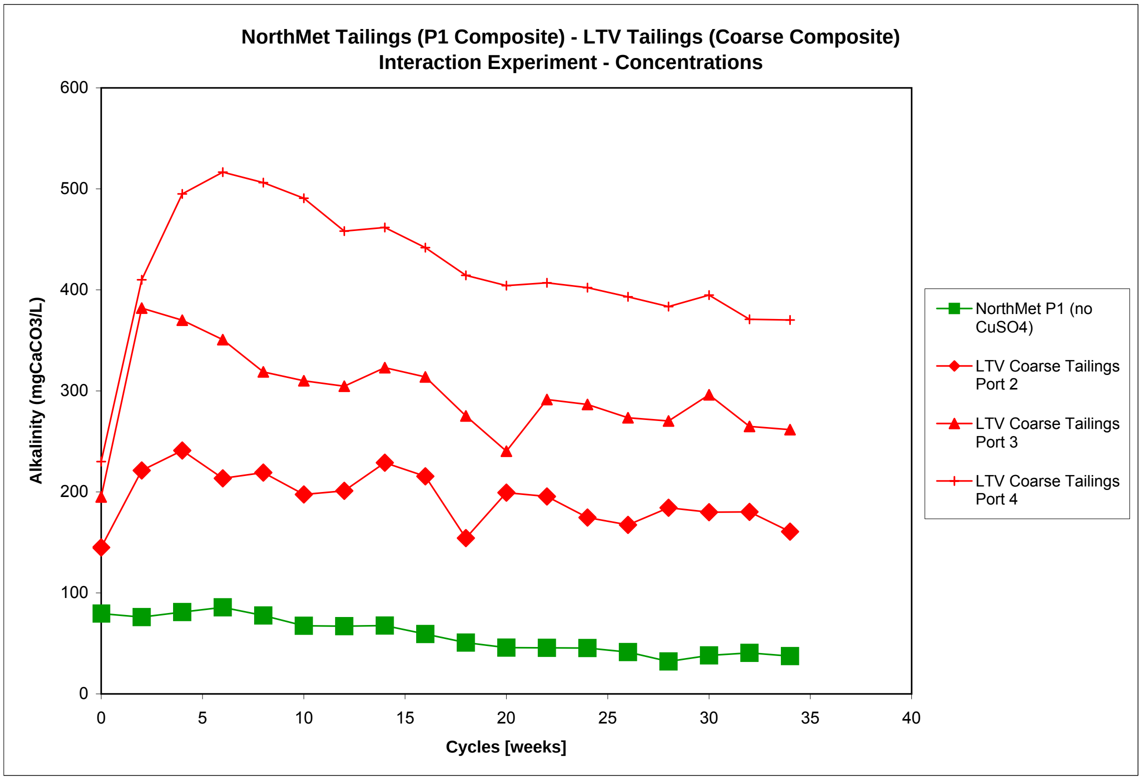
Appendix C.3
LTVSMC Contact Experiment

Graph C.3.37

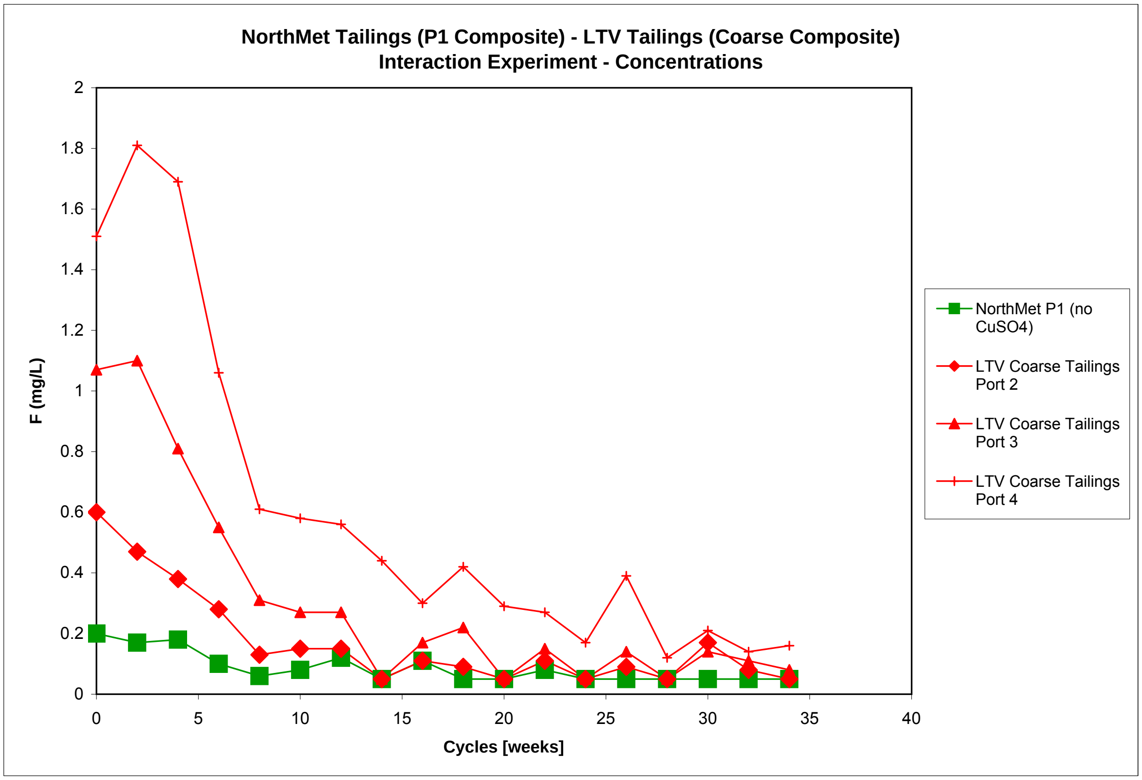


Appendix C.3
LTVSMC Contact Experiment

Graph C.3.38

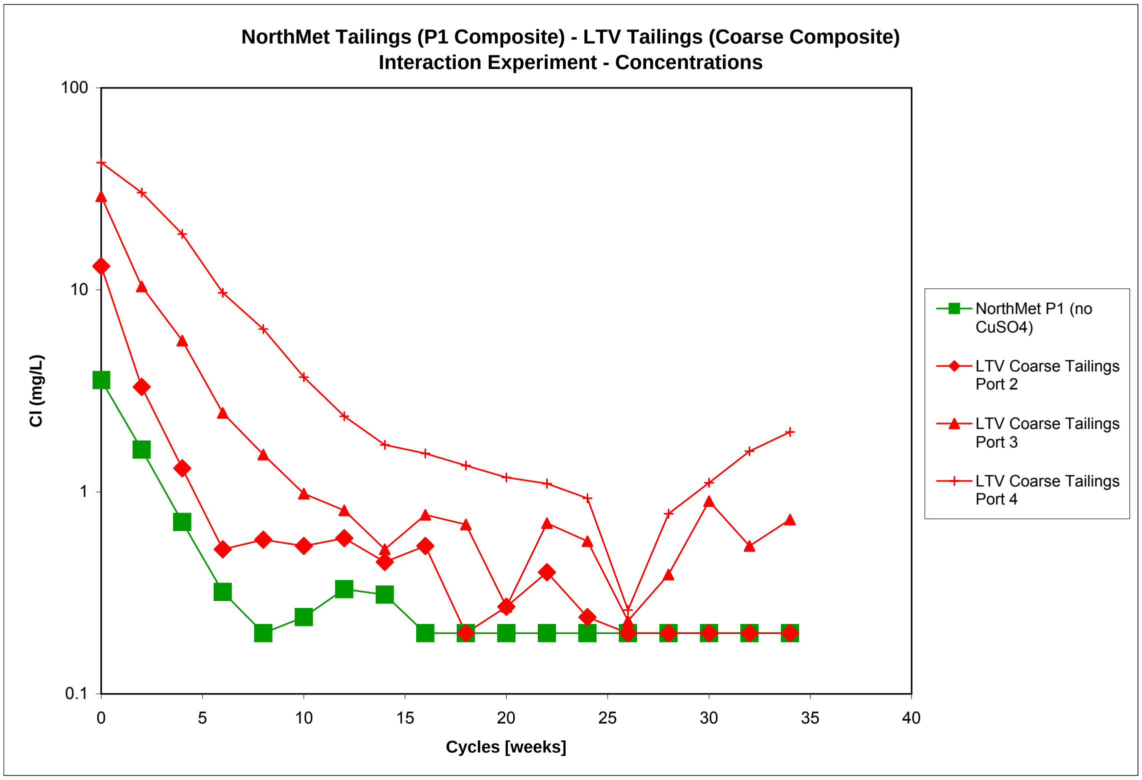


Graph C.3.39

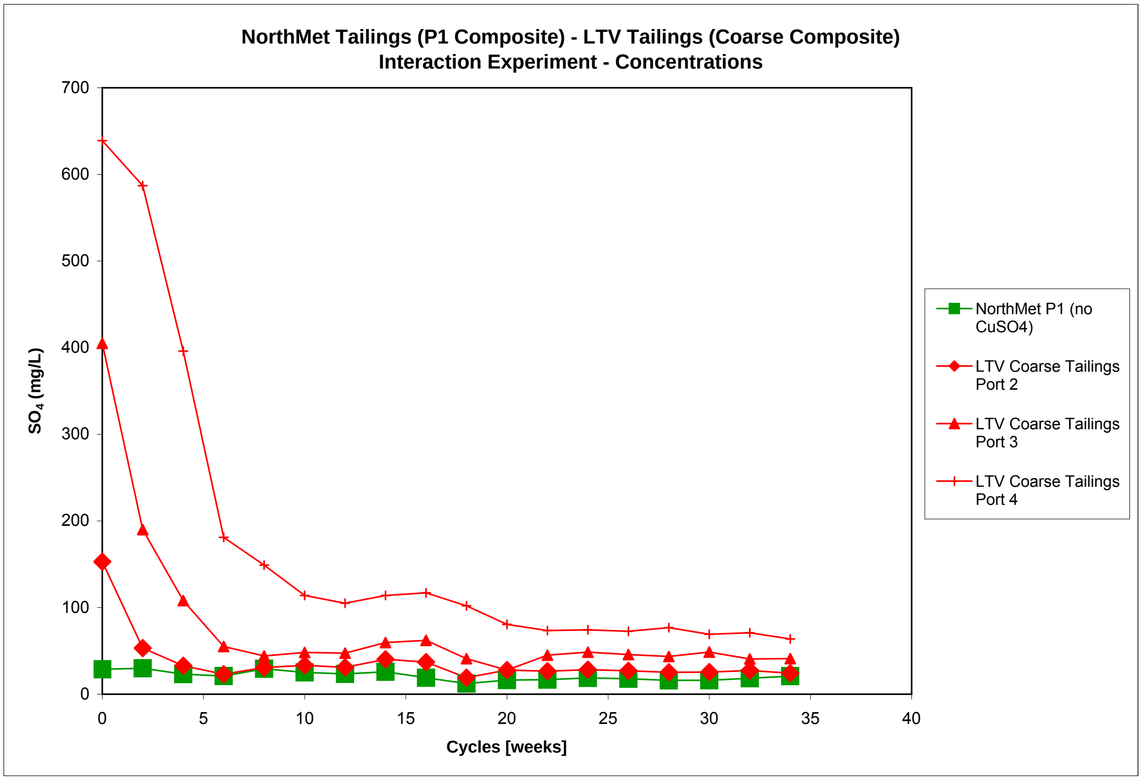


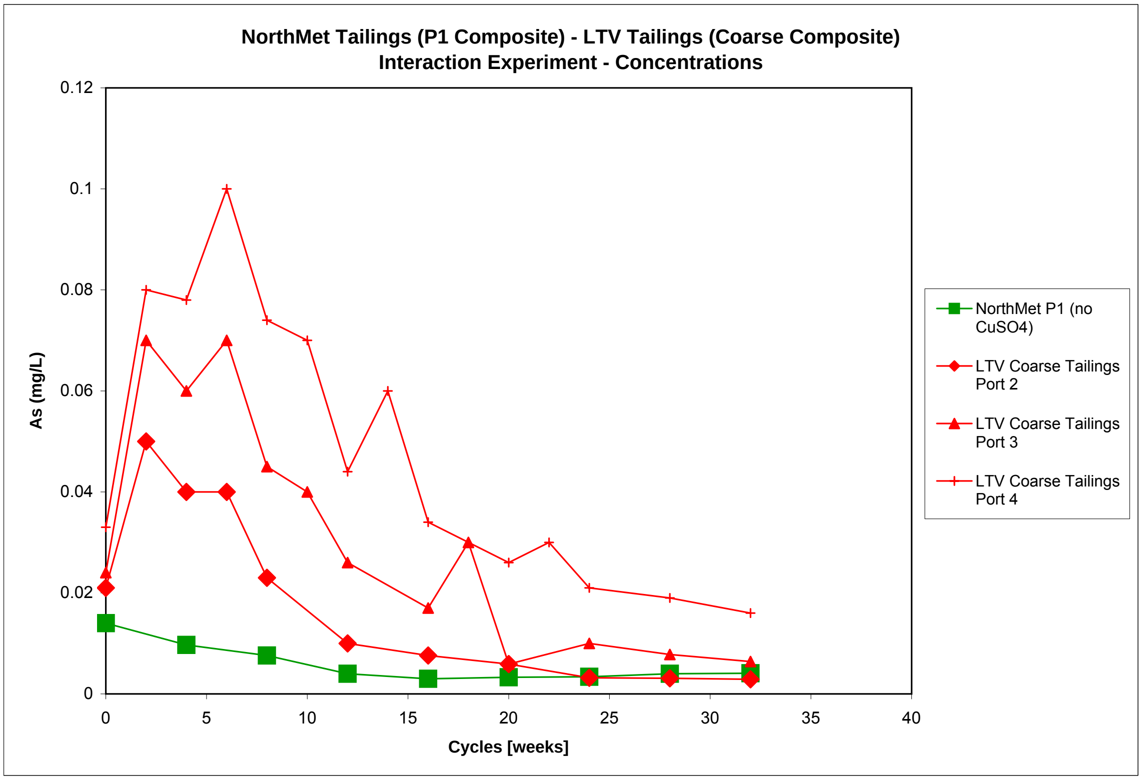
NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations

Graph C.3.40



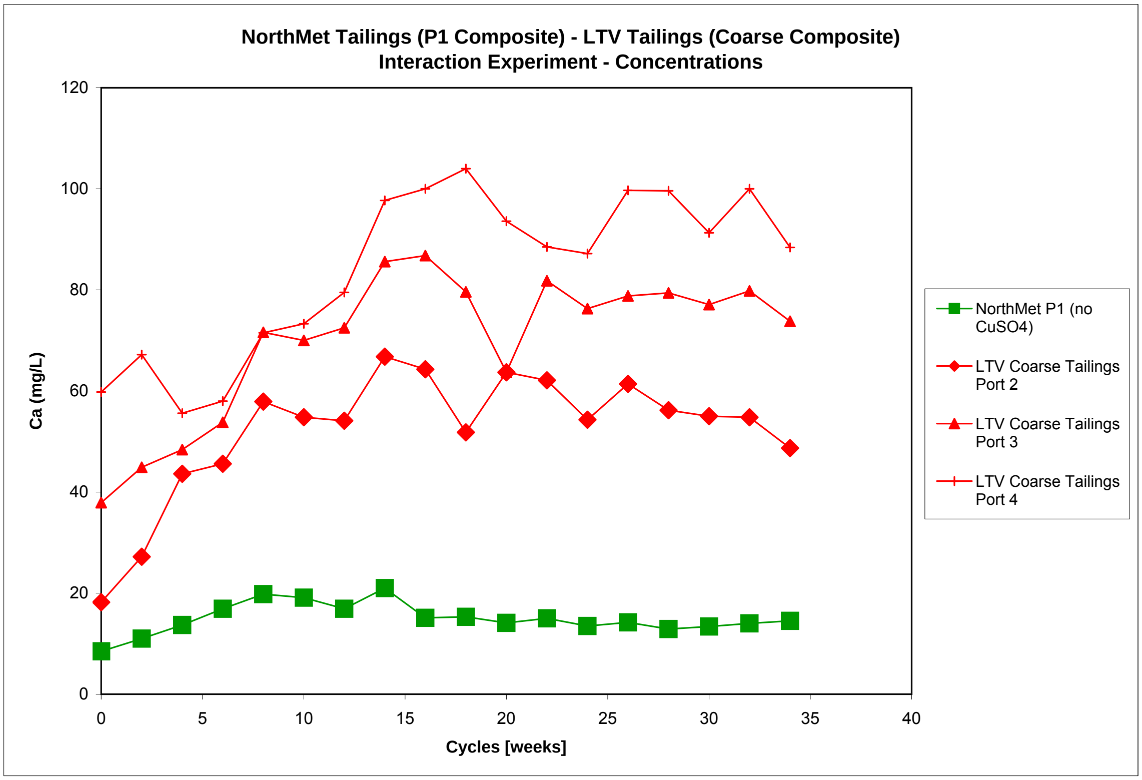
NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations


NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
SO4 (mg/L)
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
As (mg/L)
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

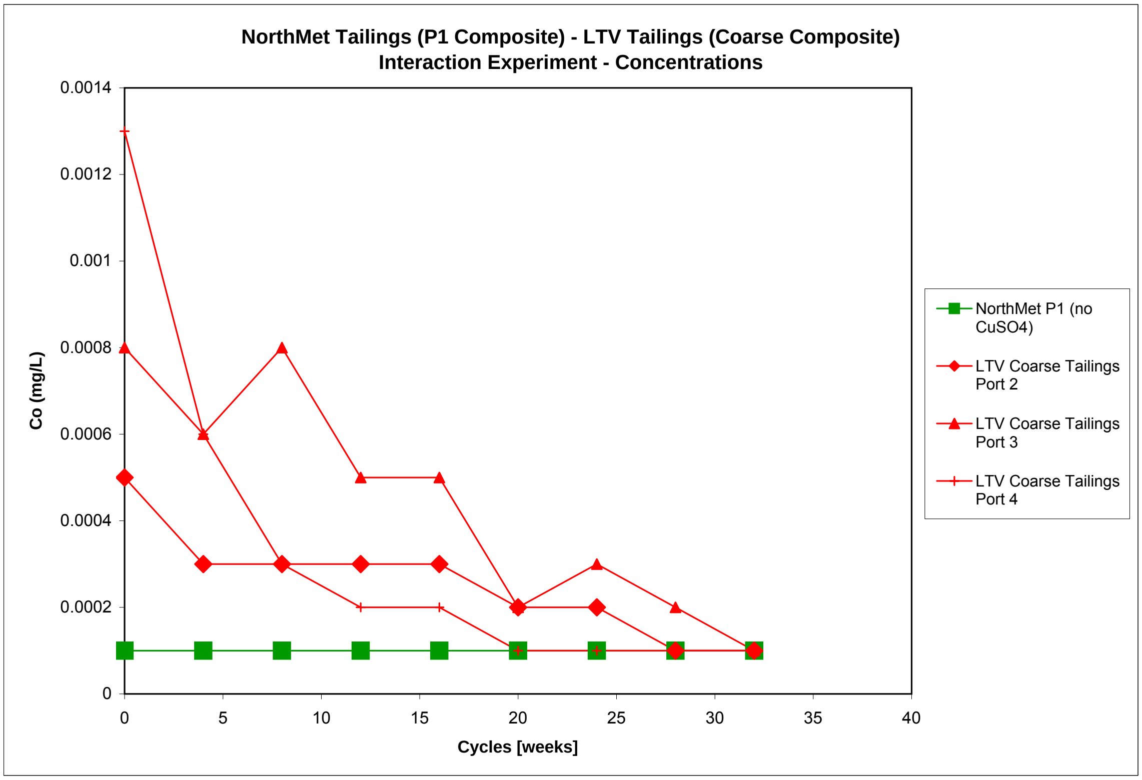
Appendix C.3
LTVSMC Contact Experiment

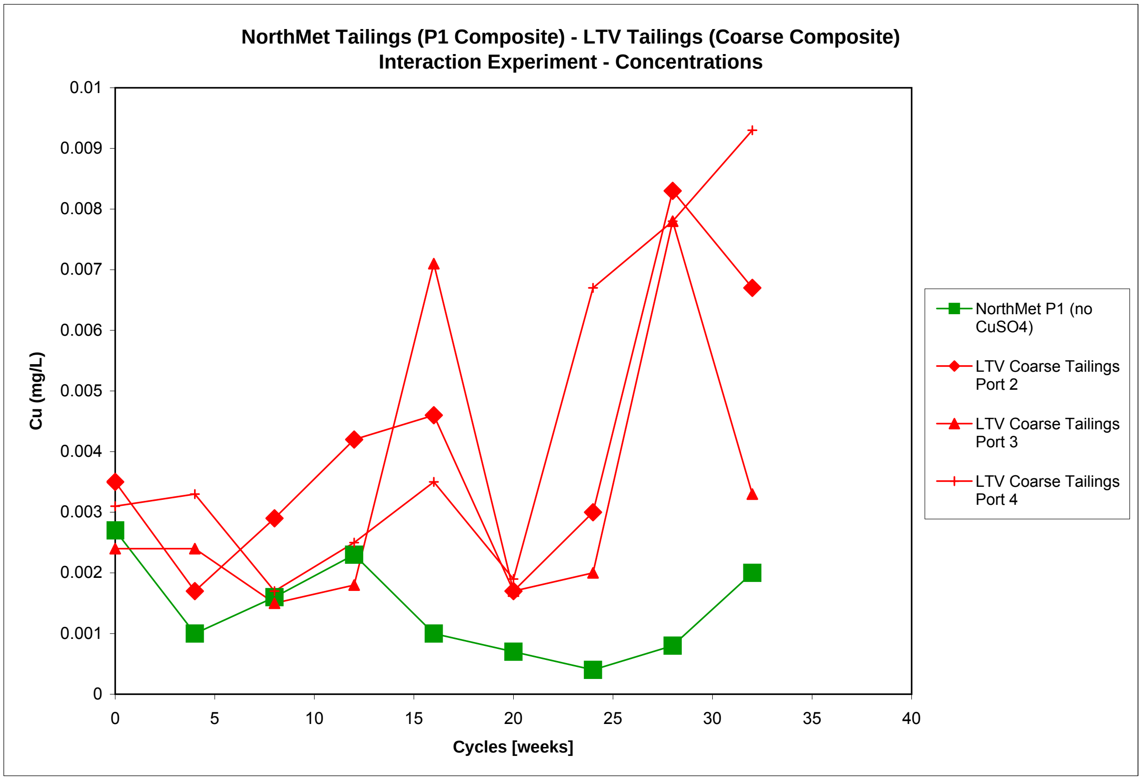
Graph C.3.43

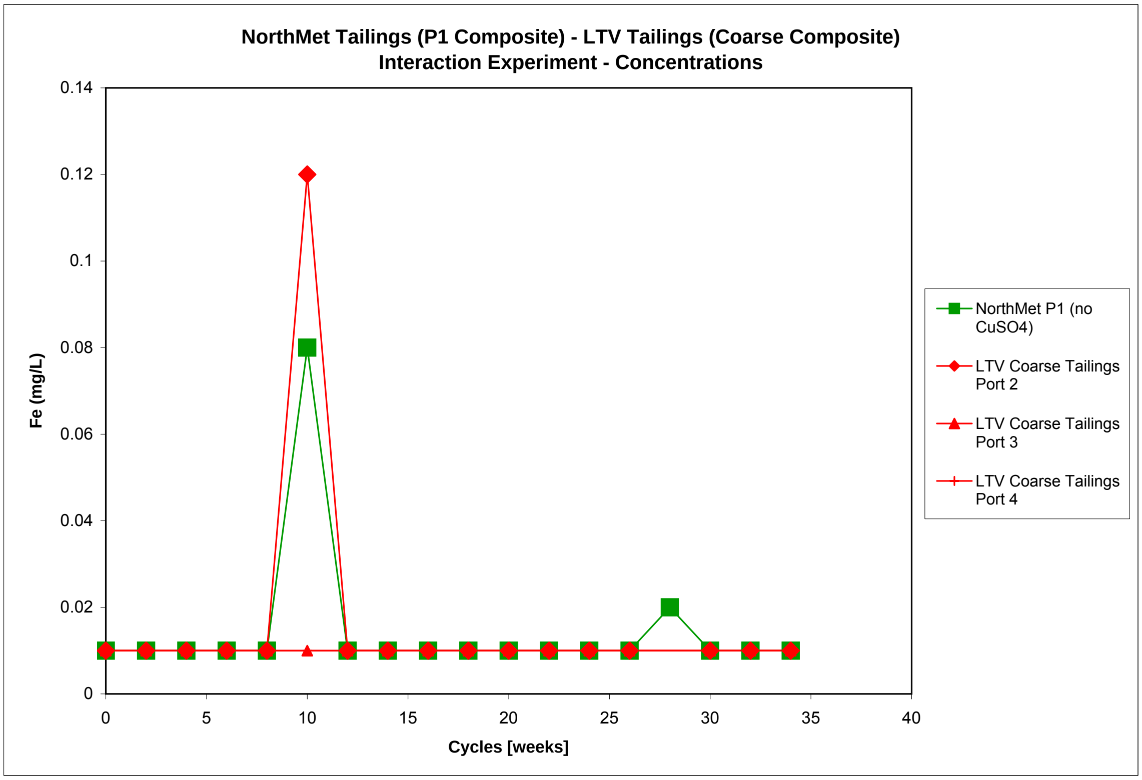


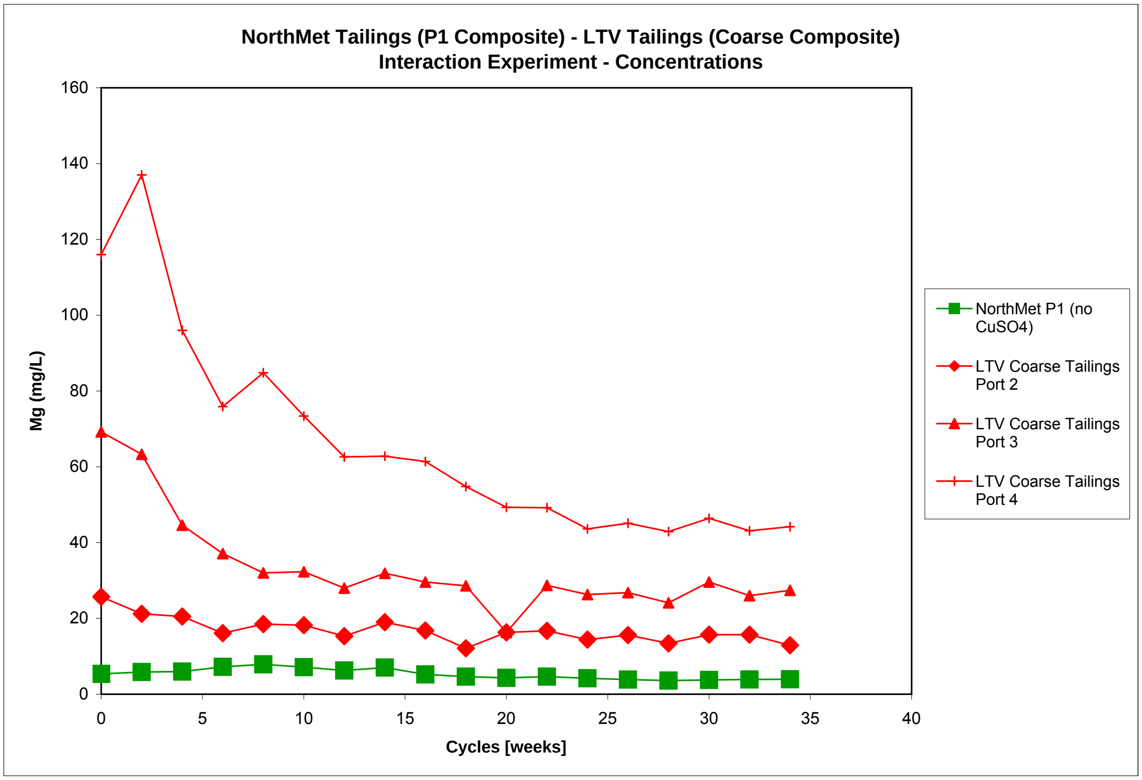
Appendix C.3
LTVSMC Contact Experiment

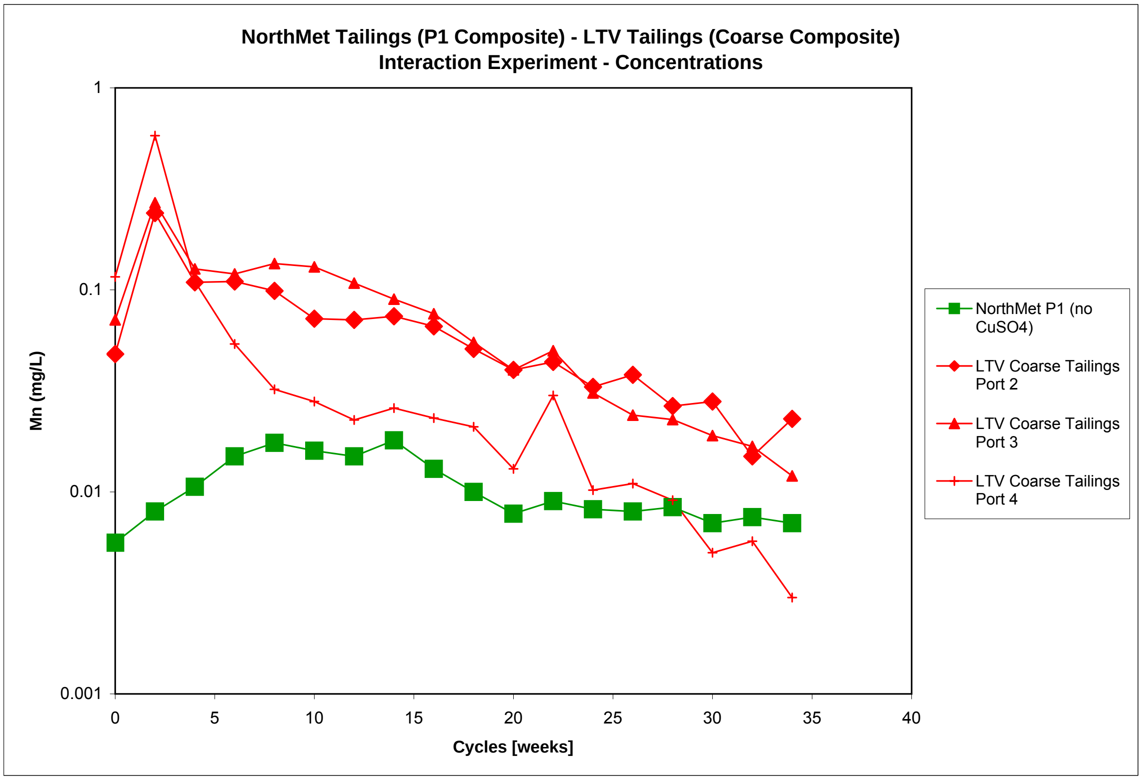
Graph C.3.44




NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Cu (mg/L)
0
0.001
0.002
0.003
0.004
0.005
0.006
0.007
0.008
0.009
0.01
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

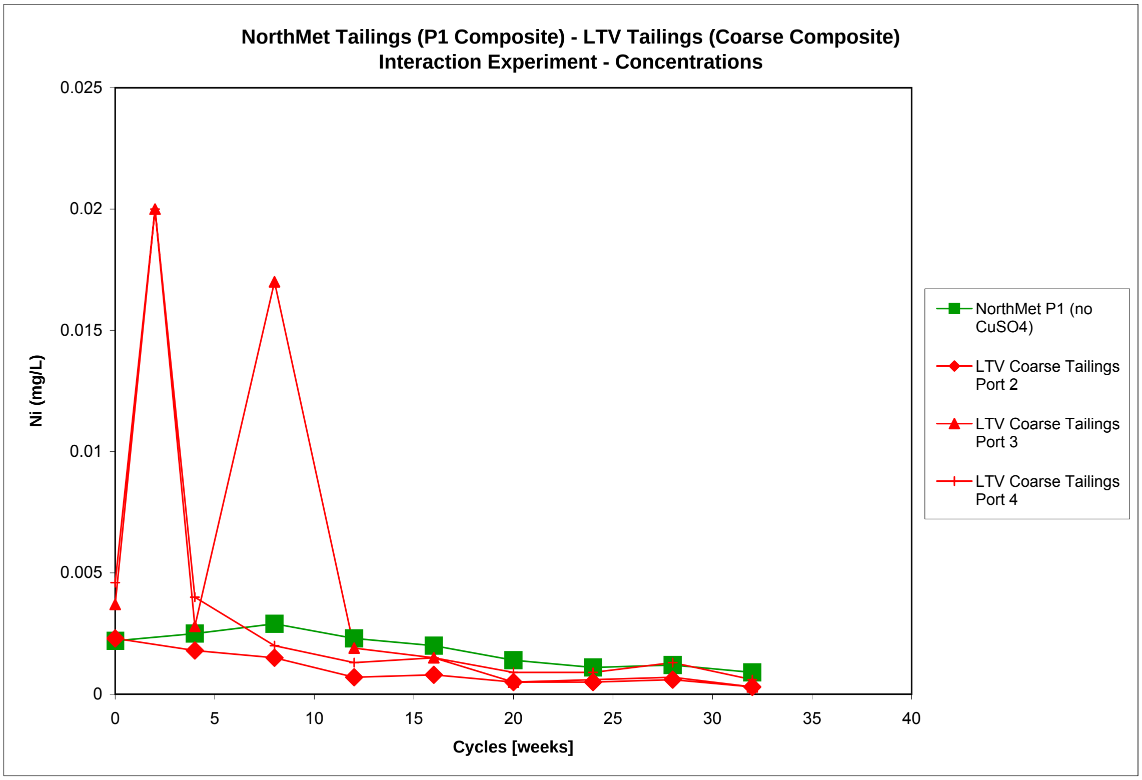

NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Fe (mg/L)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Mg (mg/L)
0
20
40
60
80
100
120
140
160
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Mn (mg/L)
0.001
0.01
0.1
1
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

Appendix C.3
LTVSMC Contact Experiment

Graph C.3.49



LTV_combined.xls

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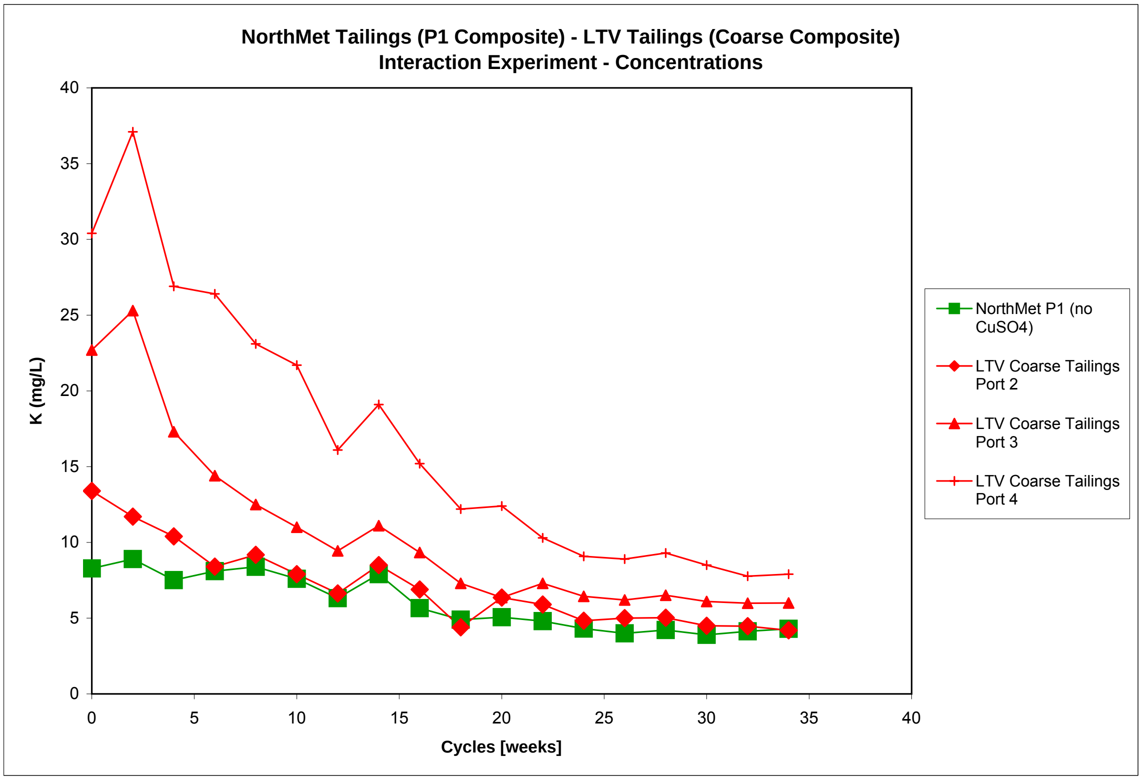
Appendix C.3
LTVSMC Contact Experiment

Graph C.3.50



LTV_combined.xls

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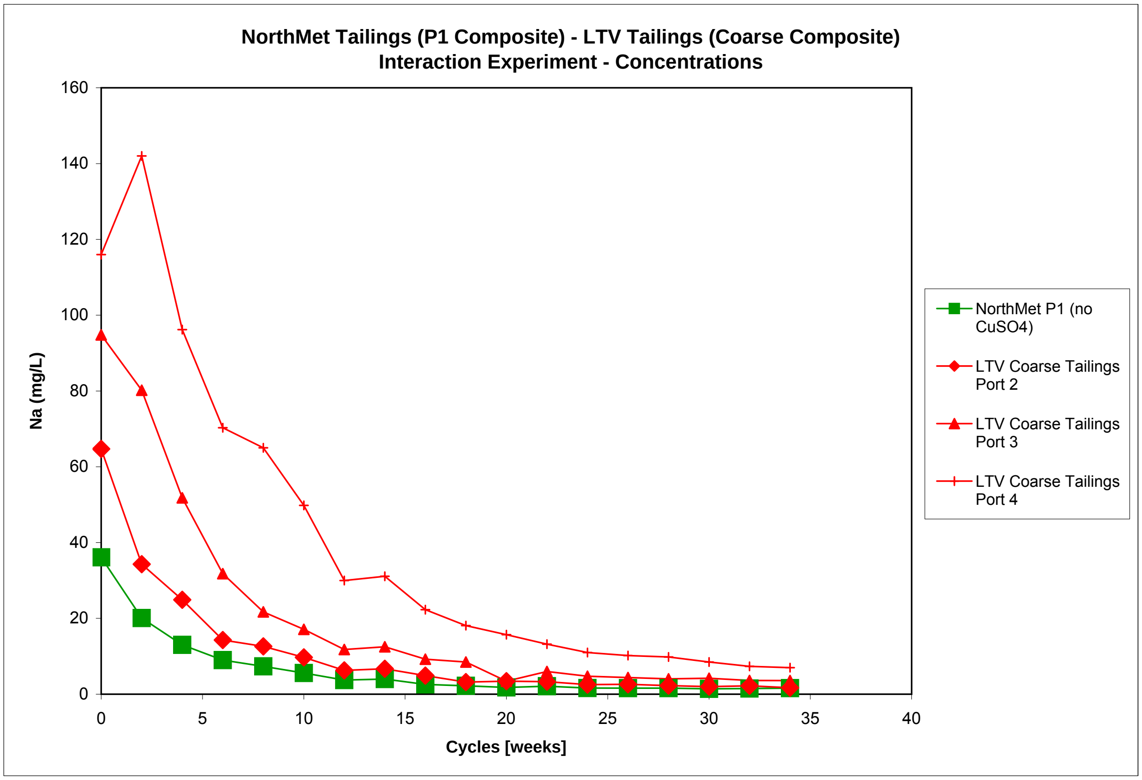
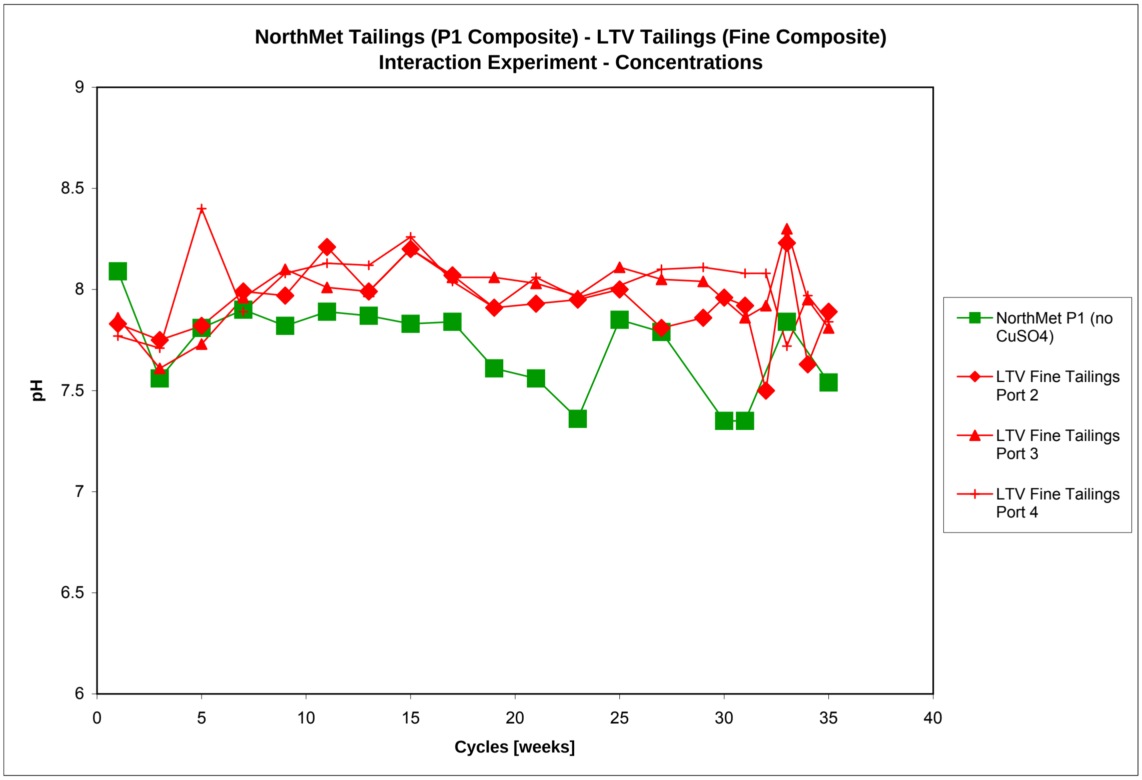
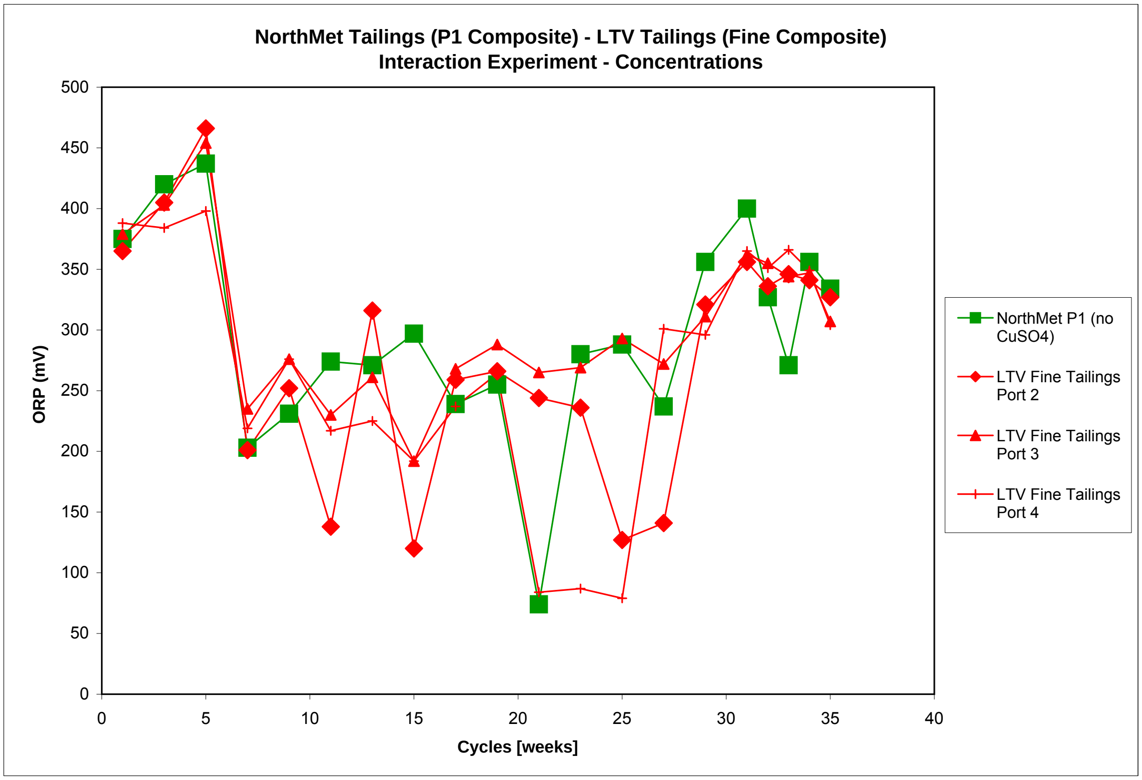
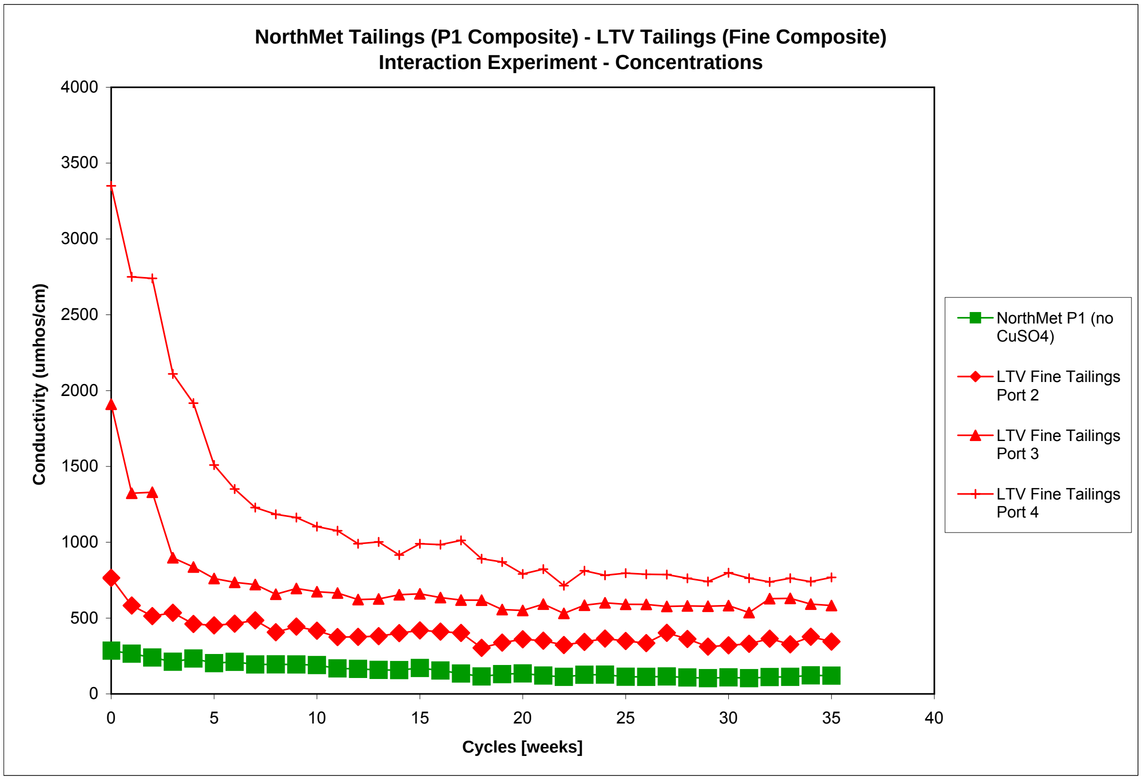

NorthMet Tailings (P1 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Na (mg/L)
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

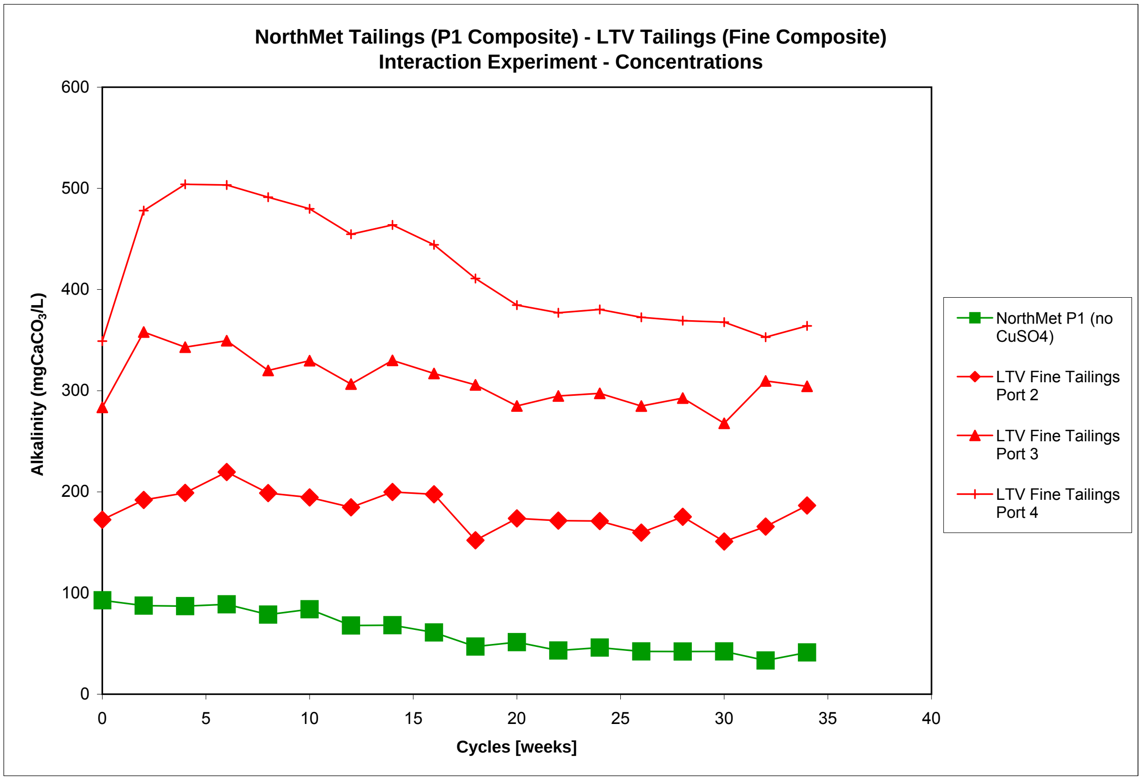

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
pH
9
8.5
8
7.5
7
6.5
6
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

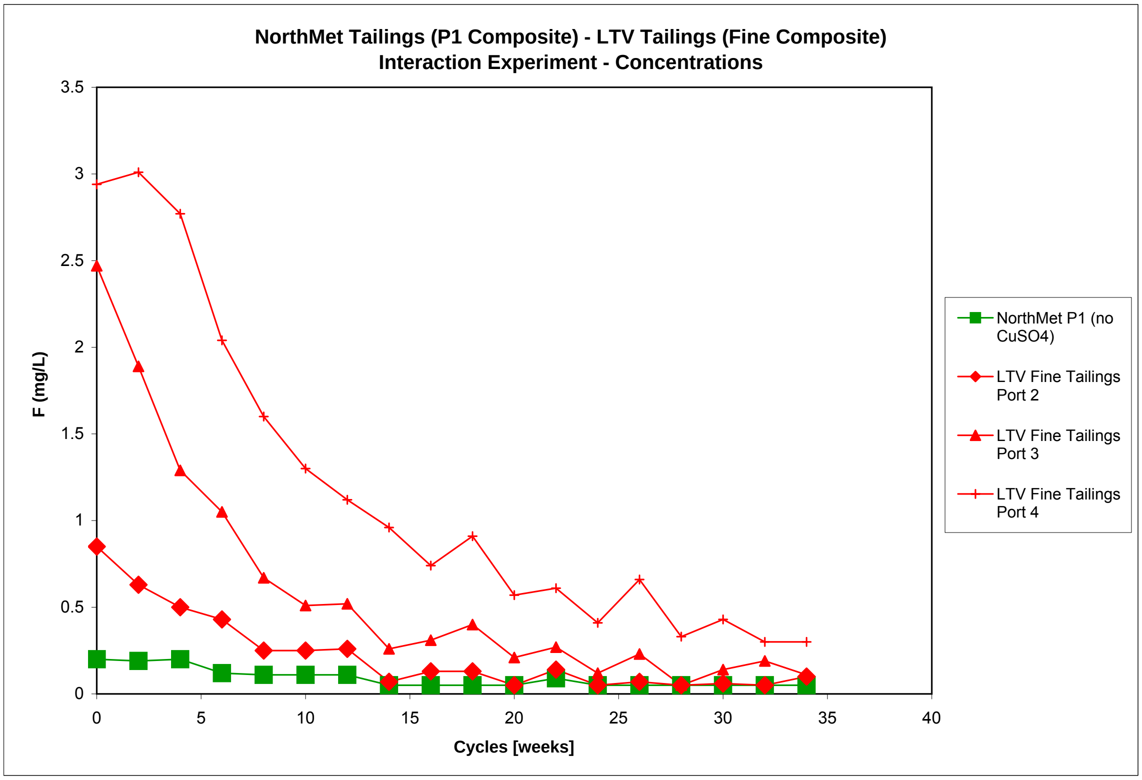
Graph C.3.53



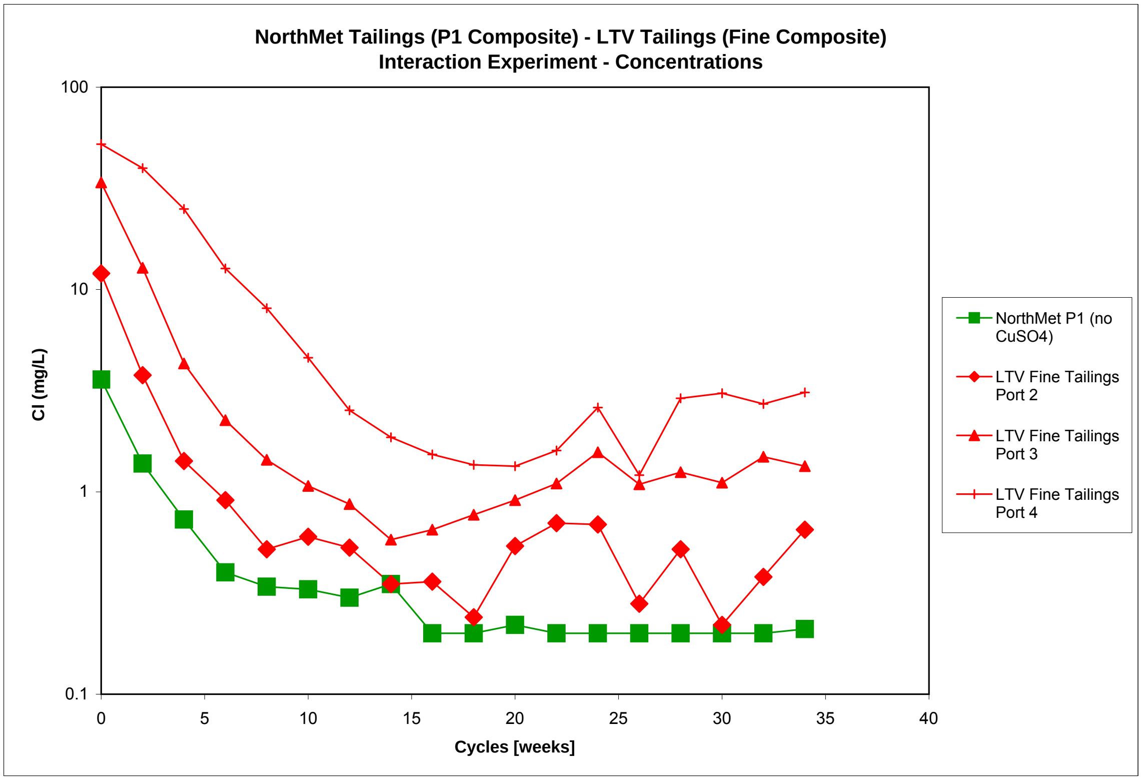
Graph C.3.54



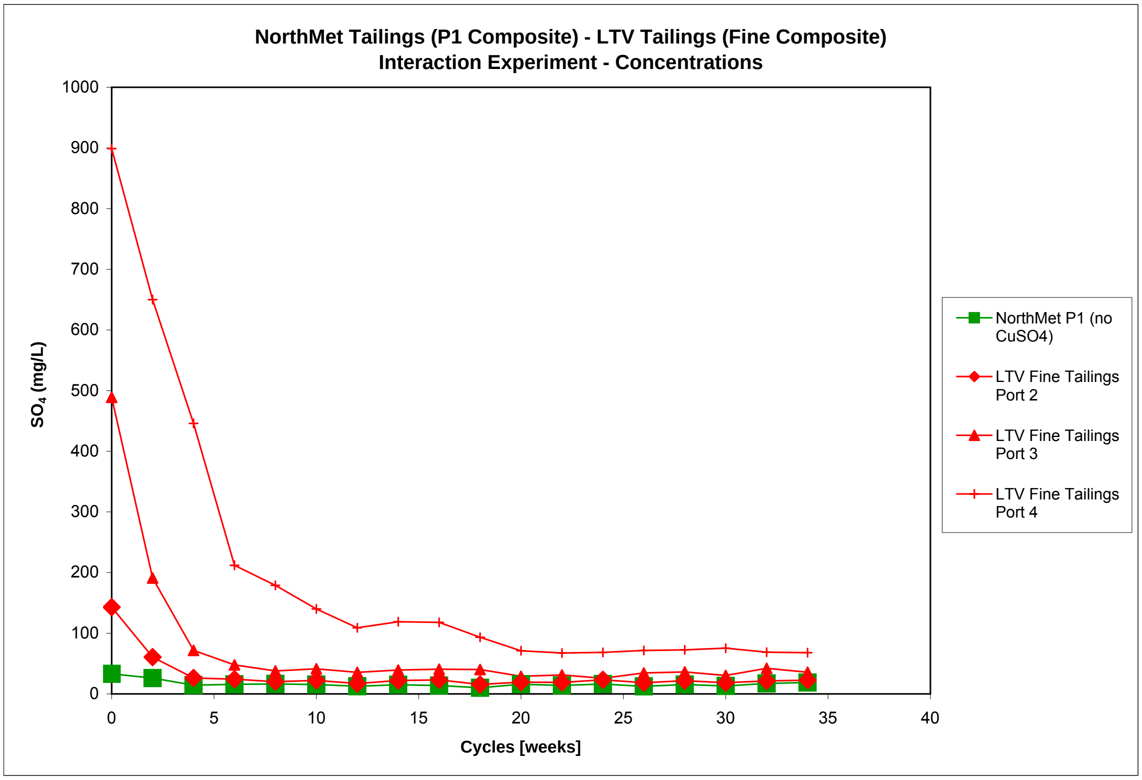

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Alkalinity (mgCaCO3/L)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

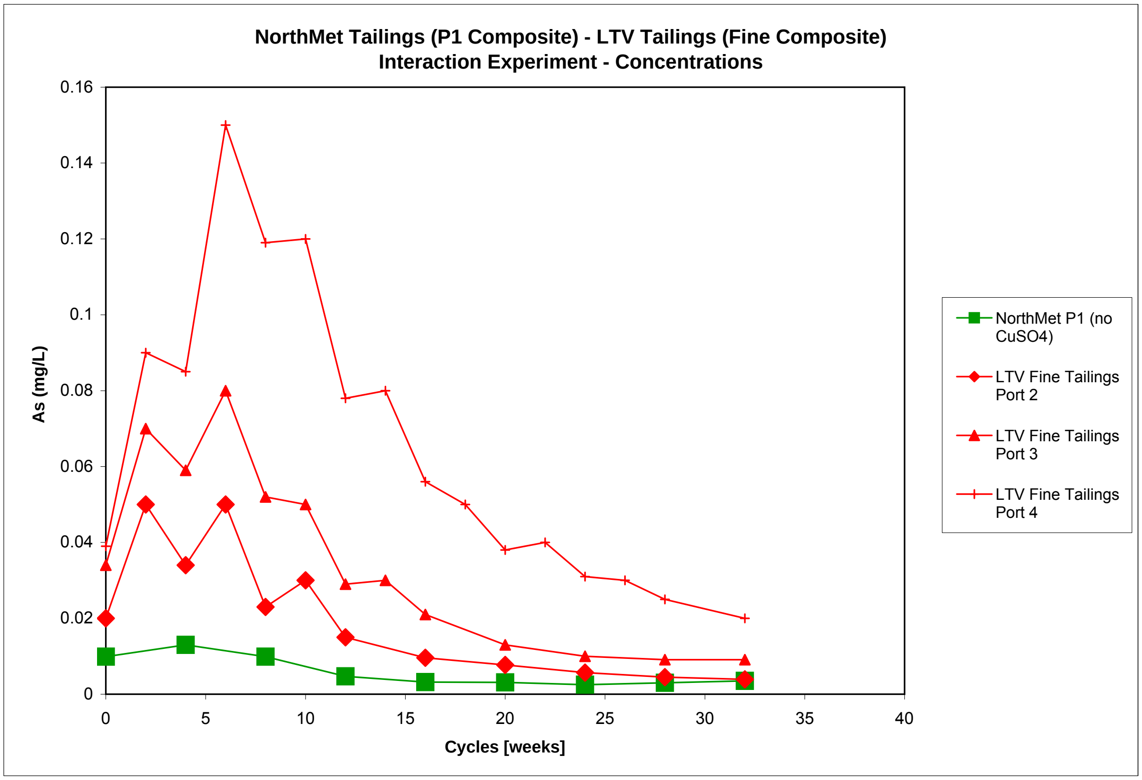

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
F (mg/L)
3.5
3
2.5
2
1.5
1
0.5
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

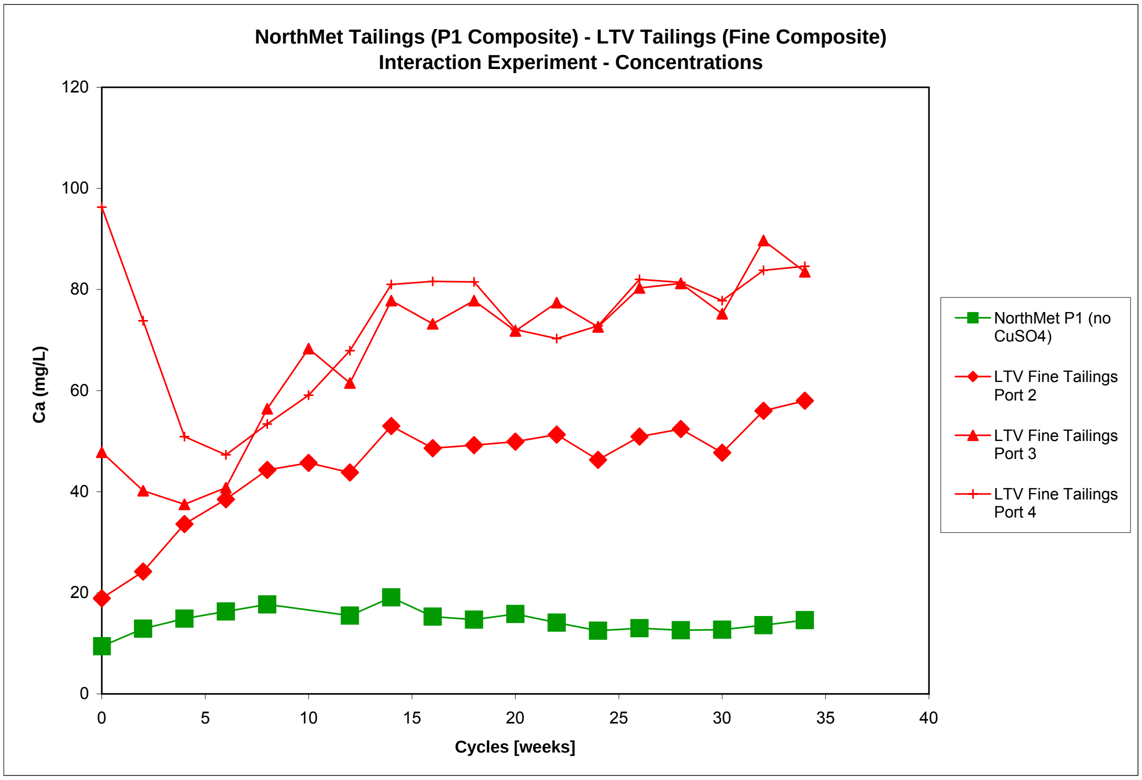
Graph C.3.57

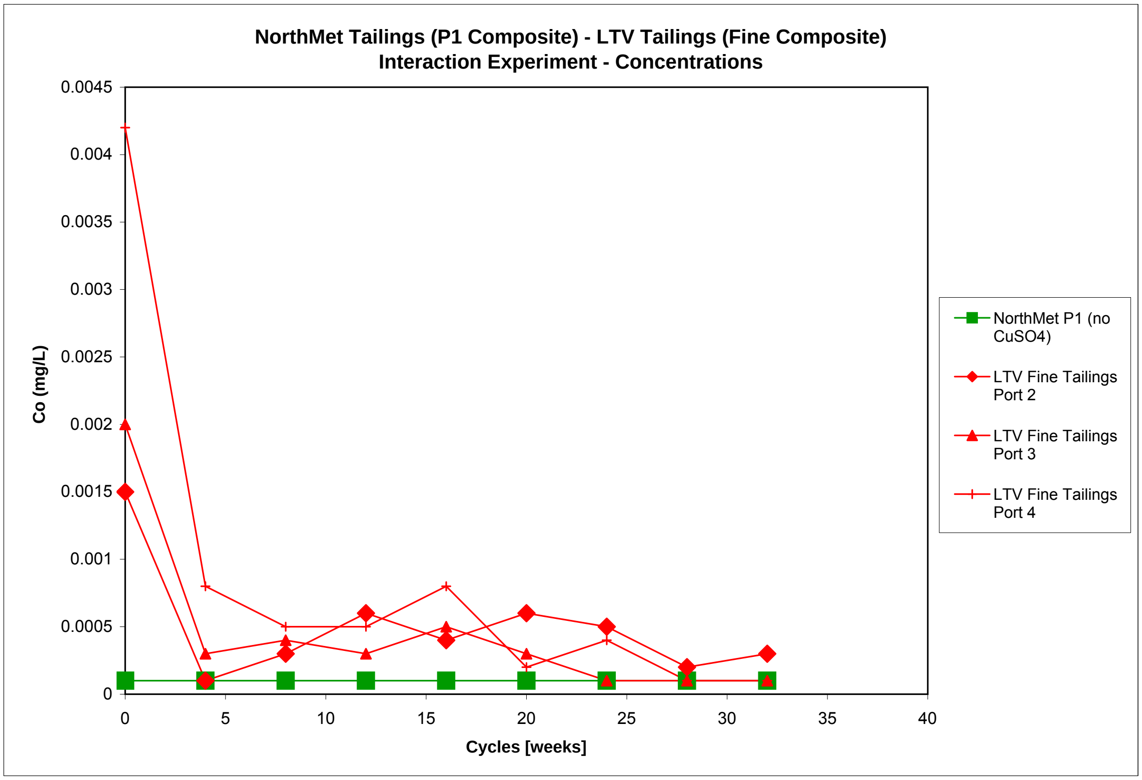


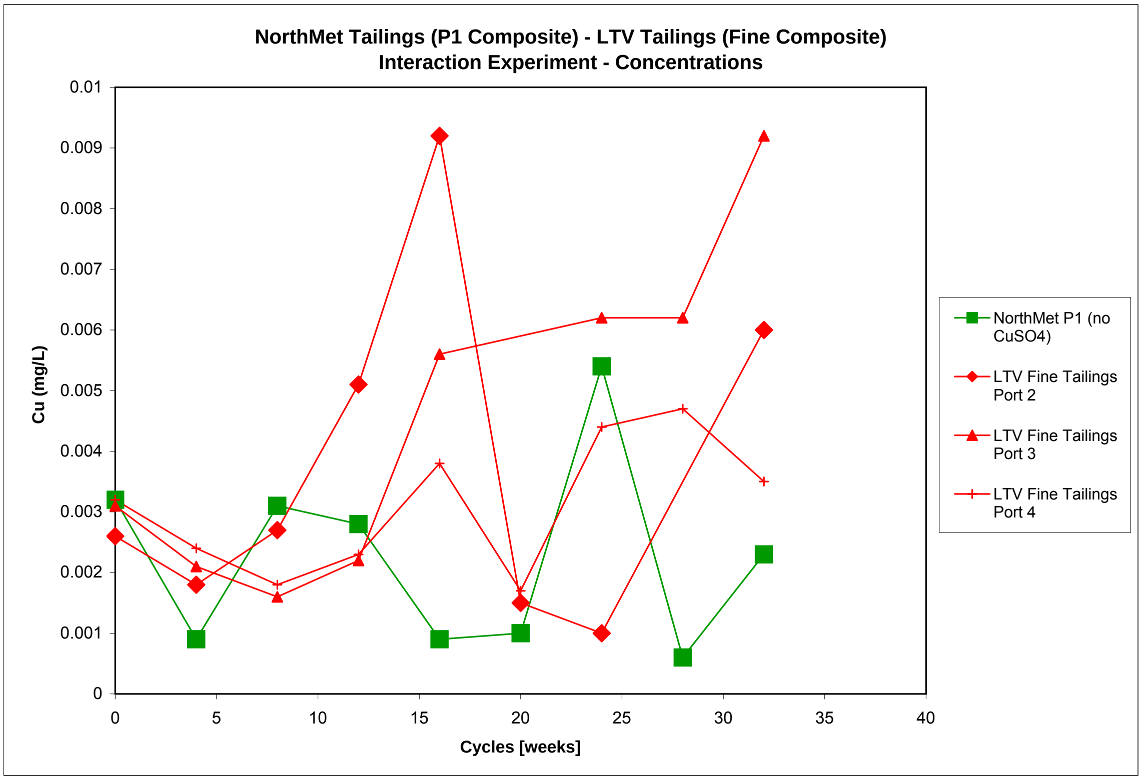
Graph C.3.58

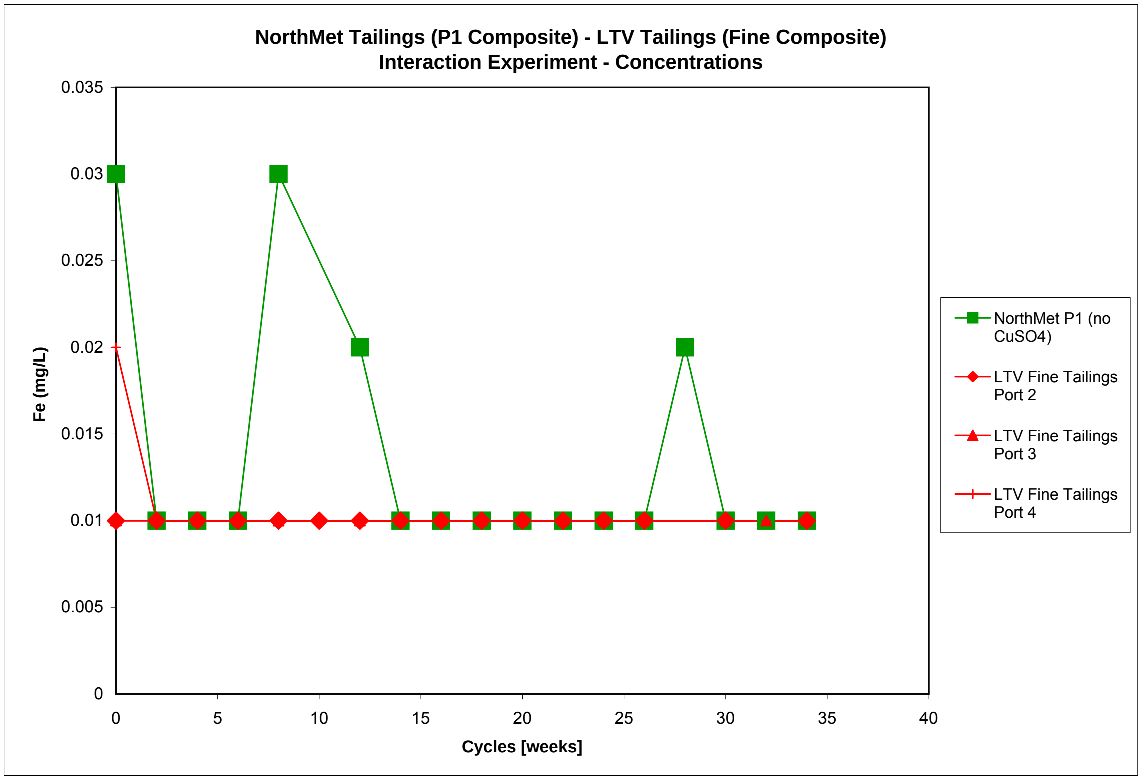


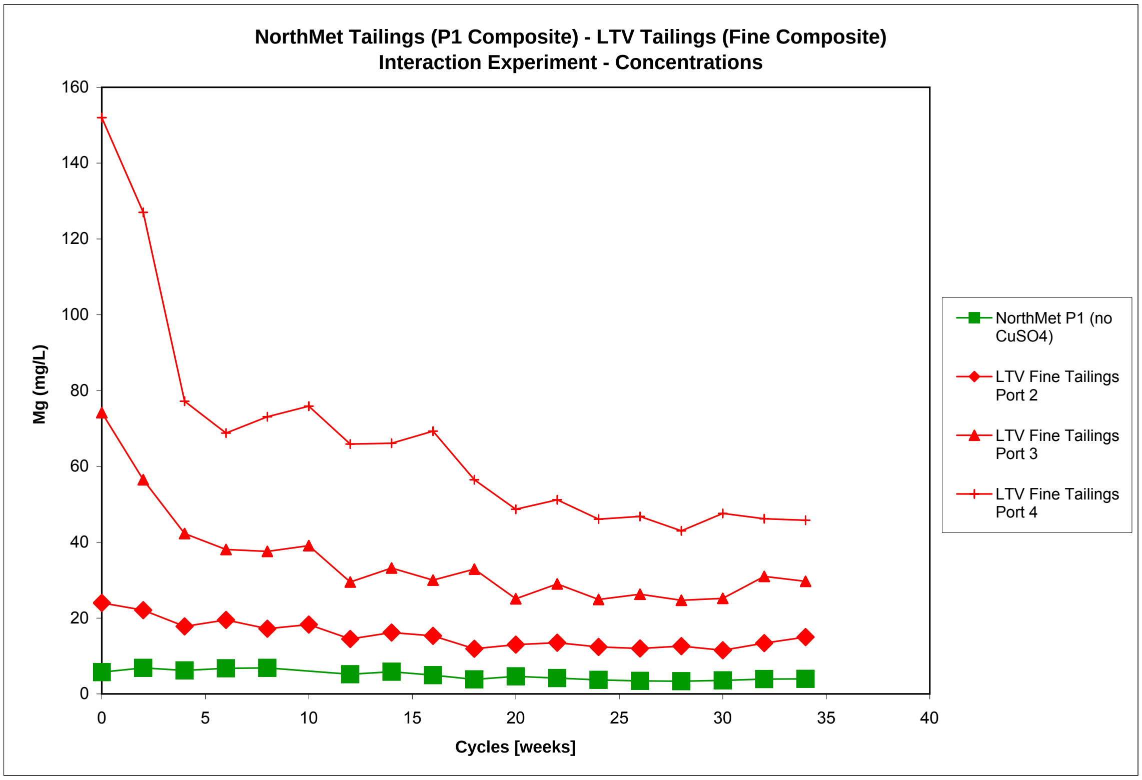

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations


NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

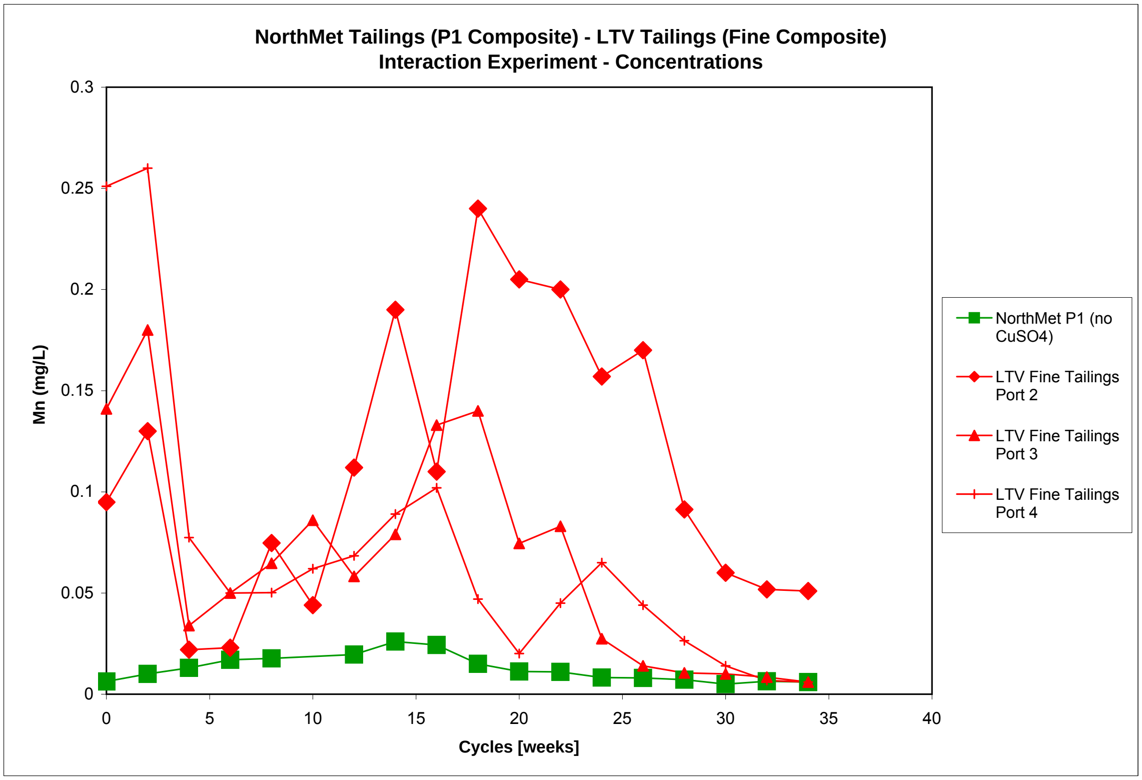

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations


NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

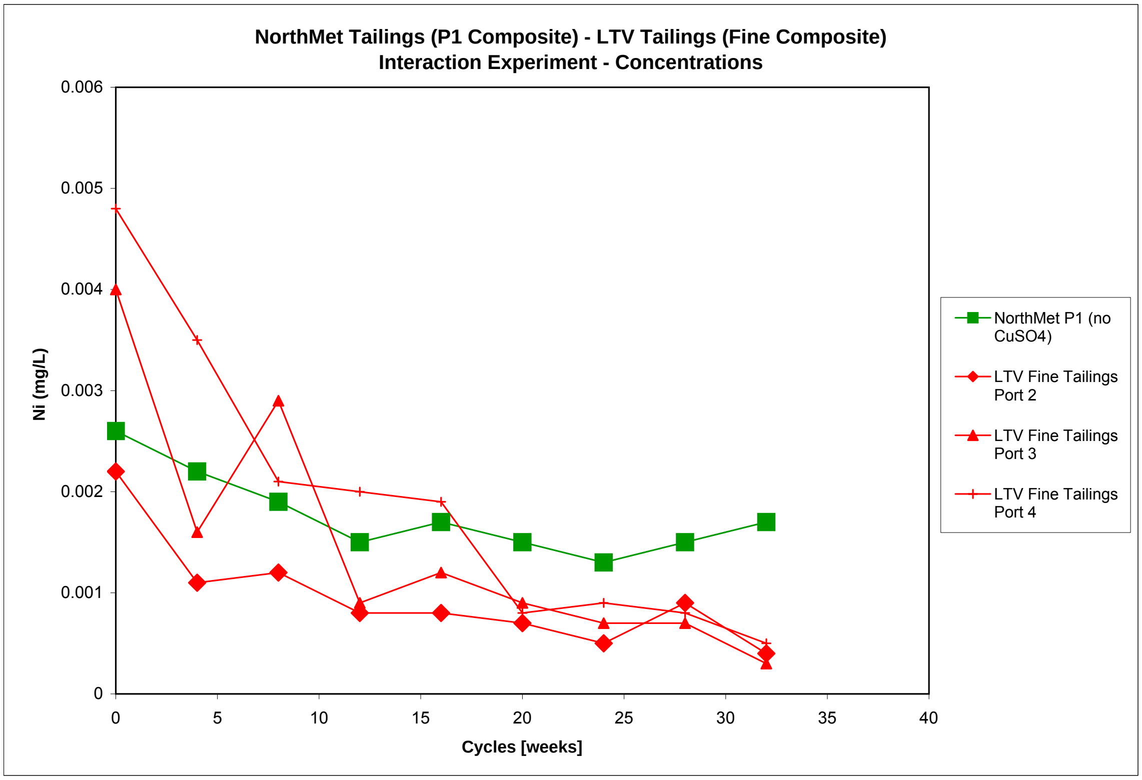

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Fe (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

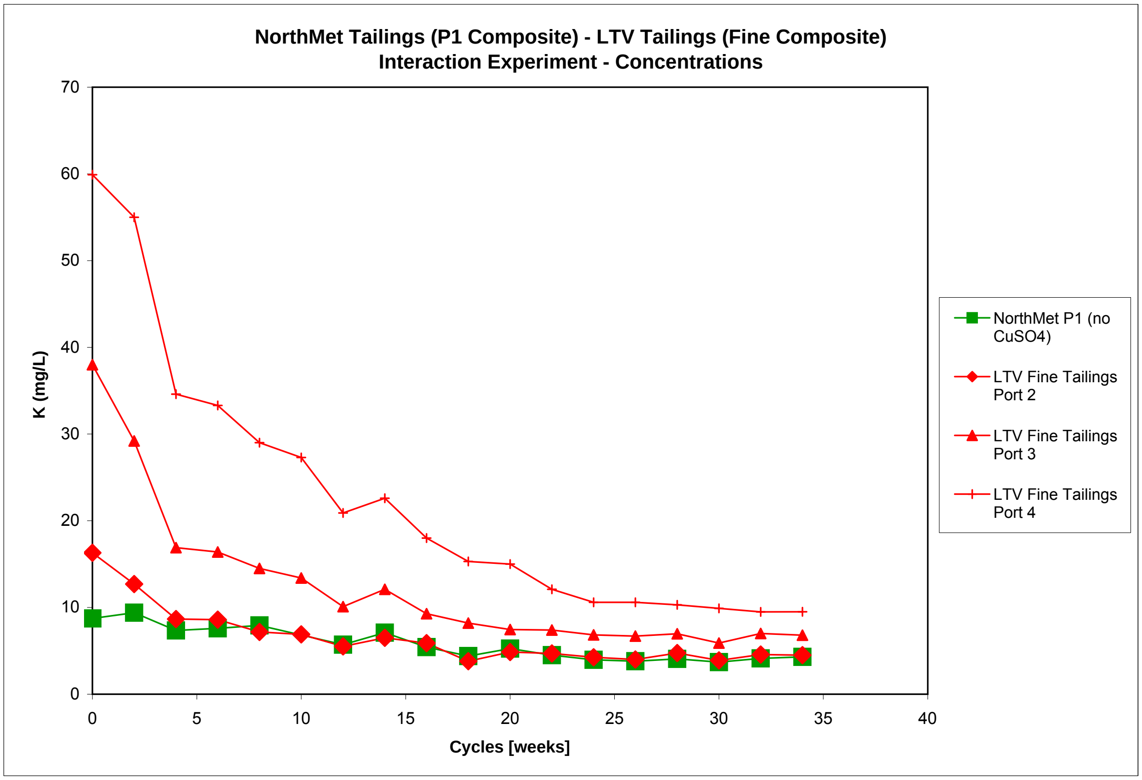

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Mg (mg/L)
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

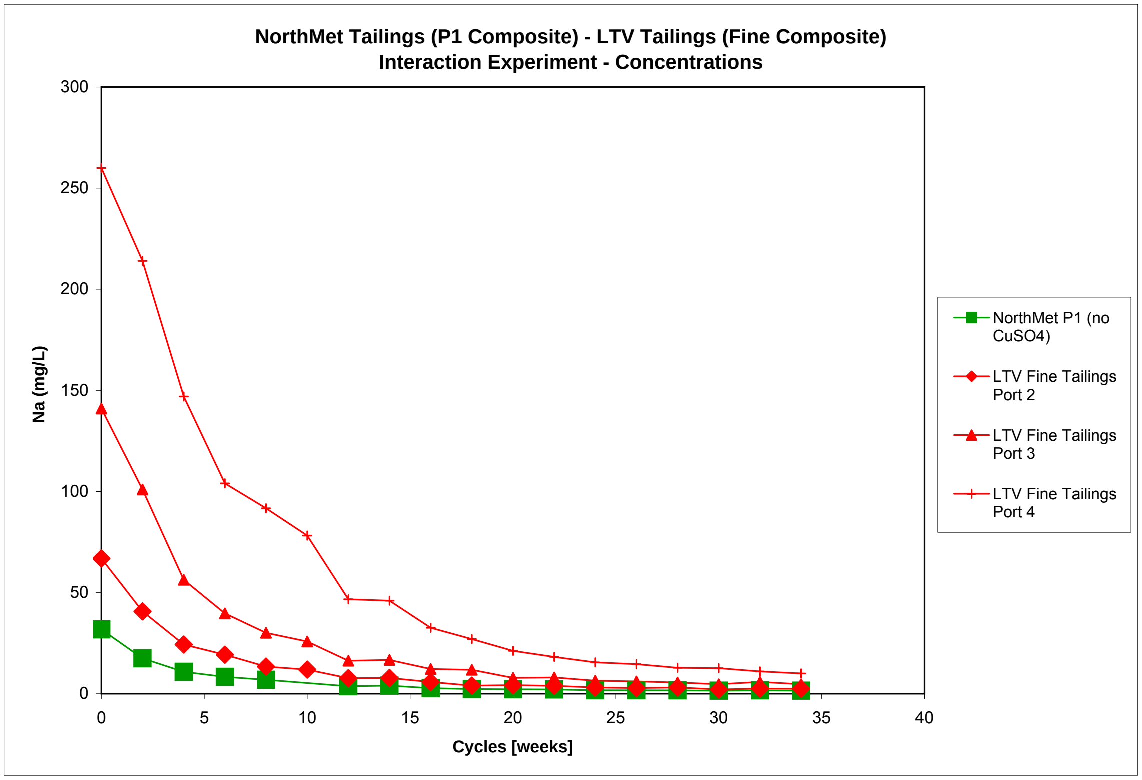
Graph C.3.65

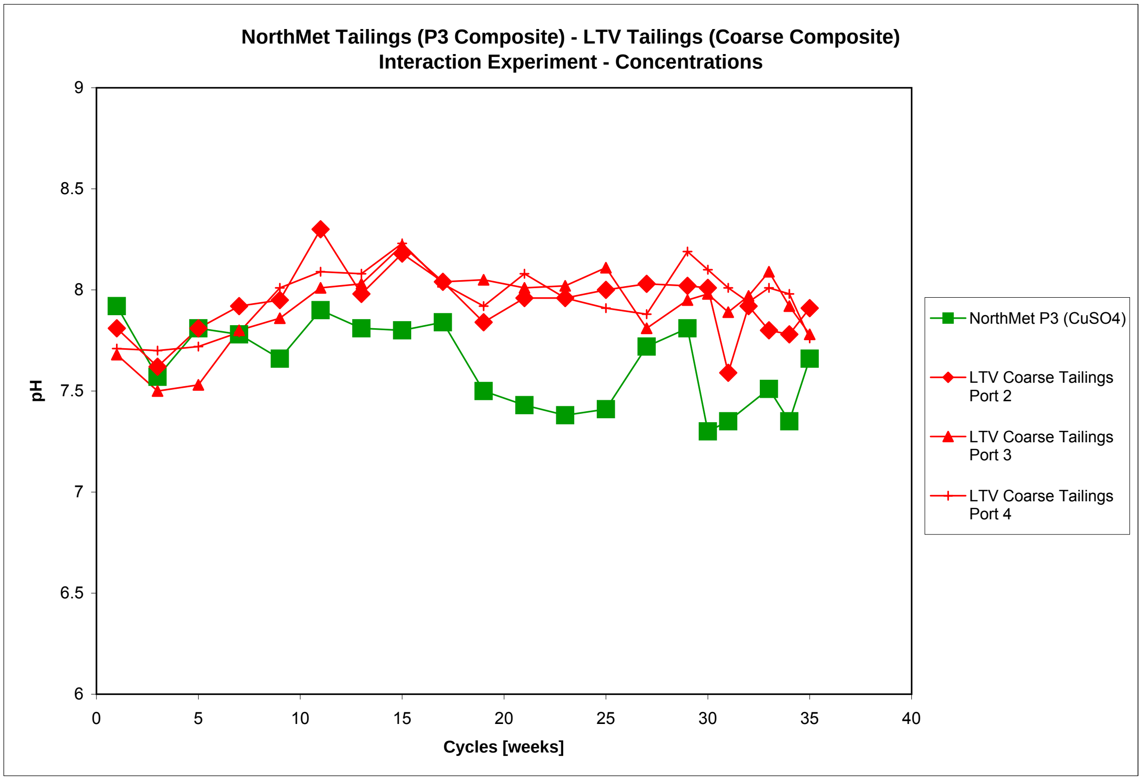

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

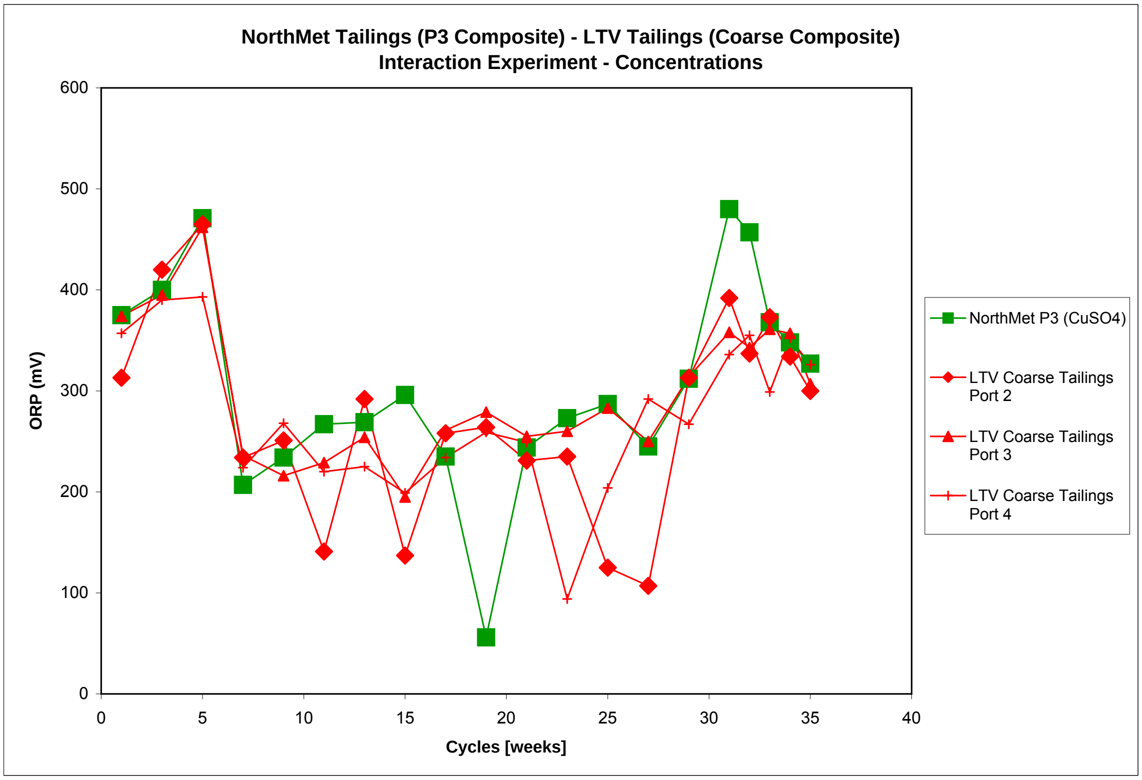
Graph C.3.66

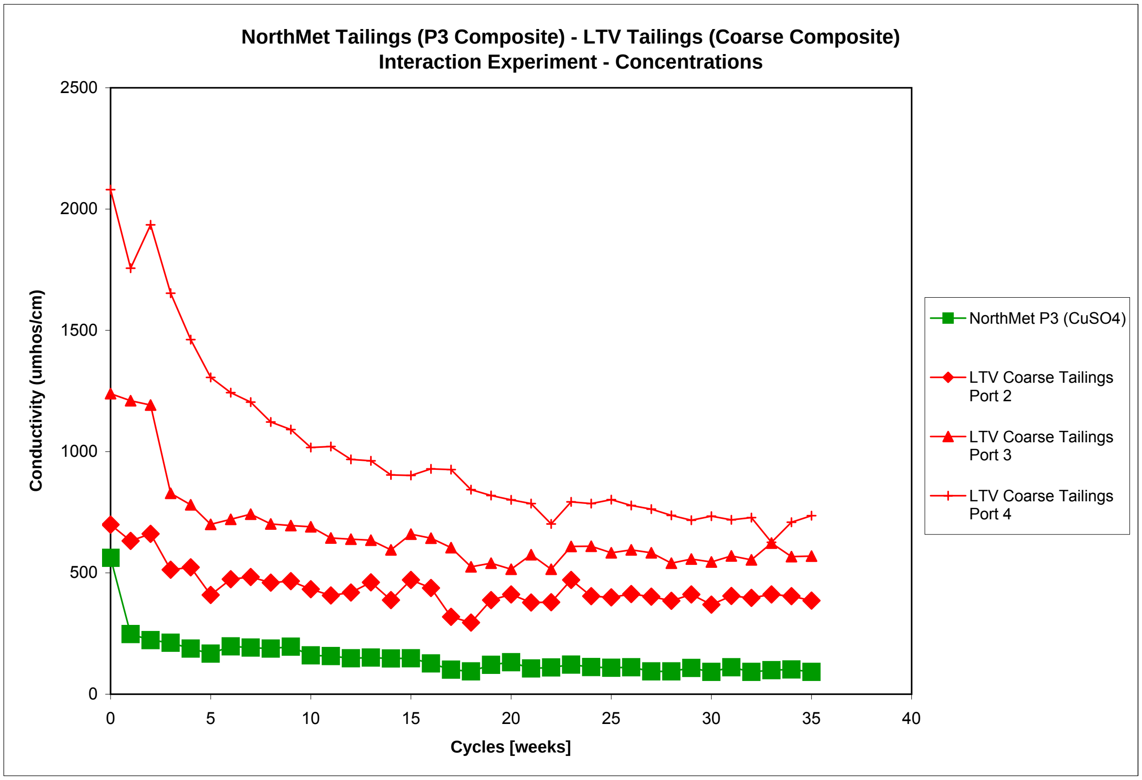

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

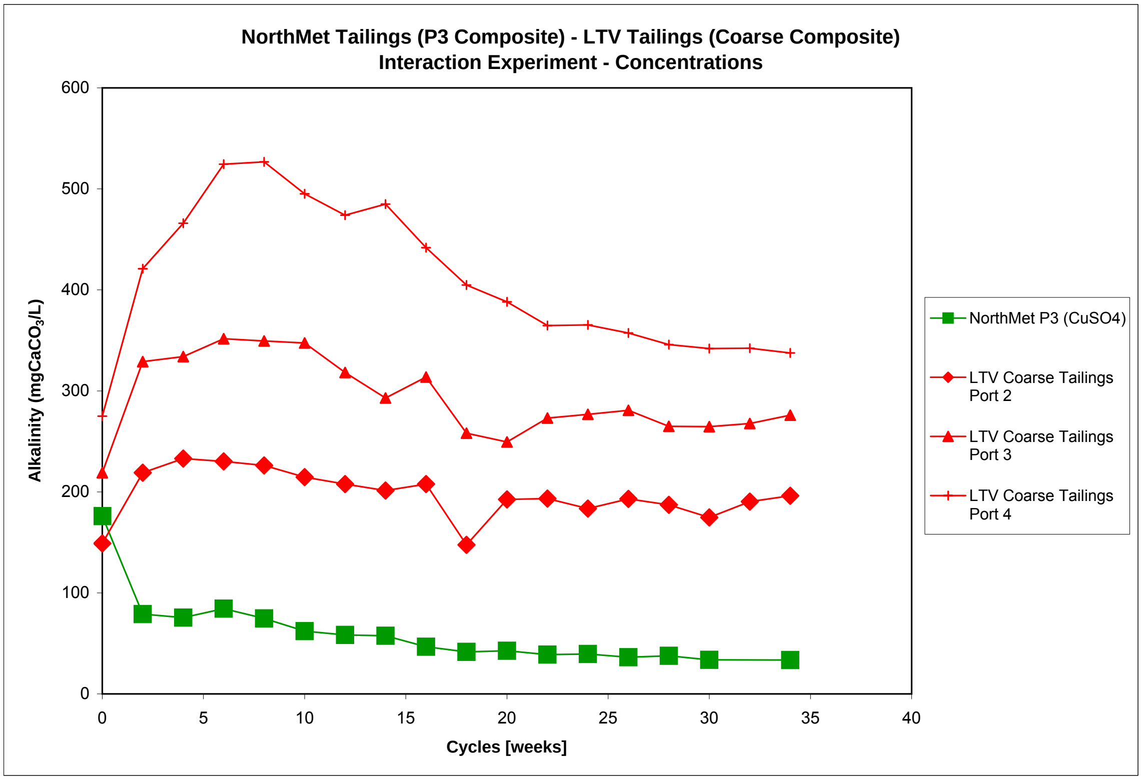

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
K (mg/L)
0
10
20
30
40
50
60
70
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

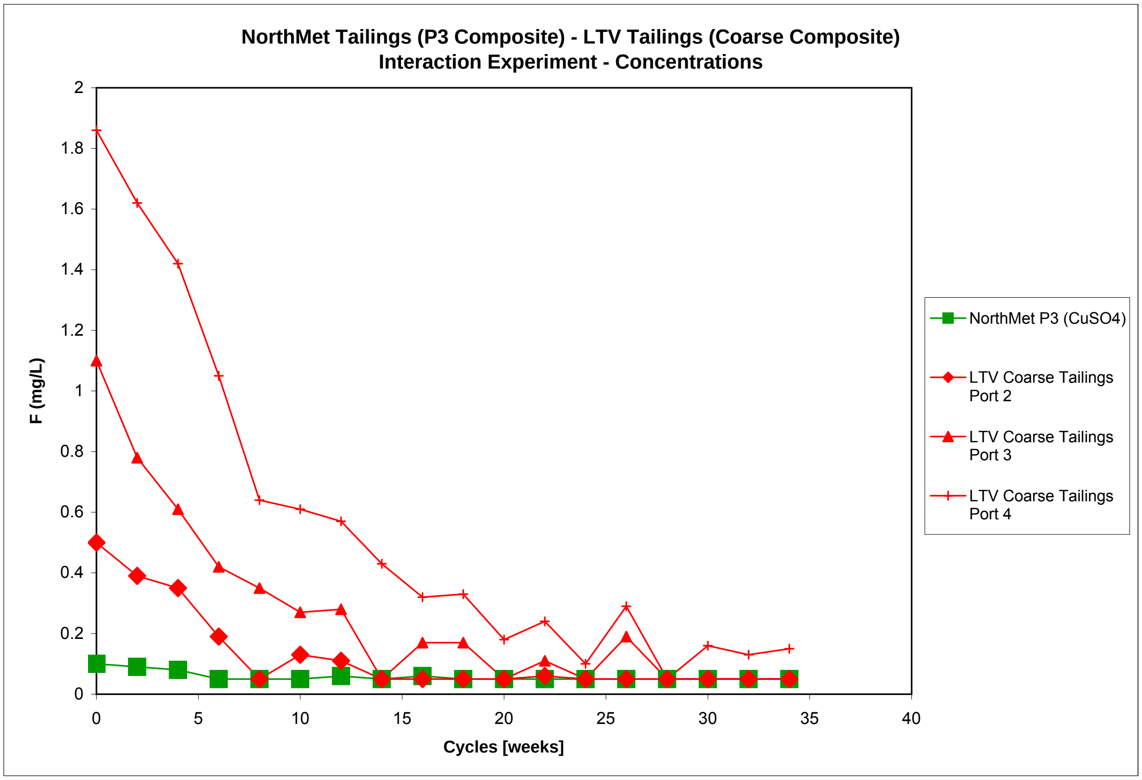

NorthMet Tailings (P1 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Na (mg/L)
0
50
100
150
200
250
300
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P1 (no CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 4

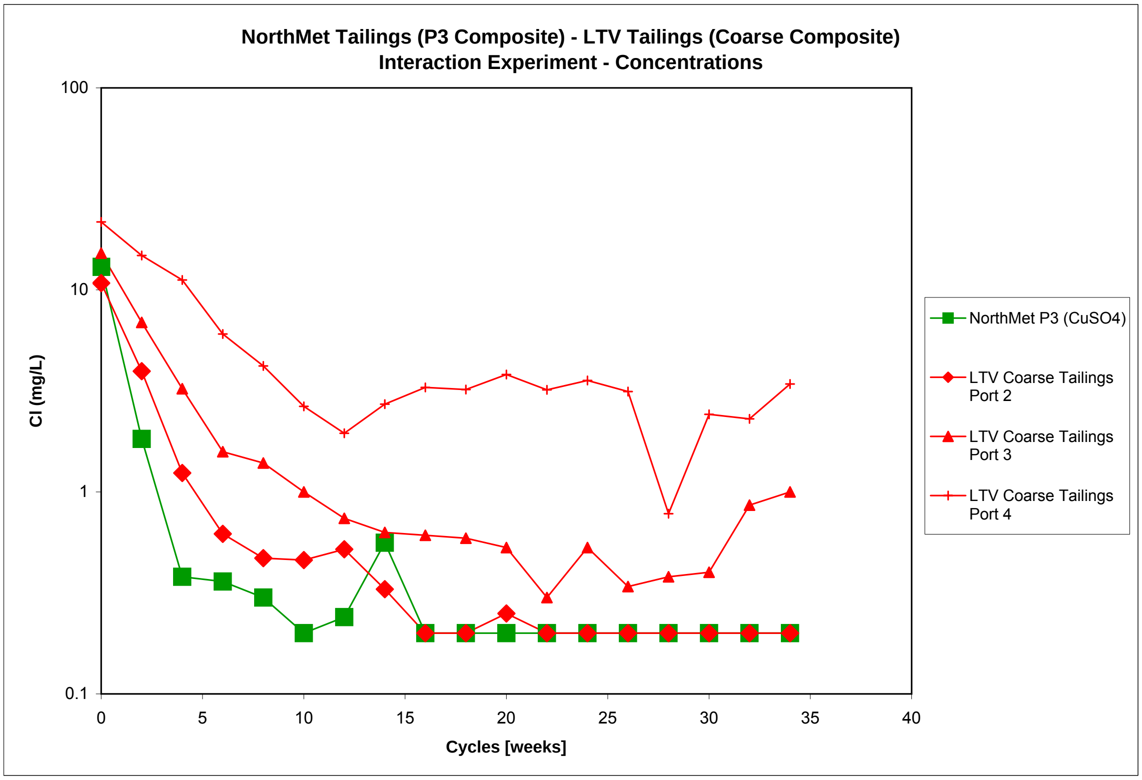

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
pH
9
8.5
8
7.5
7
6.5
6
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

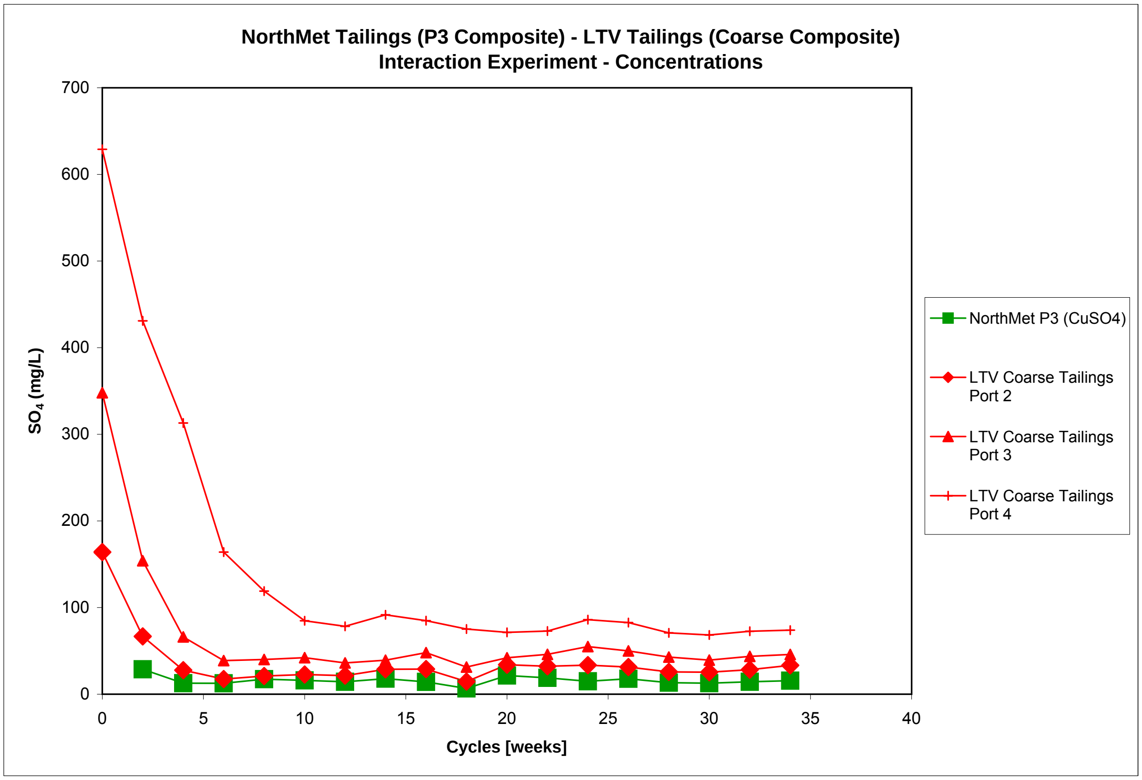

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
ORP (mV)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

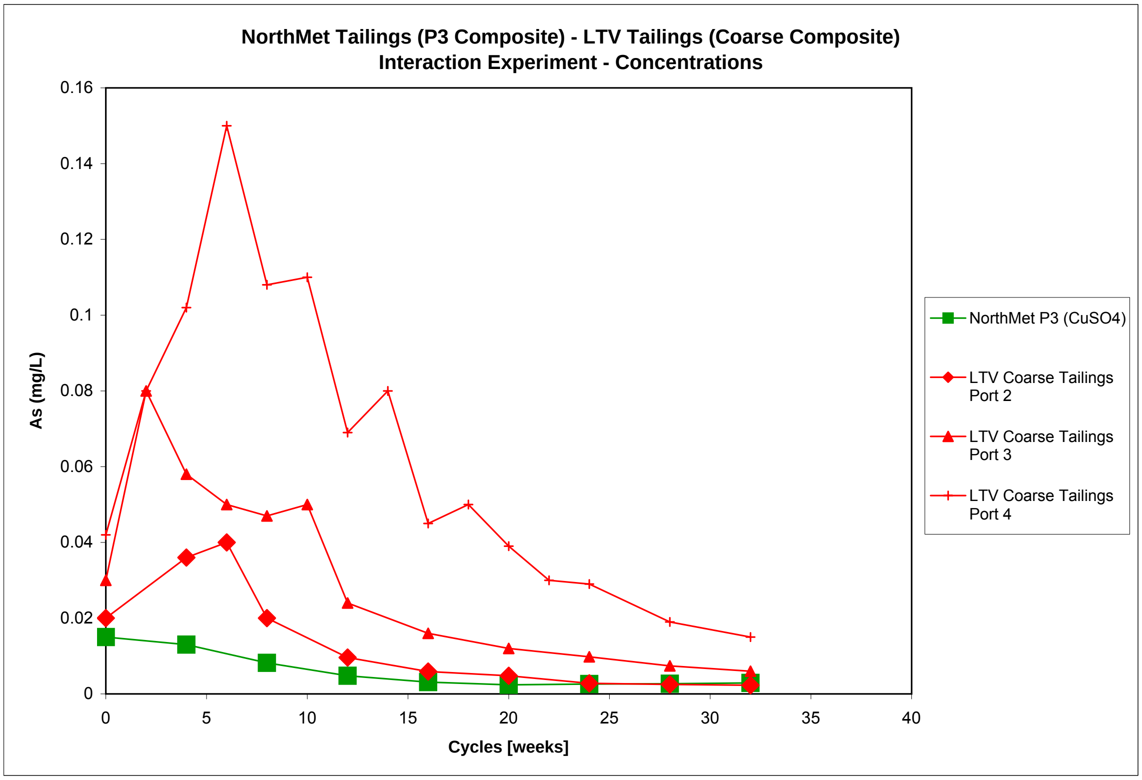

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Conductivity (umhos/cm)
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Alkalinity (mgCaCO3/L)
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

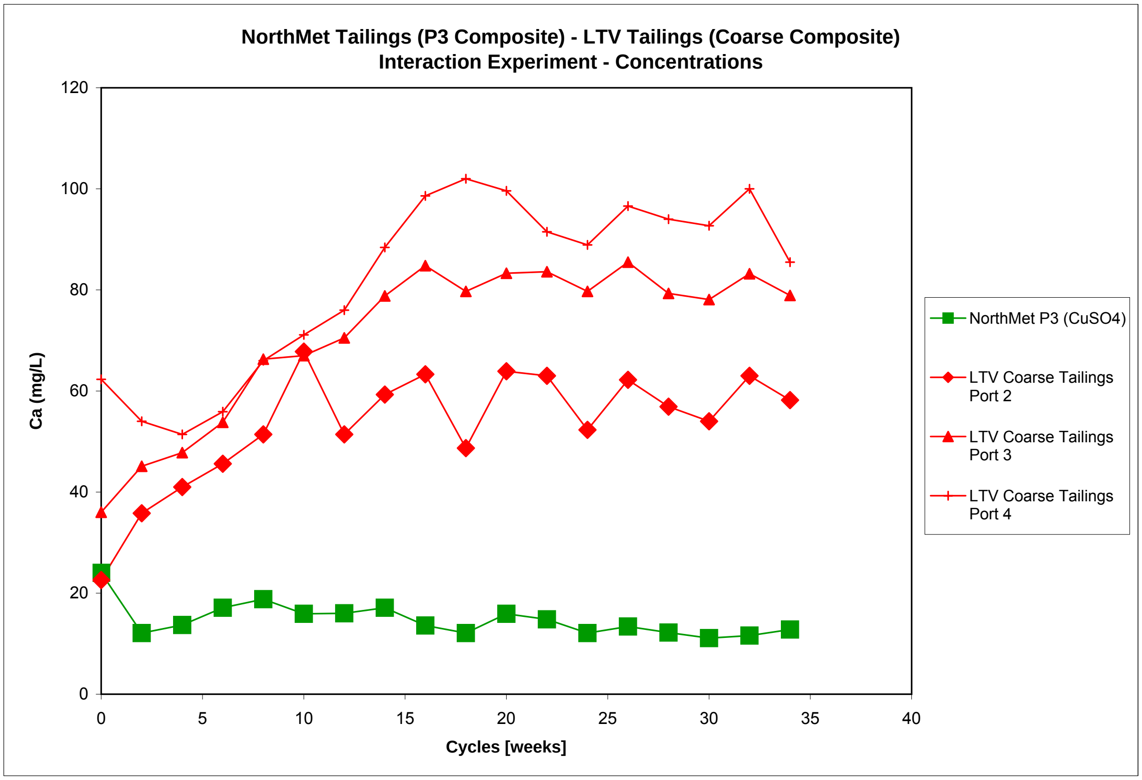

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
F (mg/L)
2
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Cl (mg/L)
100
10
1
0.1
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

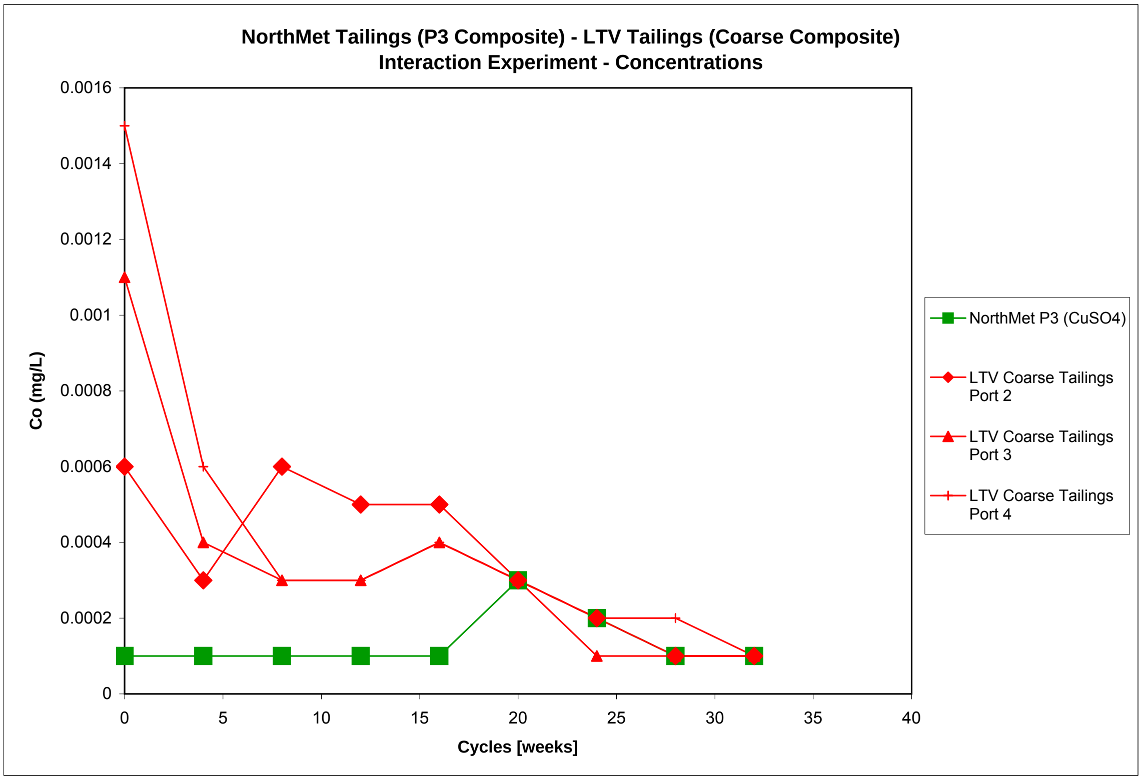

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
SO4 (mg/L)
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

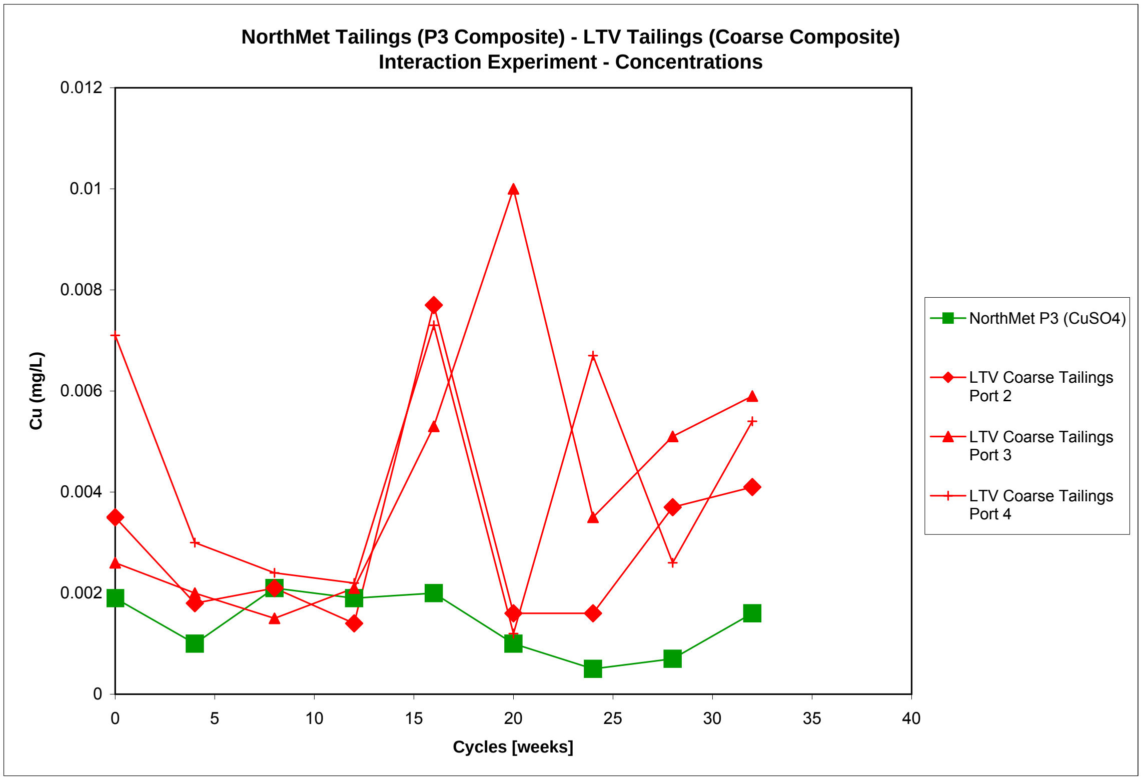

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
As (mg/L)
0.16
0.14
0.12
0.1
0.08
0.06
0.04
0.02
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

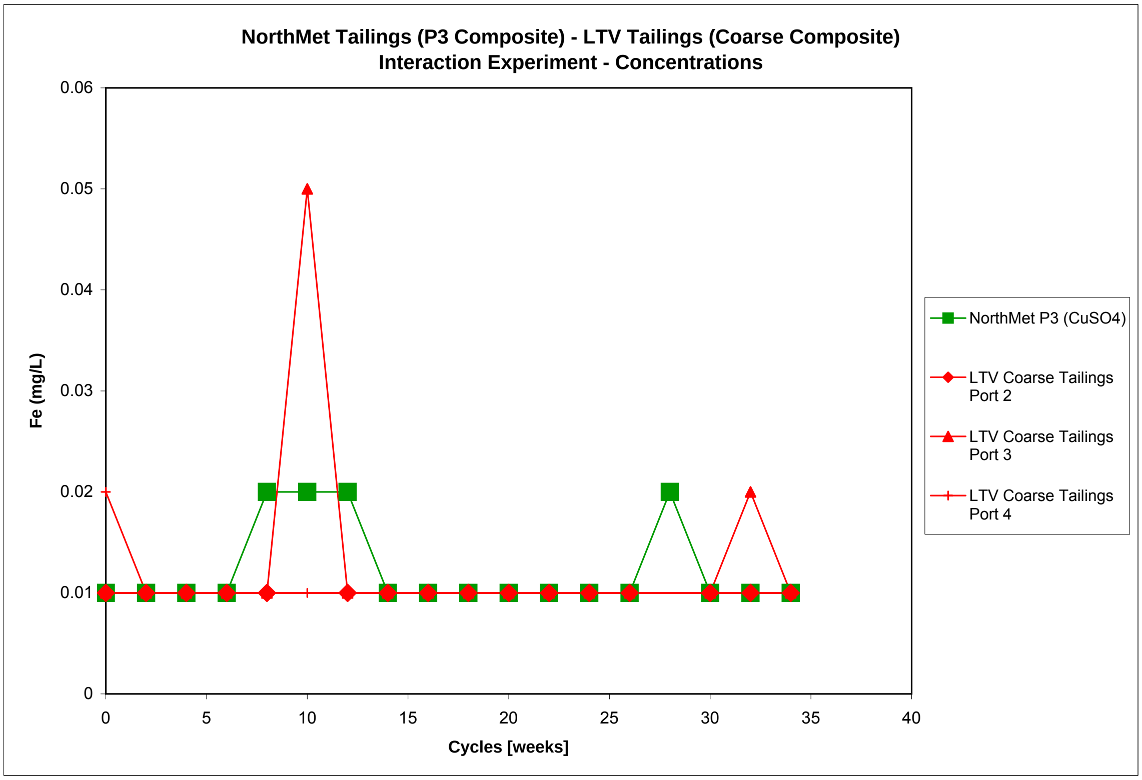
Graph C.3.77


NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations

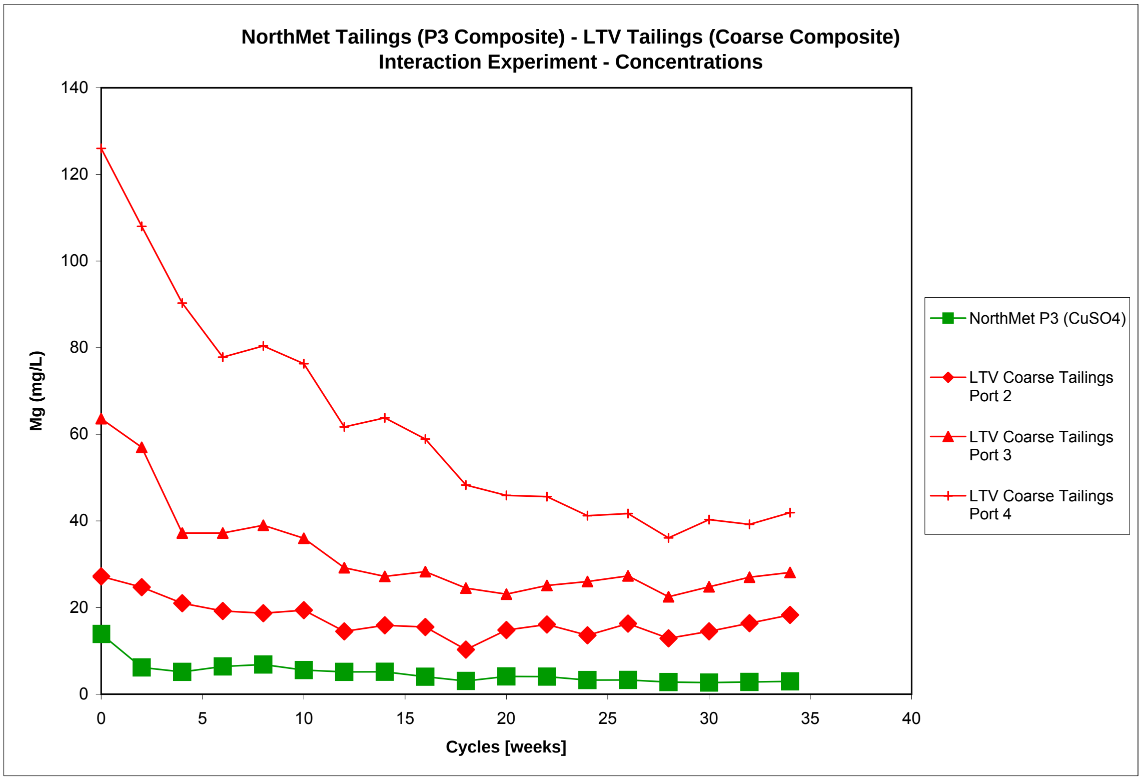
Graph C.3.78


NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations

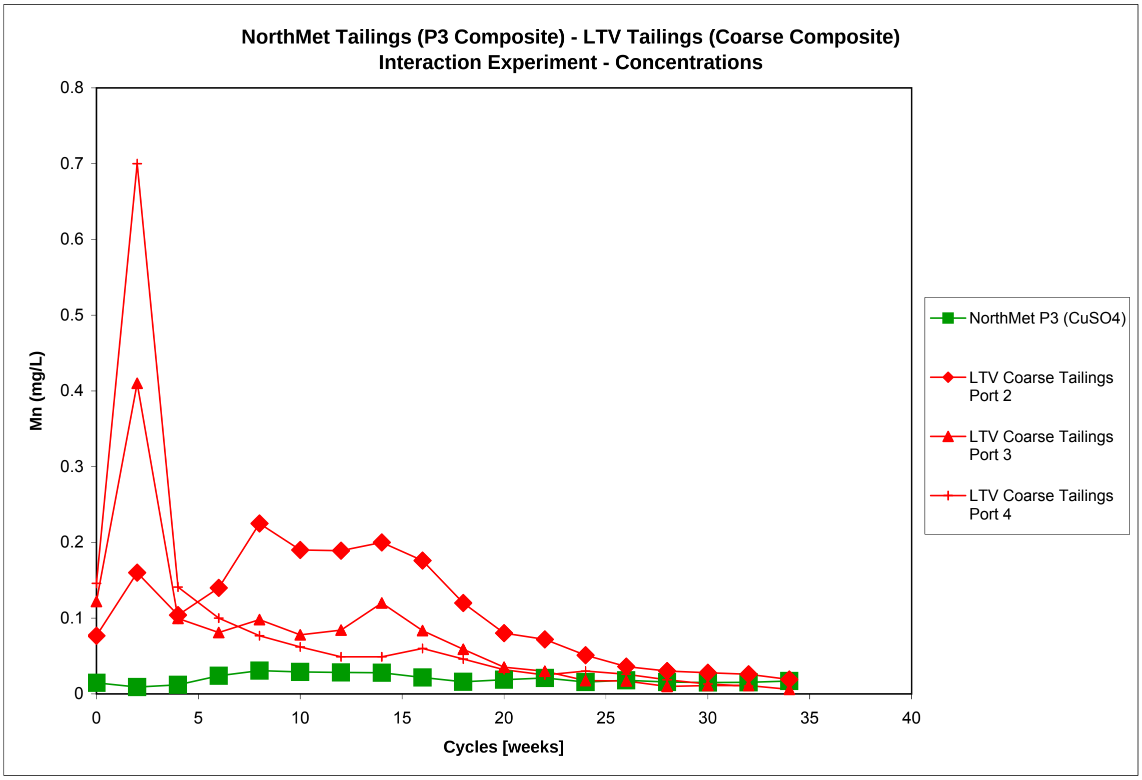

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Cu (mg/L)
0.012
0.01
0.008
0.006
0.004
0.002
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

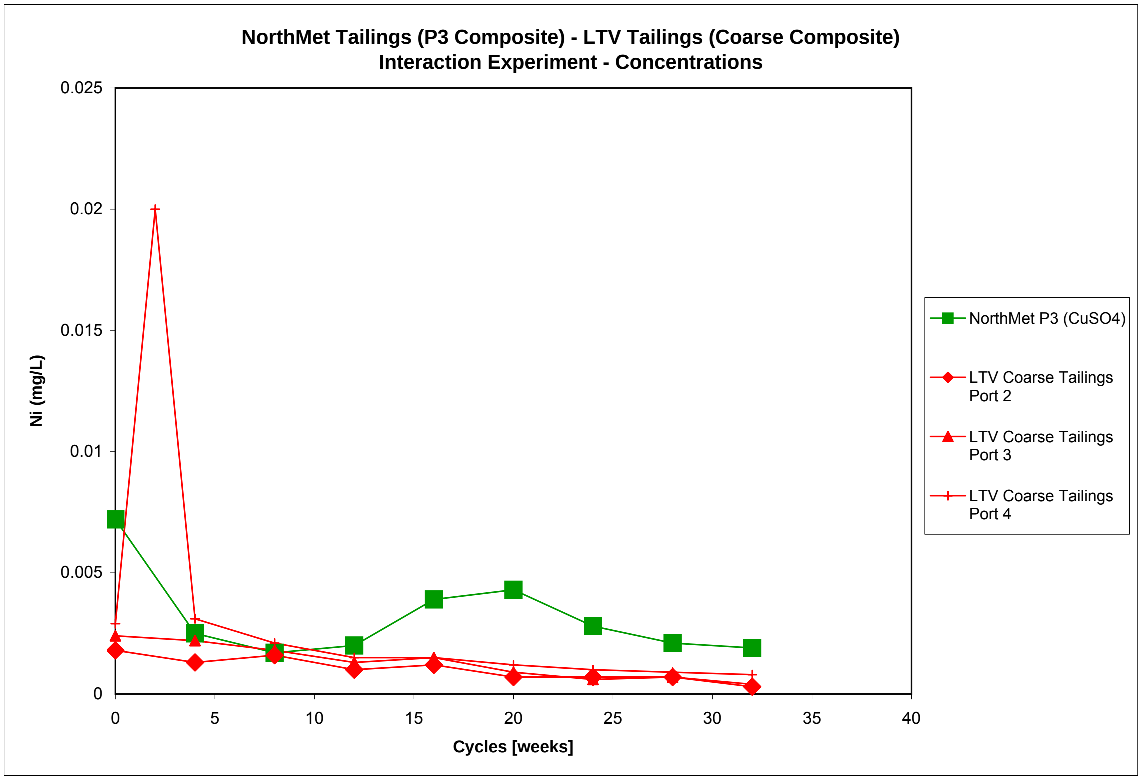

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Fe (mg/L)
0.06
0.05
0.04
0.03
0.02
0.01
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

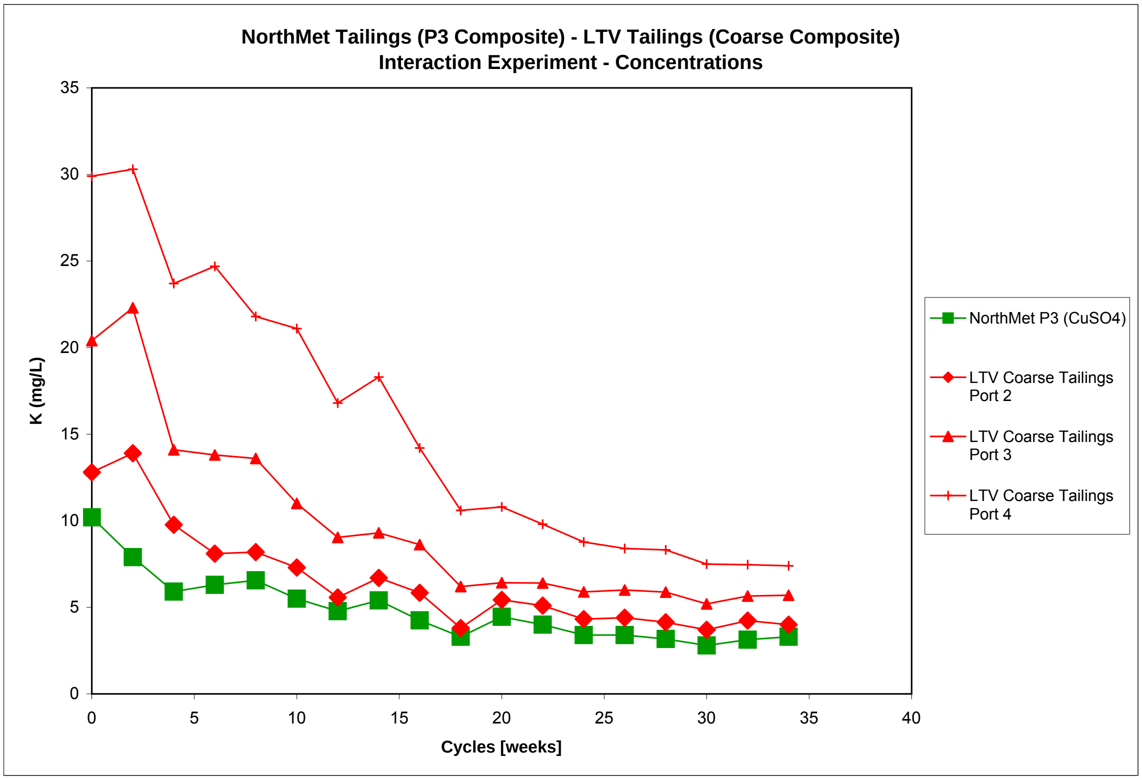
Graph C.3.81

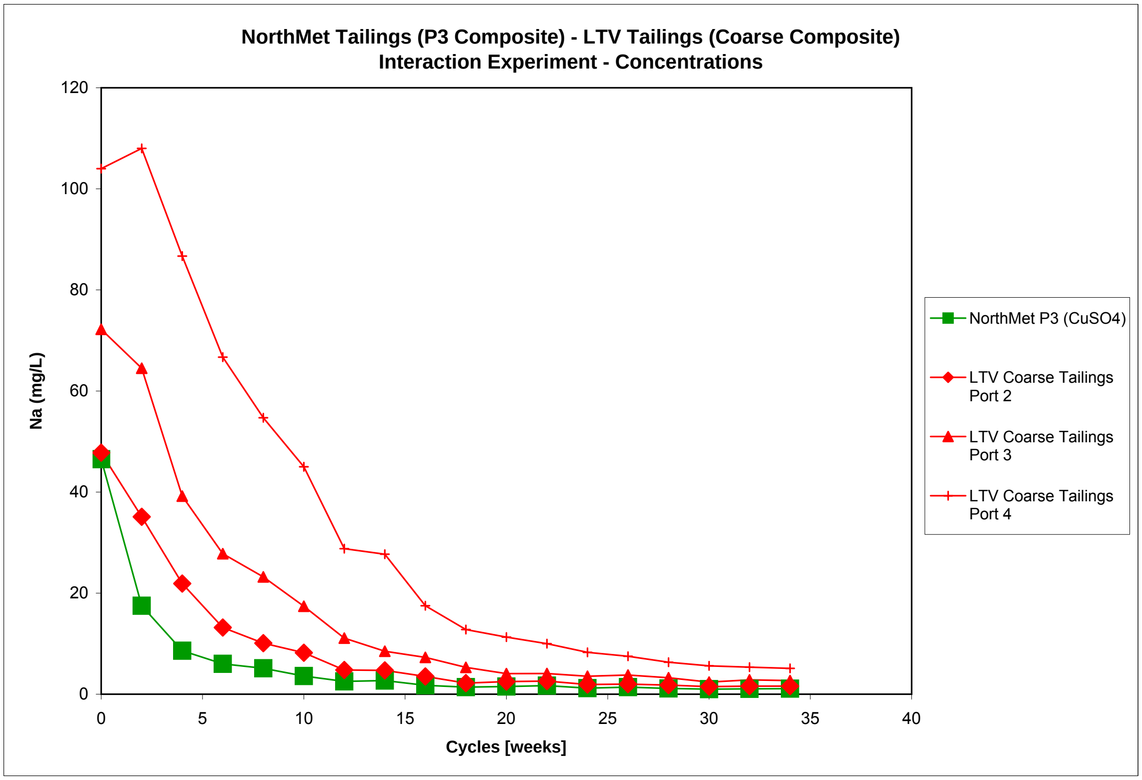

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations

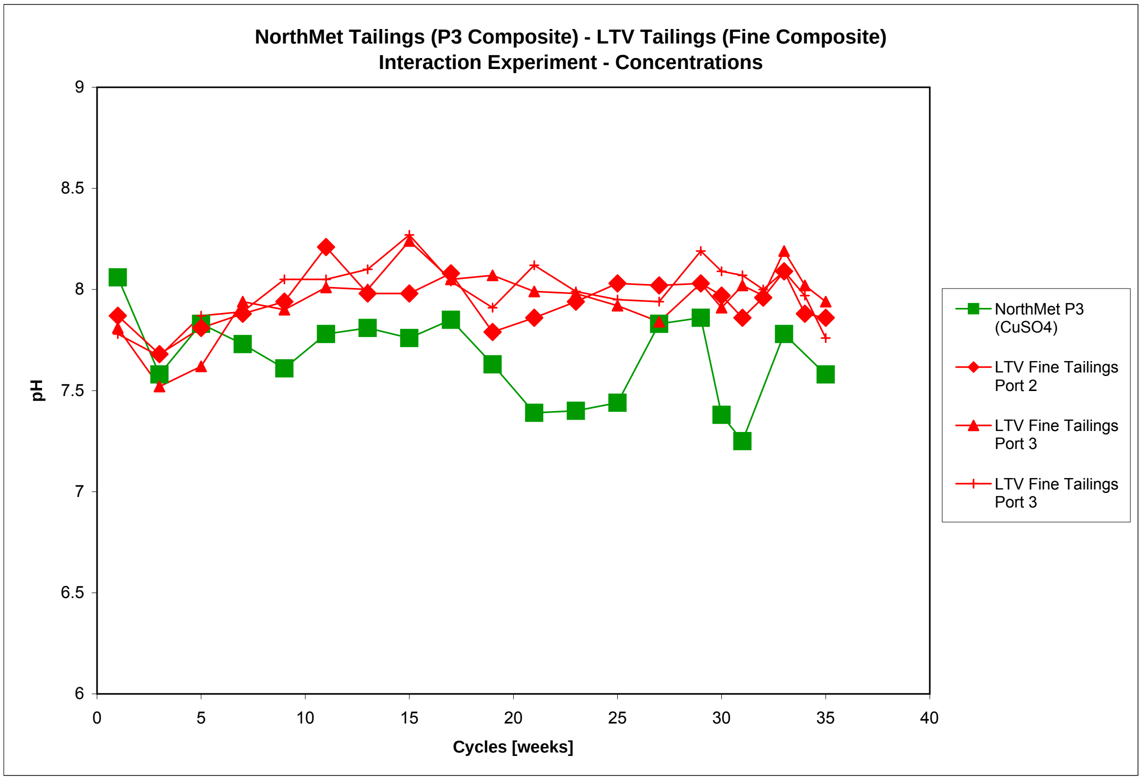
Graph C.3.82

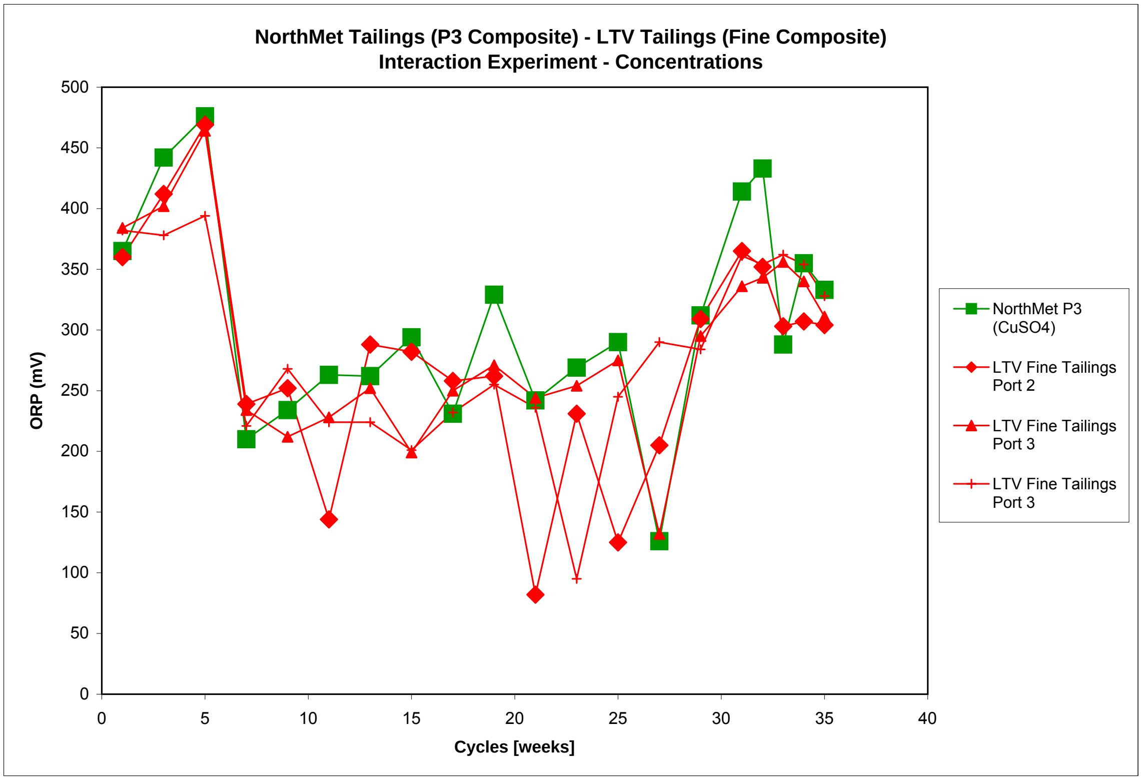

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations

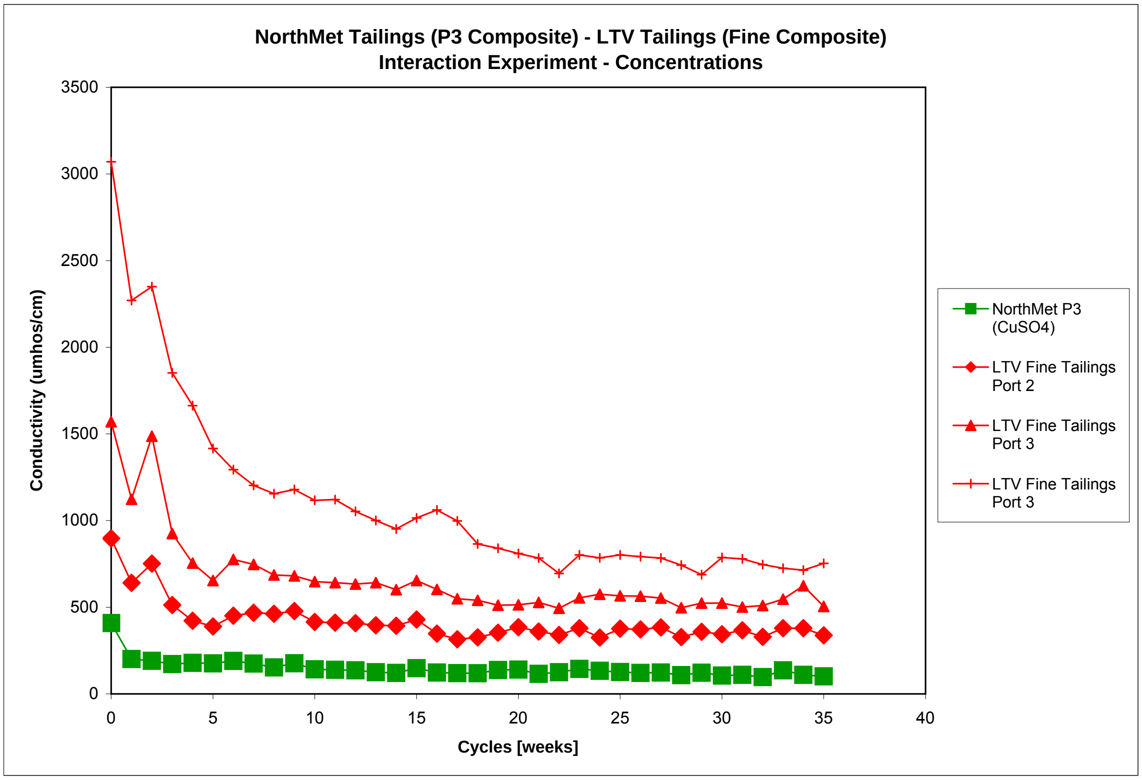

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Ni (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

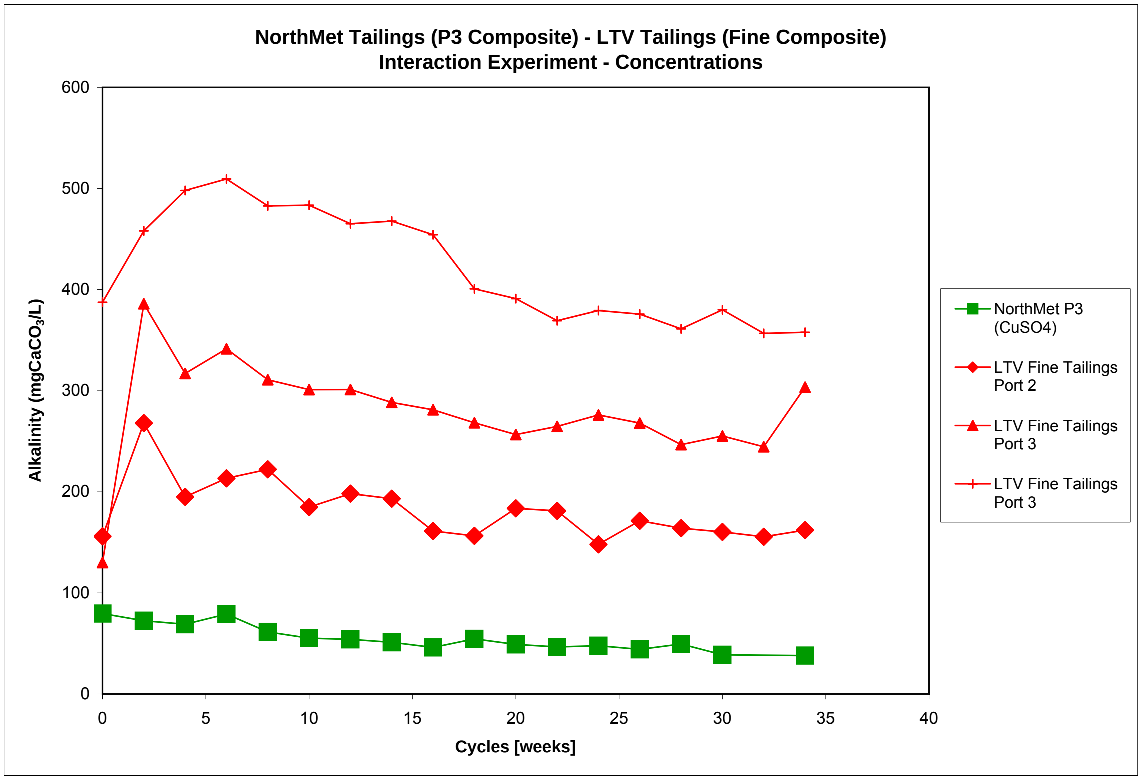

NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
K (mg/L)
35
30
25
20
15
10
5
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4


NorthMet Tailings (P3 Composite) - LTV Tailings (Coarse Composite)
Interaction Experiment - Concentrations
Na (mg/L)
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Coarse Tailings Port 2
LTV Coarse Tailings Port 3
LTV Coarse Tailings Port 4

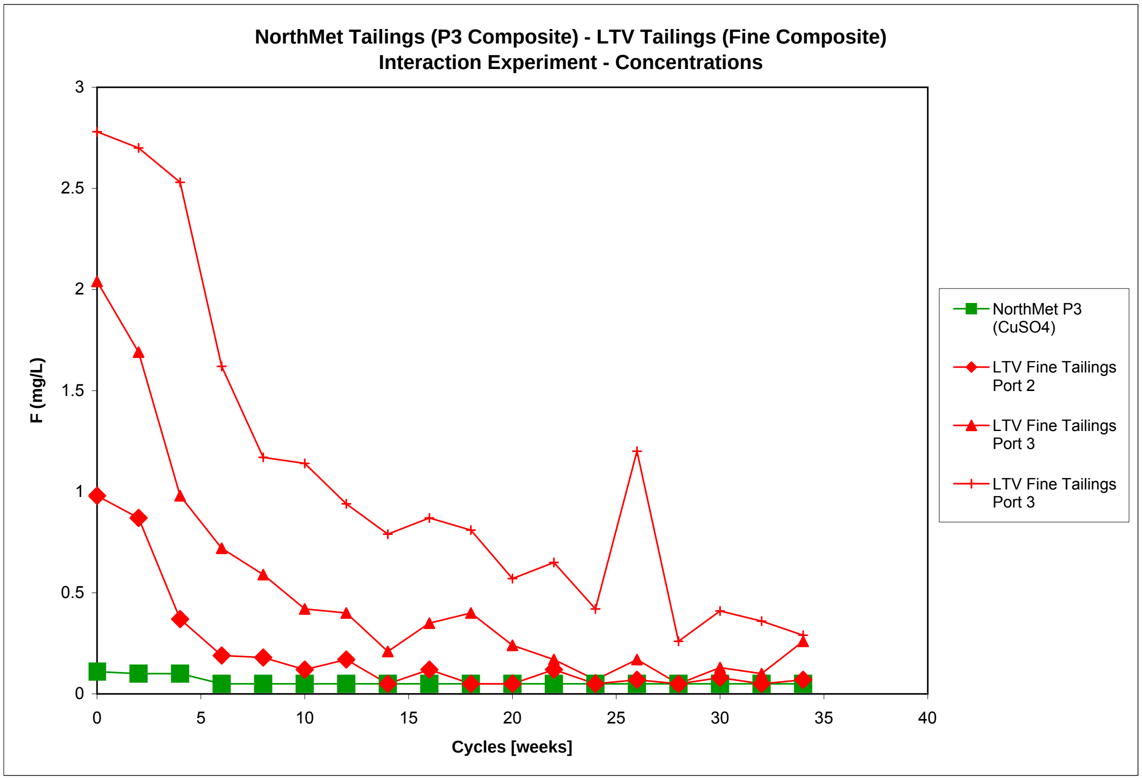

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
pH
9
8.5
8
7.5
7
6.5
6
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3


NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
ORP (mV)
500
450
400
350
300
250
200
150
100
50
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

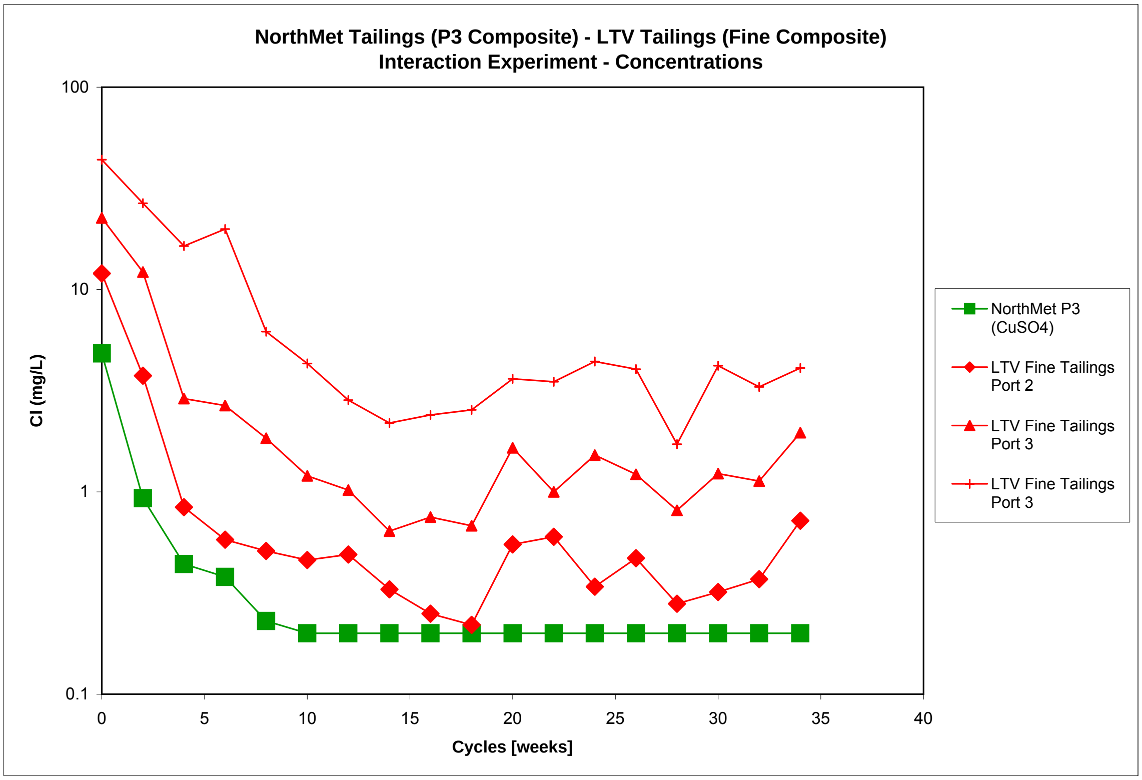

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Conductivity (umhos/cm)
3500
3000
2500
2000
1500
1000
500
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

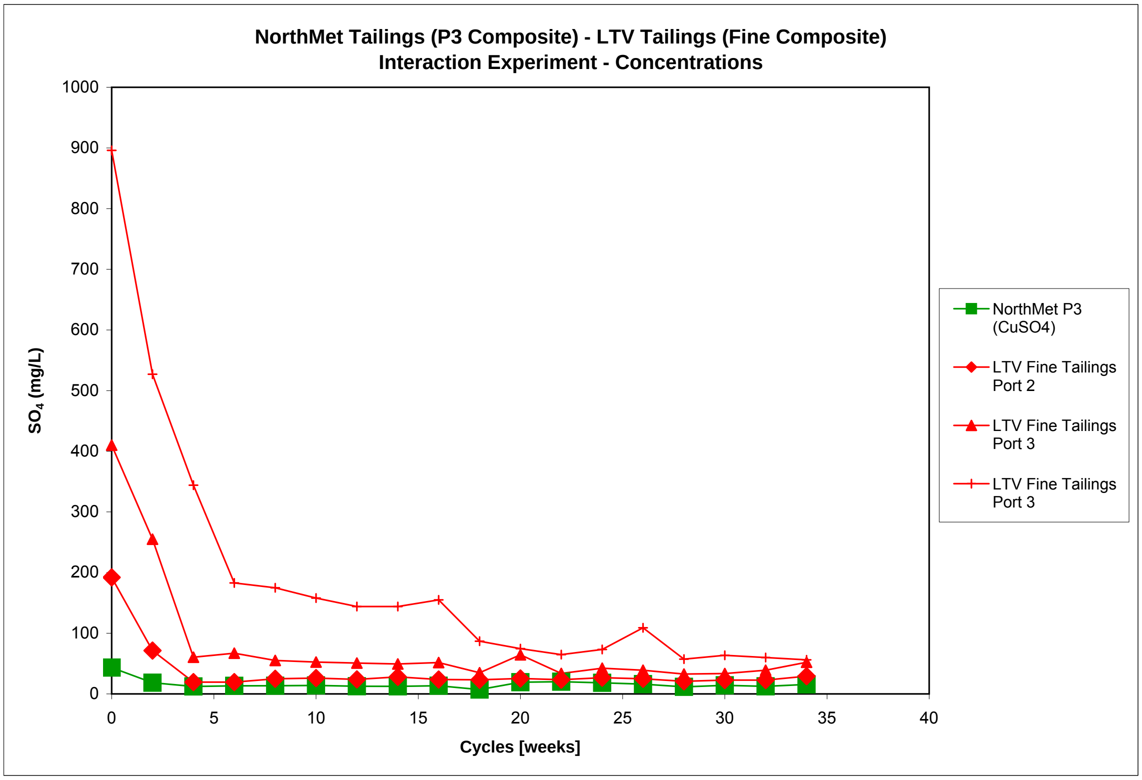


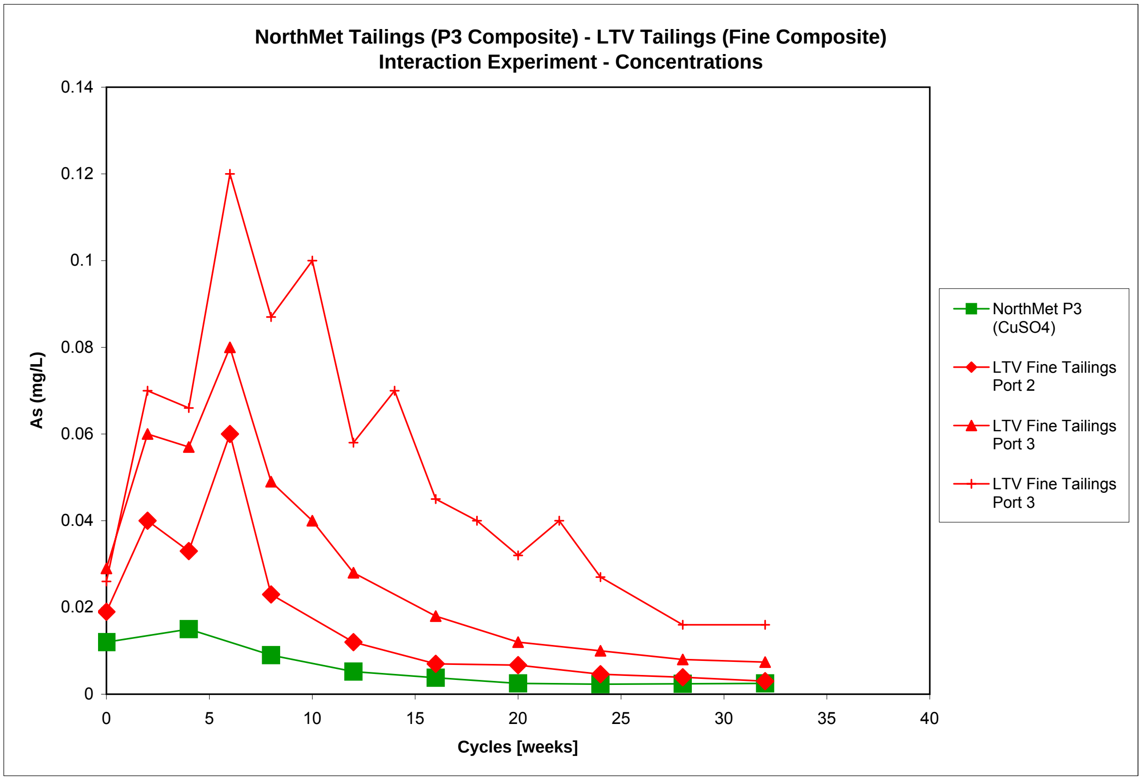
NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

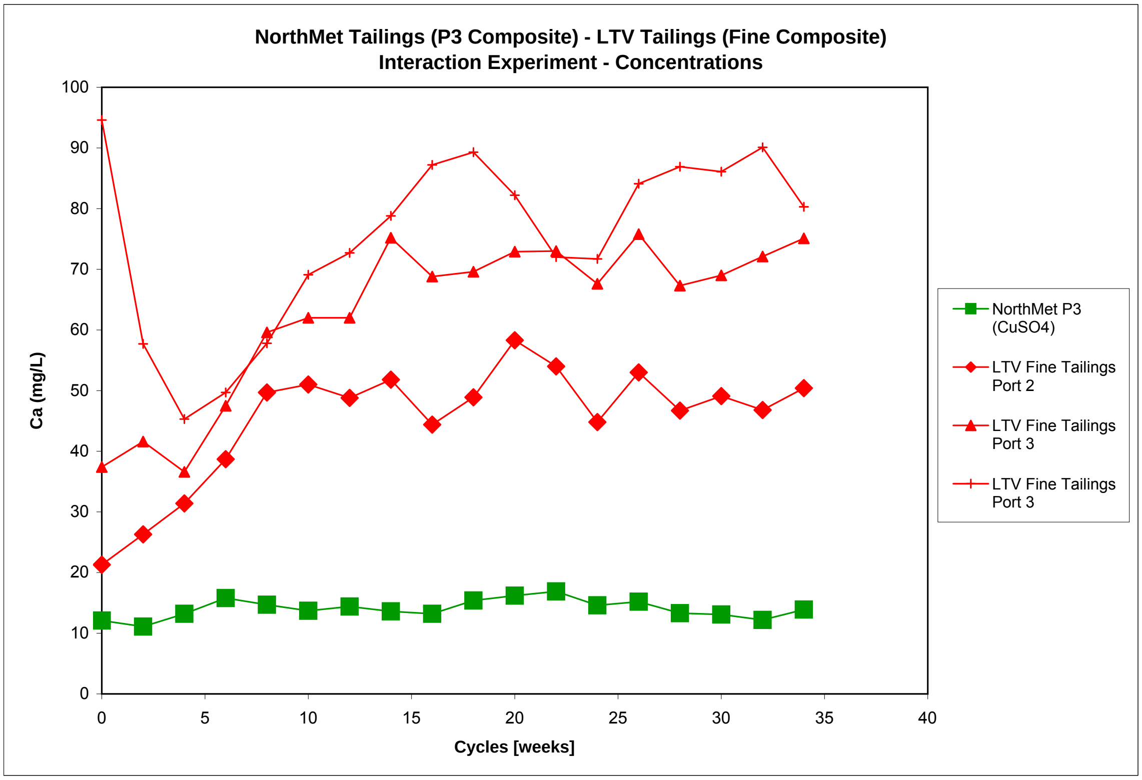


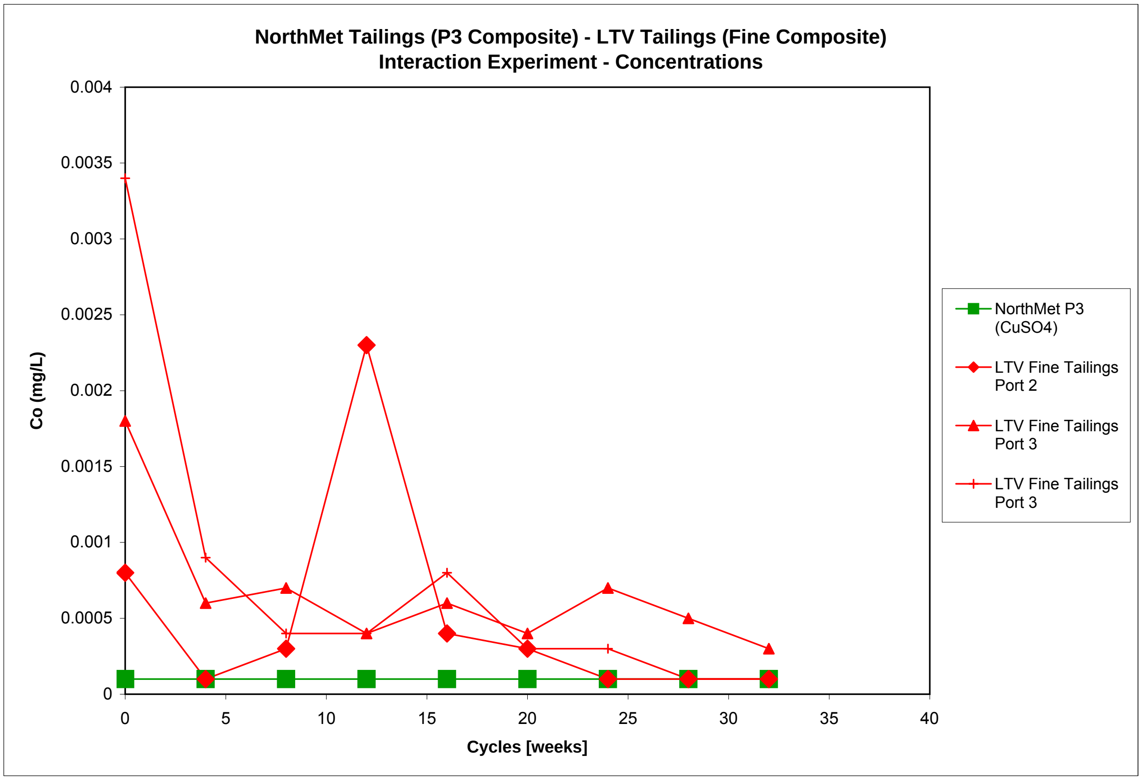
NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

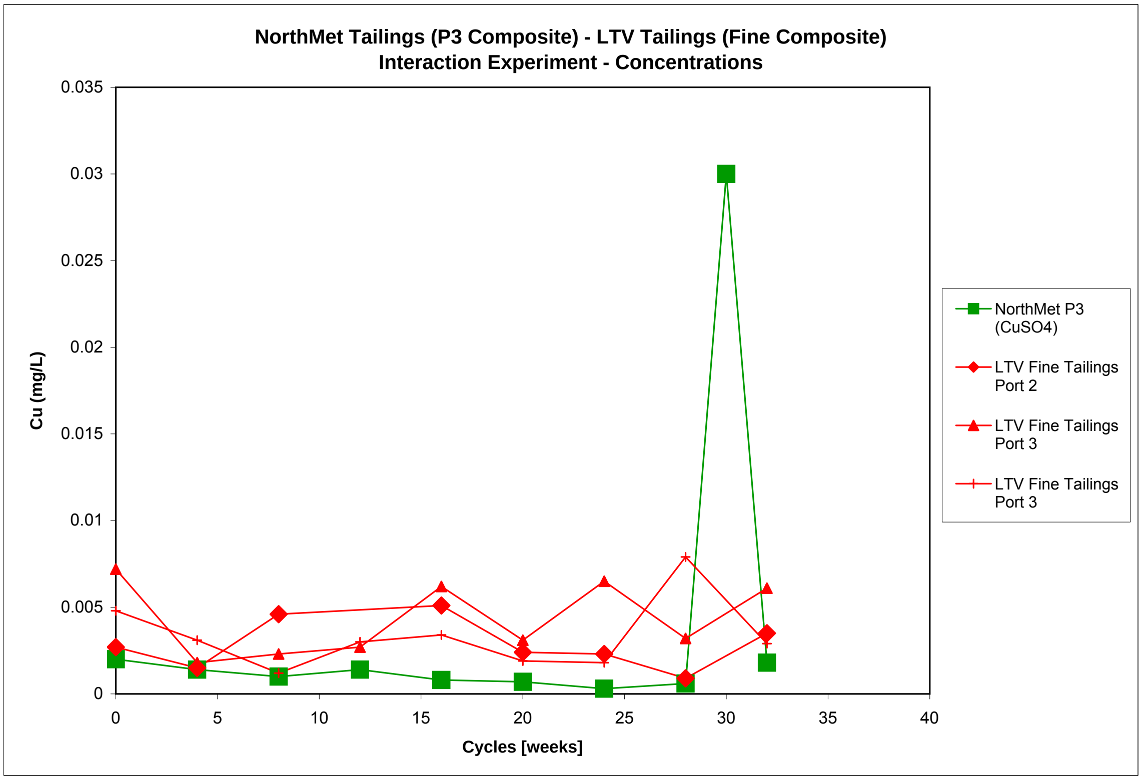

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Cl (mg/L)
100
10
1
0.1
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

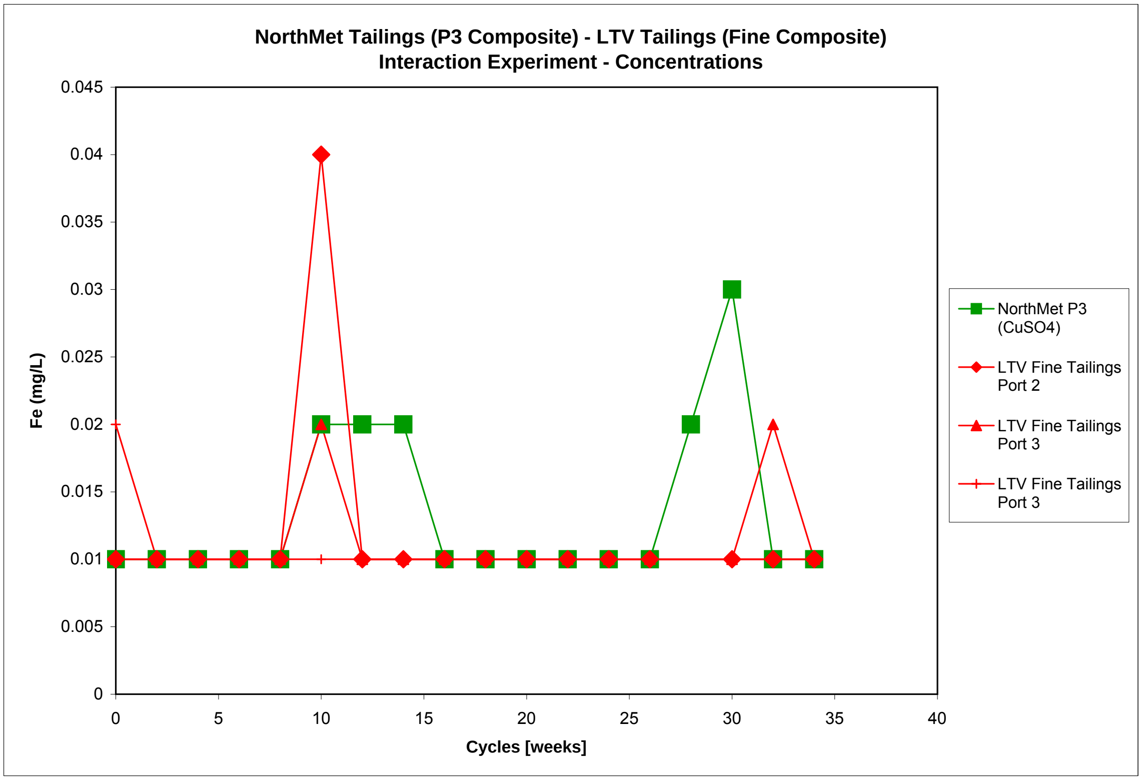

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
SO4 (mg/L)
1000
900
800
700
600
500
400
300
200
100
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

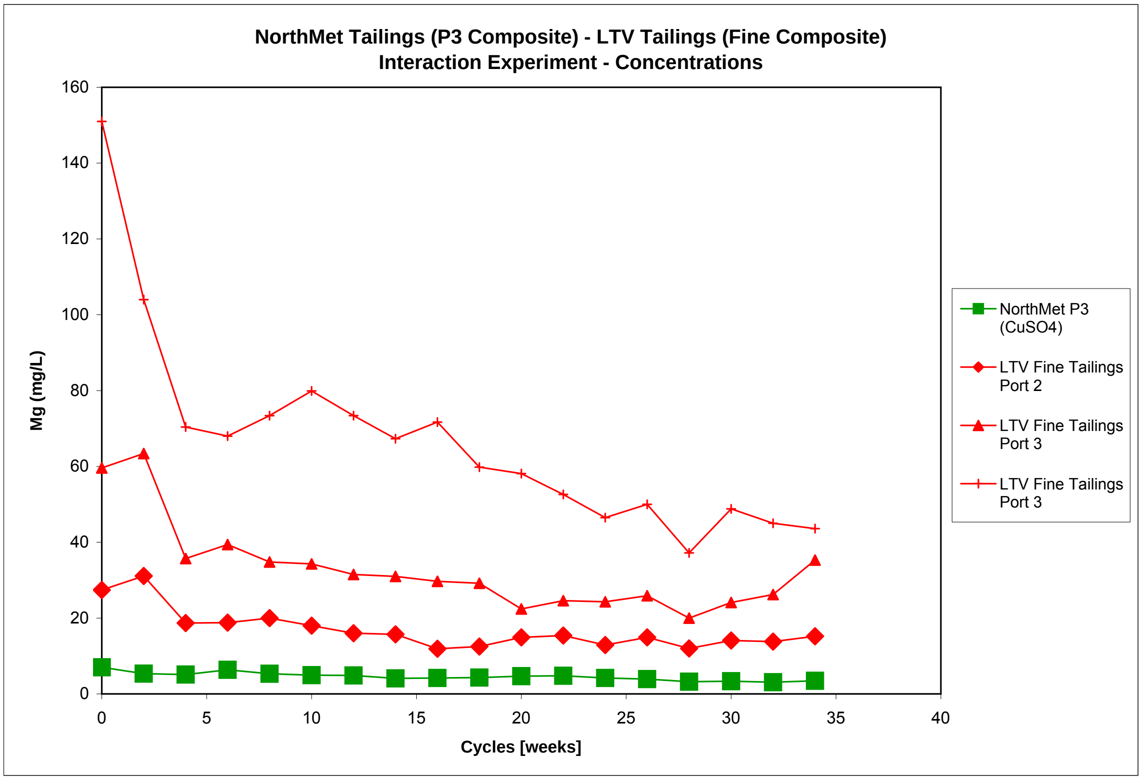

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
As (mg/L)
0
0.02
0.04
0.06
0.08
0.1
0.12
0.14
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

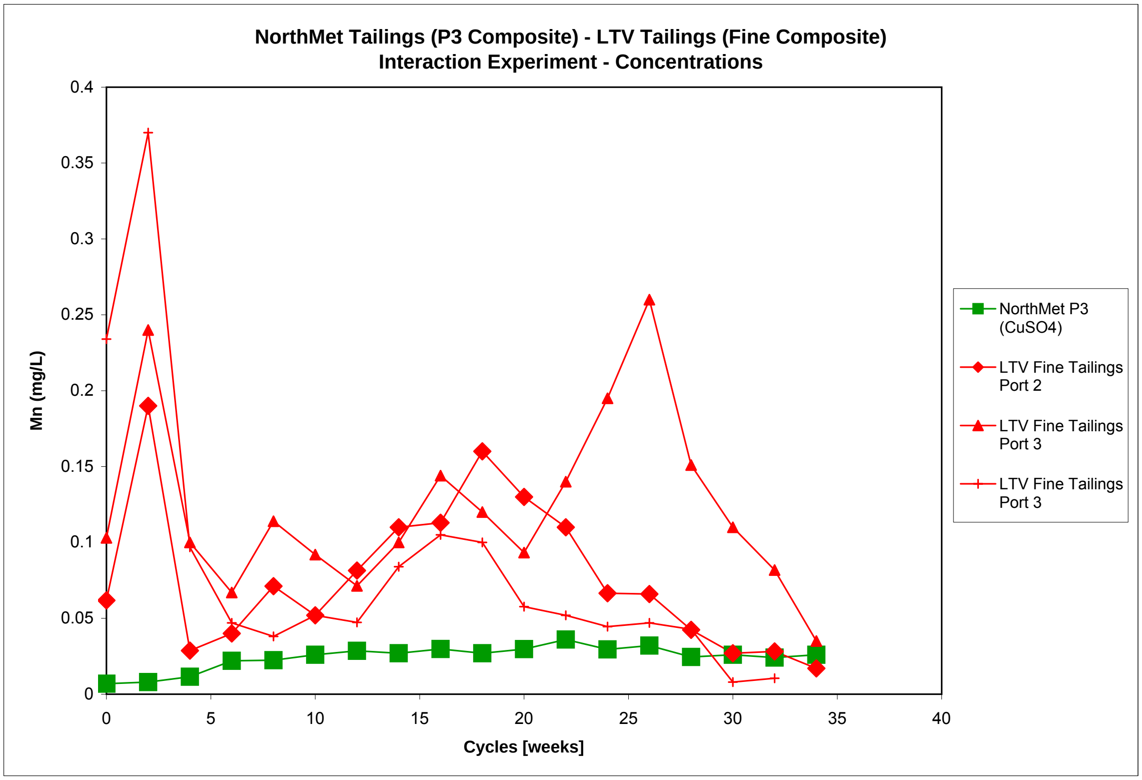

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Ca (mg/L)
0
10
20
30
40
50
60
70
80
90
100
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

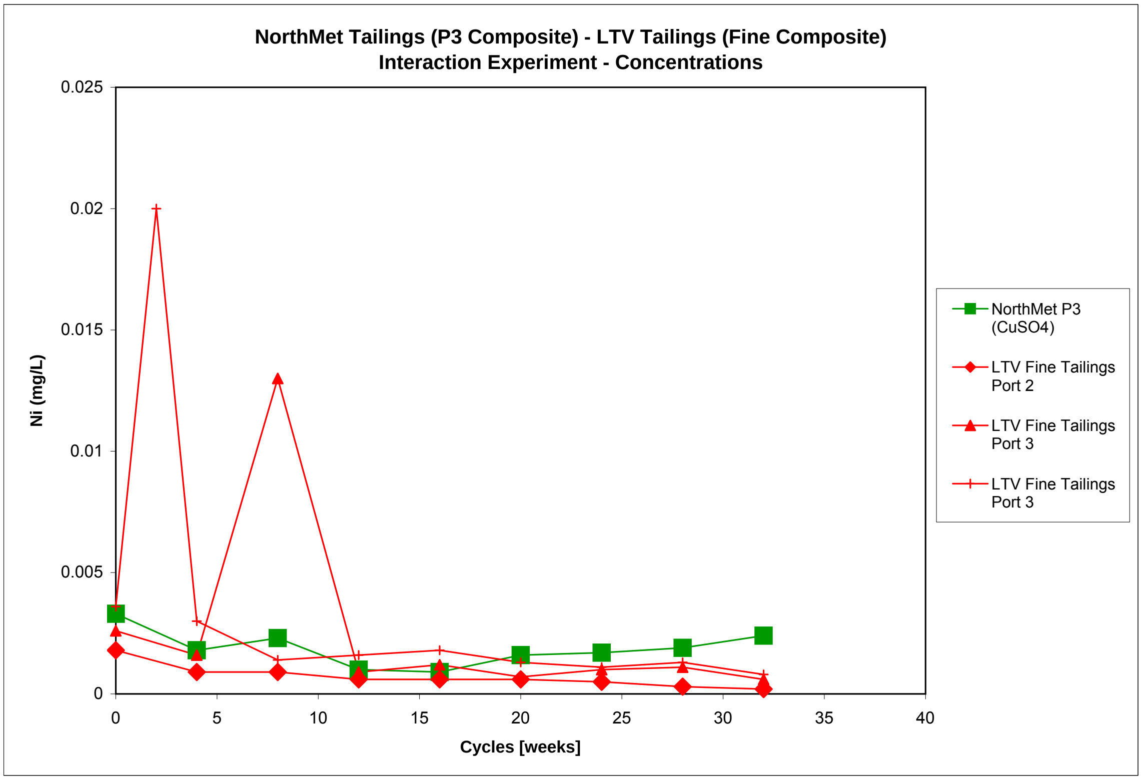

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Co (mg/L)
0.004
0.0035
0.003
0.0025
0.002
0.0015
0.001
0.0005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3


NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Cu (mg/L)
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

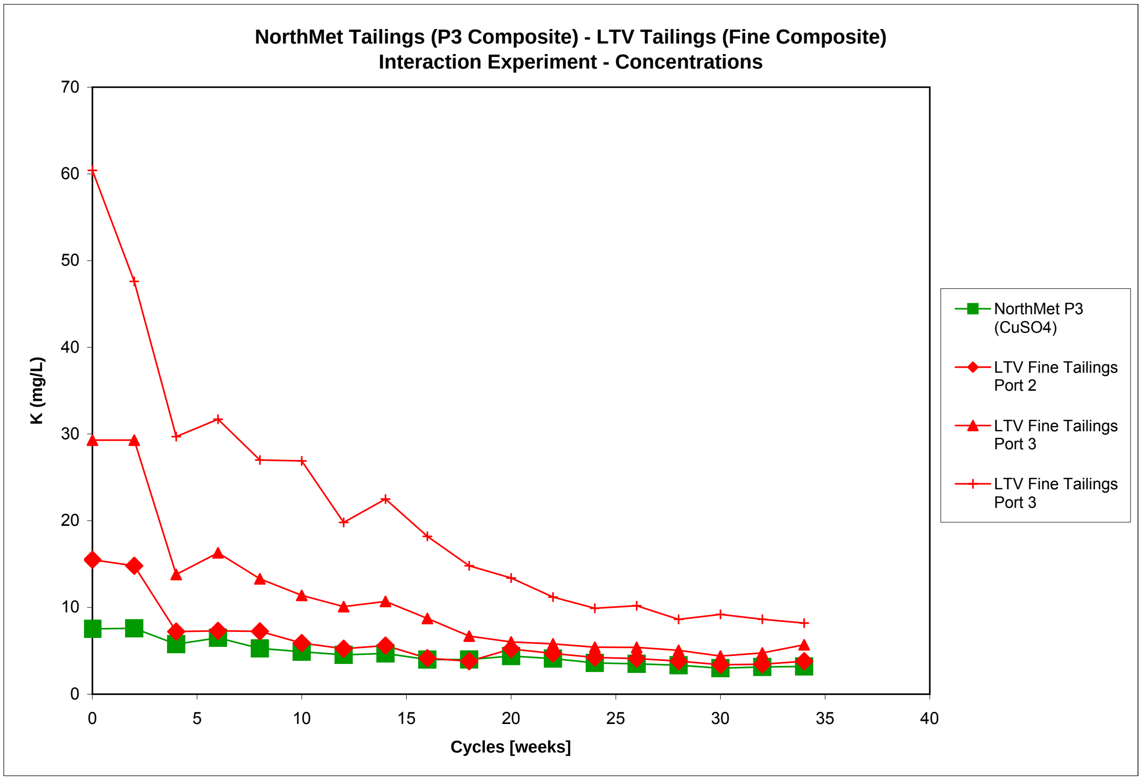

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Fe (mg/L)
0.045
0.04
0.035
0.03
0.025
0.02
0.015
0.01
0.005
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3


NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Mg (mg/L)
160
140
120
100
80
60
40
20
0
0
5
10
15
20
25
30
35
40
Cycles [weeks]
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3


NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Mn (mg/L)
0.4
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

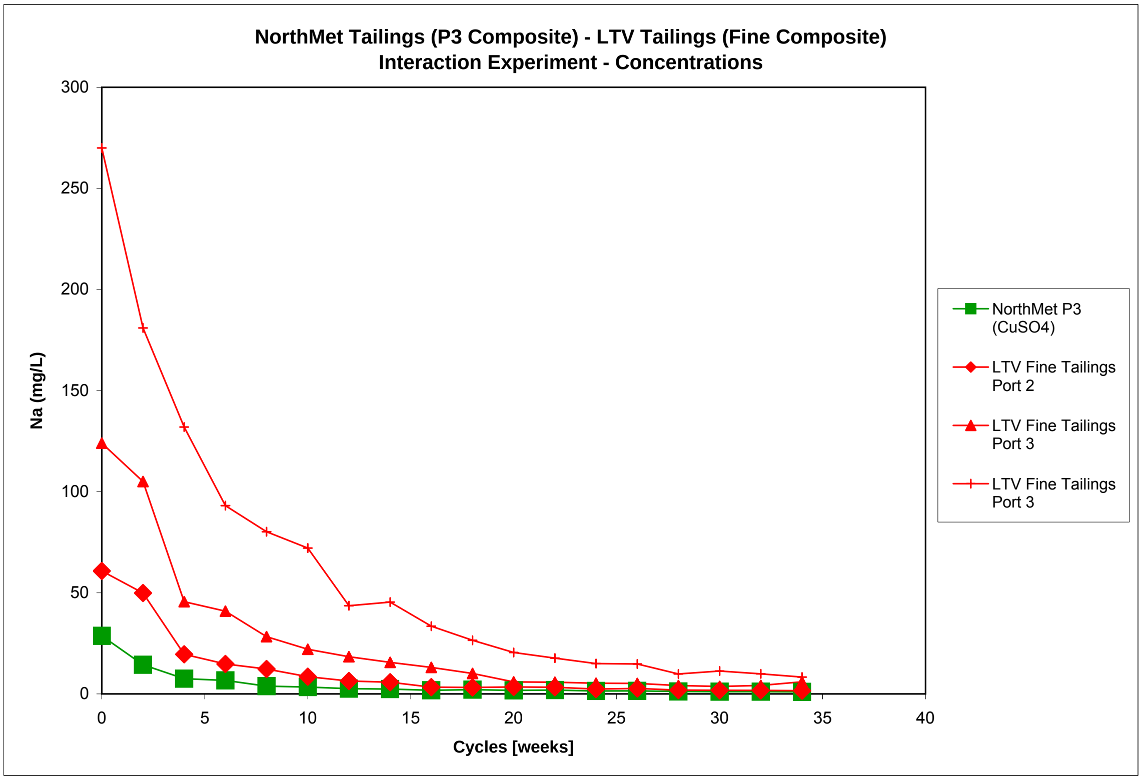

NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations
Ni (mg/L)
0.025
0.02
0.015
0.01
0.005
0
Cycles [weeks]
0
5
10
15
20
25
30
35
40
NorthMet P3 (CuSO4)
LTV Fine Tailings Port 2
LTV Fine Tailings Port 3
LTV Fine Tailings Port 3

Graph C.3.101



NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

Graph C.3.102



NorthMet Tailings (P3 Composite) - LTV Tailings (Fine Composite)
Interaction Experiment - Concentrations

Appendix C.4

Low Level Hg Analyses

Appendix C.4
Low Level Hg Analysis

Sample ID	Test Type	Description	Hg (ng/L)
T1 Cycle 39	ASTM	P1S	4.2
T2 Cycle 39	ASTM	P1 Solid	2.8
T3 Cycle 39	ASTM	P2S	3.5
T4 Cycle 39	ASTM	P3S	2.5
T5 Cycle 17	ASTM	Parcel 2 P2S +100 mesh	3.8
T6 Cycle 17	ASTM	Parcel 2 P2S -100 +200 mesh	3.8
T7 Cycle 17	ASTM	Parcel 2 P2S -200 mesh	3.1
T8 Cycle 17	ASTM	Parcel 1-2 PISCS +100 mesh	<2.0
T9 Cycle 17	ASTM	Parcel 1-2 PISCS -100 +200 mesh	2.4
T10 Cylce 17	ASTM	Parcel 1-2 PISCS -200 mesh	3
T11 Cycle 17	ASTM	Parcel 3 P3S +100 mesh	2.6
T12 Cycle 17	ASTM	Parcel 3 P3S -100 +200 mesh	3.2
T13 Cycle 17	ASTM	Parcel 3 P3S -200 mesh	3
T22 Cycle 11	LTV contact	P1S Composite Port 1 Coarse Stream	3.2
T23 Cycle 11	LTV contact	Coarse Sand Port 2 P1S	2.9
T24 Cycle 11	LTV contact	Coarse Sand Port 3 P1S	3.7
T25 Cycle 11	LTV contact	Coarse Sand Port 4 P1S	3.6
T26 Cycle 11	LTV contact	P1S Composite Port 1 Fine Stream	2.8
T27 Cycle 11	LTV contact	Fine Sand/Slimes Port 2 (P1S)	3.2
T28 Cycle 11	LTV contact	Fine Sand/Slimes Port 3 (P1S)	3.2
T29 Cycle 11	LTV contact	Fine Sand/Slimes Port 4 (P1S)	3.2
T30 Cycle 11	LTV contact	P3S Composite Port 1 Coarse Stream	3.3
T31 Cycle 11	LTV contact	Coarse Sand Port 2 P3S	3.3
T32 Cycle 11	LTV contact	Coarse Sand Port 3 P3S	3.2
T33 Cycle 11	LTV contact	Coarse Sand Port 4 P3S	3.1
T34 Cycle 11	LTV contact	P3S Composite Port 1 Fine Stream	2.8
T35 Cycle 11	LTV contact	Fine Sand/Slimes Port 2 (P3S)	3.2
T36 Cycle 11	LTV contact	Fine Sand/Slimes Port 3 (P3S)	3.2
T37 Cycle 11	LTV contact	Fine Sand/Slimes Port 4 (P3S)	5.4
T38 Cycle 11	LTV contact	Coarse Sand Port 1 Control	3.5
T39 Cycle 11	LTV contact	Coarse Sand Port 2 Control	2.8
T40 Cycle 11	LTV contact	Coarse Sand Port 3 Control	2.9
T41 Cycle 11	LTV contact	Fine Sand/Slimes Port 1 Control	2.3
T42 Cycle 11	LTV contact	Fine Sand/Slimes Port 2 Control	2.8
T43 Cycle 11	LTV contact	Fine Sand/Slimes Port 3 Control	2.6

Appendix D

Modeling Results

Appendix D.1

HYDRUS2D Modeling Results

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Vancouver, B.C. V6E 3X2
Canada

vancouver@srk.com
www.srk.com

Tel: 604.681.4196
Fax: 604.687.5532

Memorandum

To:	File	**Date:**	2007-05-31
cc:	John Chapman Steve Day	**From:**	Michel Noël
Subject:	PolyMet – Tailings impoundment: water transport modelling	**Project #:**	1UP005.001

This memo summarises the modelling that was performed to estimate the infiltration and moisture profiles at the proposed tailings impoundments. The purpose of this water transport modelling was to provide input for the water quantity and quality predictions.

1 Model

The modelling was carried out using Hydrus-2D version 2.008.

2 Material Properties

Two materials were modelled: coarse tailings and fine tailings. The hydraulic properties of the material are summarised in Table 1 below. The unsaturated properties were represented using the van Genuchten (1980) method with an air entry value restricted to -2 cm. This adjustment is to prevent the very steep slope of the derivative of the unsaturated hydraulic conductivity at saturation (Vogel and Cislerova 1988).

Table 1: Hydraulic properties

	θ_r	θ_{sat}	K_{sat} cm s^{-1}	α cm^{-1}	n	ξ	p
Coarse tailings	0.057	0.500	1.200E-03	0.124	2.280	1.0	0.500
Fine tailings	0.034	0.520	2.240E-05	0.016	1.370	1.0	0.500

The unsaturated properties listed above are based on the values reported by Carsel and Parrish (1988). The coarse tailings were assigned the values for loamy sand while the fine tailings was assigned the values for silt. The saturated hydraulic conductivity for both materials was adjusted to the values measured by the laboratory testing.

3 Modelling

3.1 Setup

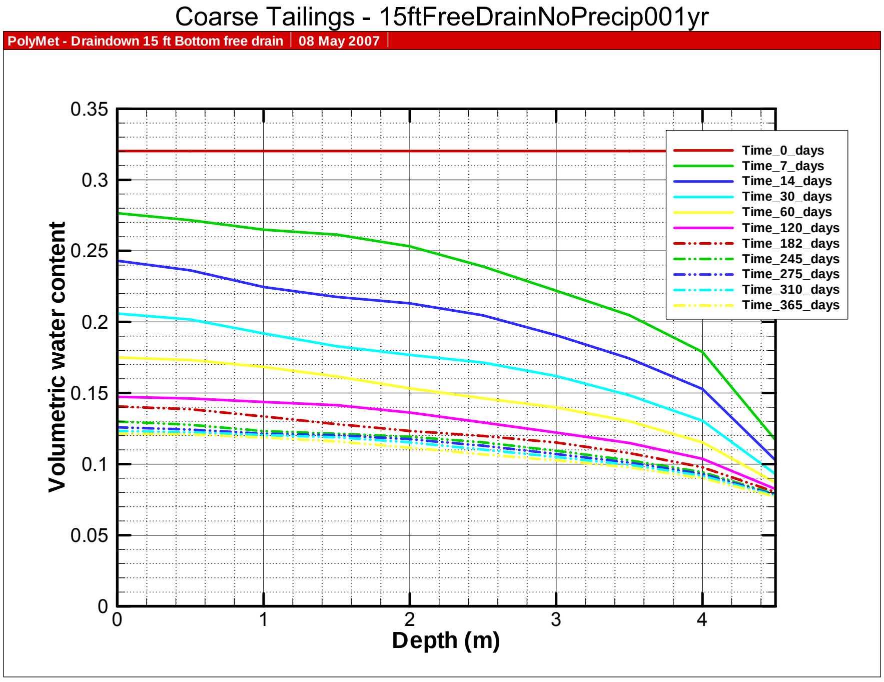
The geometry of the model consisted of a 1 m wide column with variable heights, namely 15, 30, 45 and 60 m. The simulations were applied for a period of 1 or 100 years. The top boundary was assigned a no flux condition or an infiltration rate of 7.7 or 25 inches per year. The bottom boundary was assigned either a constant pressure or free drainage. The constant pressure was set at -0.1 m, which is equivalent to have a water table 0.1 below the base of the tailings. The free drainage condition corresponds to a unit vertical hydraulic gradient. Table 2 summarises the various simulations that were performed.

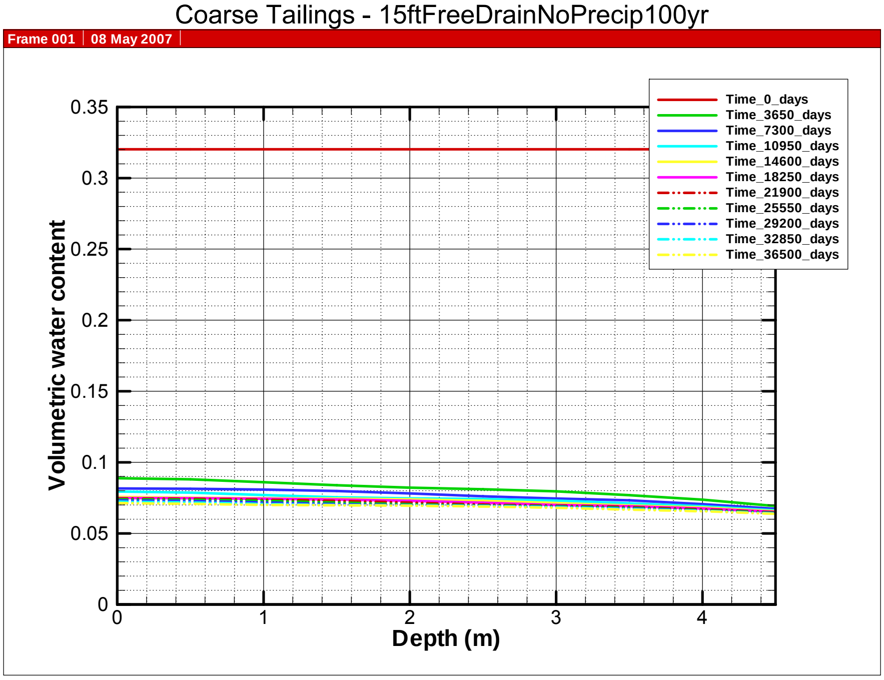
The water content profiles for the individual simulations listed in Table 2 are shown in Section 3.2.

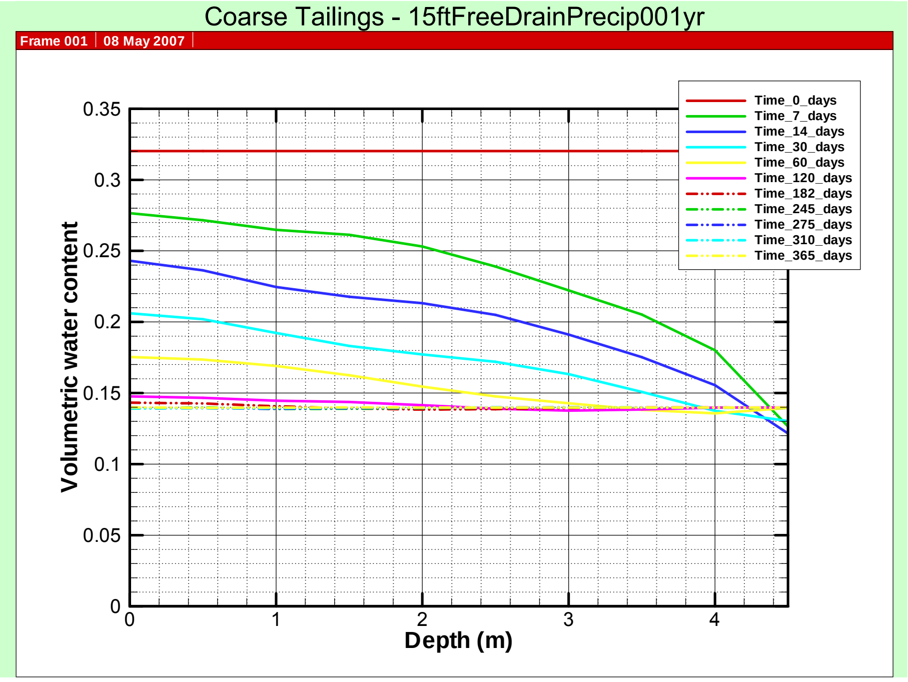
Table 2: Summary of simulated cases

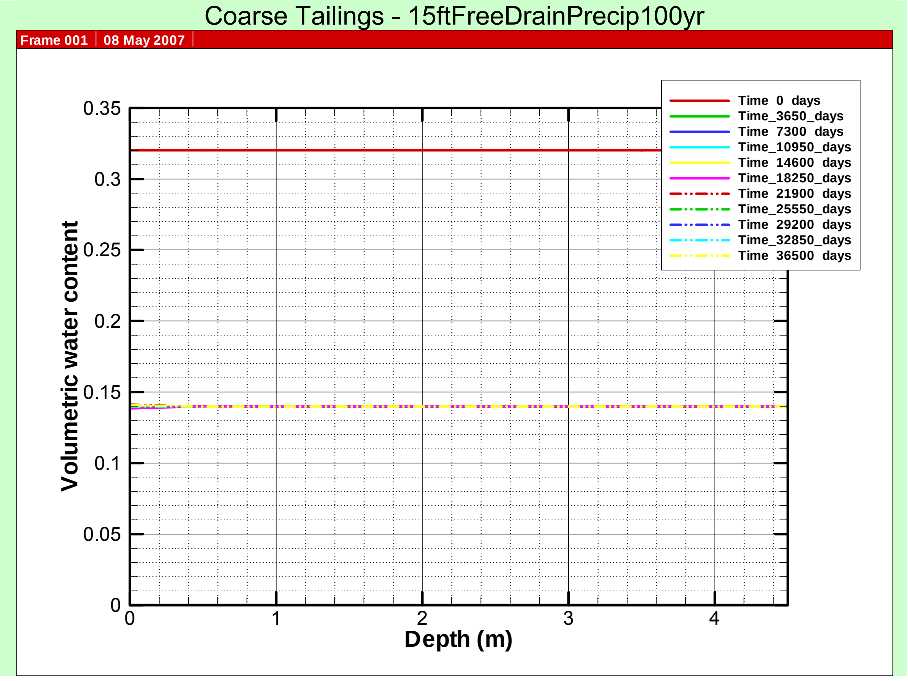
Sheet name	Tailings	Precip	Bottom boundary	Duration	Column height
		in/yr		year	ft
15ftFreeDrainNoPrecip001yr	coarse	0	Free drain	1	15
15ftFreeDrainNoPrecip100yr	coarse	0	Free drain	100	15
15ftFreeDrainPrecip001yr	coarse	7.7	Free drain	1	15
15ftFreeDrainPrecip100yr	coarse	7.7	Free drain	100	15
15ftHeadNoPrecip001yr	coarse	0	Head -0.1 m	1	15
15ftHeadNoPrecip100yr	coarse	0	Head -0.1 m	100	15
15ftHeadPrecip001yr	coarse	7.7	Head -0.1 m	1	15
15ftHeadPrecip100yr	coarse	7.7	Head -0.1 m	100	15
30ftFreeDrainNoPrecip001yr	coarse	0	Free drain	1	30
30ftFreeDrainPrecip001yr	coarse	7.7	Free drain	1	30
45ftFreeDrainNoPrecip001yr	coarse	0	Free drain	1	45
45ftFreeDrainNoPrecip100yr	coarse	0	Free drain	100	45
45ftFreeDrainPrecip001yr	coarse	7.7	Free drain	1	45
45ftFreeDrainPrecip100yr	coarse	7.7	Free drain	100	45
45ftHeadNoPrecip001yr	coarse	0	Head -0.1 m	1	45
45ftHeadNoPrecip100yr	coarse	0	Head -0.1 m	100	45
45ftHeadPrecip001yr	coarse	7.7	Head -0.1 m	1	45
45ftHeadPrecip100yr	coarse	7.7	Head -0.1 m	100	45
FINE15ftFreeDrainNoPrecip001yr	Fine	0	Free drain	1	15
FINE15ftFreeDrainNoPrecip100yrs	Fine	0	Free drain	100	15
FINE15ftFreeDrainPrecip001yr	Fine	7.7	Free drain	1	15
FINE15ftFreeDrainPrecip100yrs	Fine	7.7	Free drain	100	15
FINE30ftFreeDrainNoPrecip001yr	Fine	0	Free drain	1	30
FINE30ftFreeDrainPrecip001yr	Fine	7.7	Free drain	1	30
FINE45ftFreeDrainNoPrecip001yr	Fine	0	Free drain	1	45
FINE45ftFreeDrainNoPrecip100yrs	Fine	0	Free drain	100	45
FINE45ftFreeDrainPrecip001yr	Fine	7.7	Free drain	1	45
FINE45ftFreeDrainPrecip100yrs	Fine	7.7	Free drain	100	45
R25C15ftFreeDrain001yr	coarse	25	Free drain	1	15
R25F15ftFreeDrain001yr	Fine	25	Free drain	1	15
R25C30ftFreeDrain001yr	coarse	25	Free drain	1	30
R25F30ftFreeDrain001yr	Fine	25	Free drain	1	30
R25C60ftFreeDrain001yr	coarse	25	Free drain	1	60
R25F60ftFreeDrain001yr	Fine	25	Free drain	1	60

3.2 Results

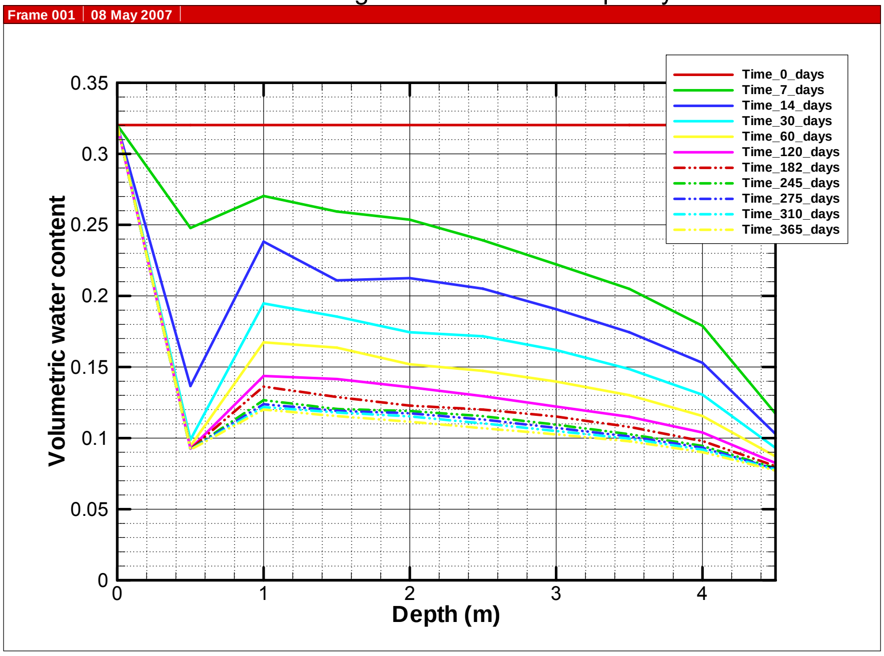

Coarse Tailings - 15ftFreeDrainNoPrecip001yr
PolyMet - Draindown 15 ft Bottom free drain
08 May 2007
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
1
2
3
4
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days


Coarse Tailings - 15ftFreeDrainNoPrecip100yr
Frame 001
08 May 2007
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
1
2
3
4
Time_0_days
Time_3650_days
Time_7300_days
Time_10950_days
Time_14600_days
Time_18250_days
Time_21900_days
Time_25550_days
Time_29200_days
Time_32850_days
Time_36500_days

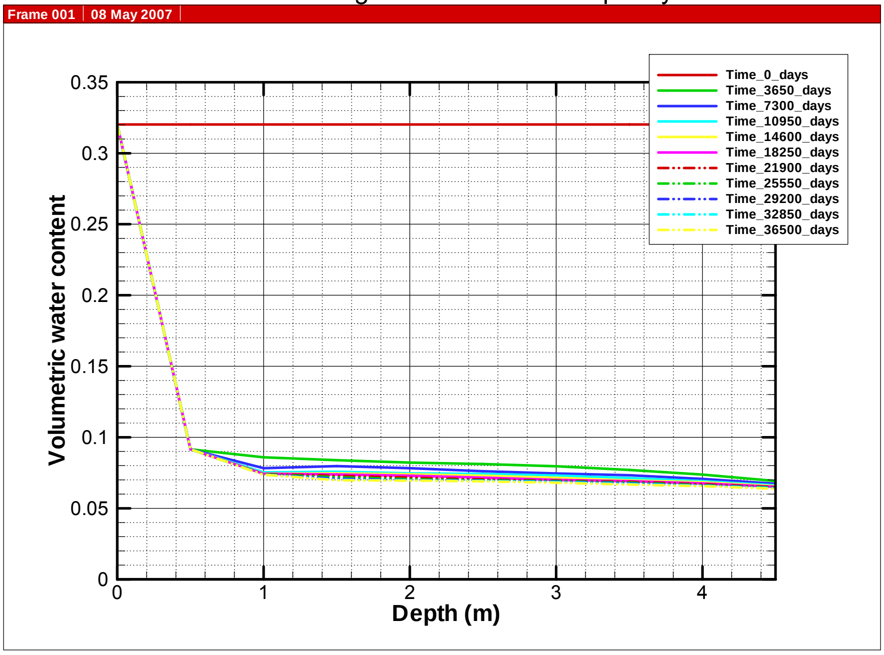

Coarse Tailings - 15ftFreeDrainPrecip001yr
Frame 001 | 08 May 2007
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
1
2
3
4
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days

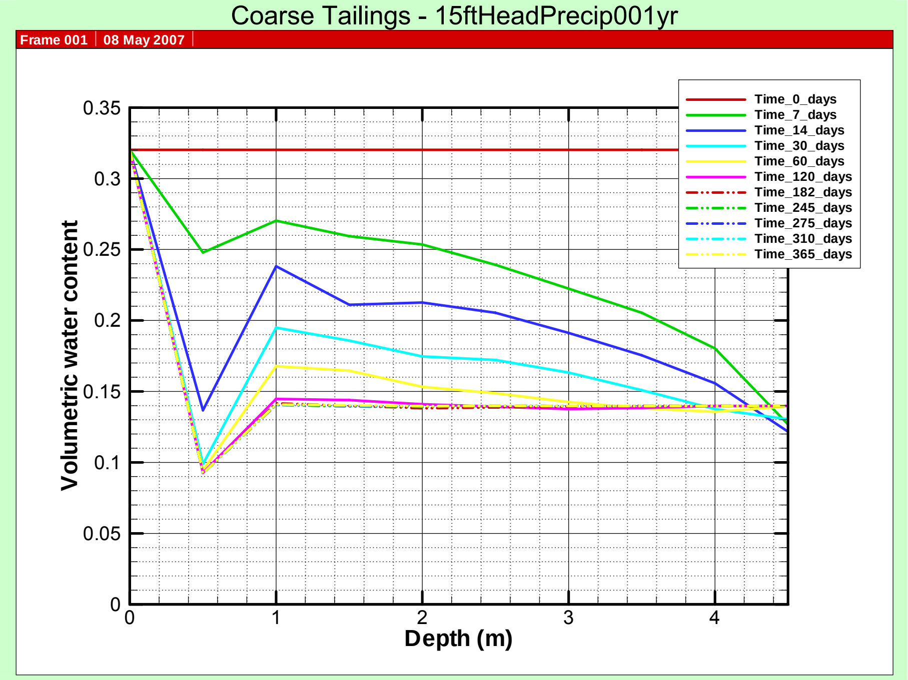

Coarse Tailings - 15ftFreeDrainPrecip100yr
Frame 001 | 08 May 2007
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
1
2
3
4
Time_0_days
Time_3650_days
Time_7300_days
Time_10950_days
Time_14600_days
Time_18250_days
Time_21900_days
Time_25550_days
Time_29200_days
Time_32850_days
Time_36500_days

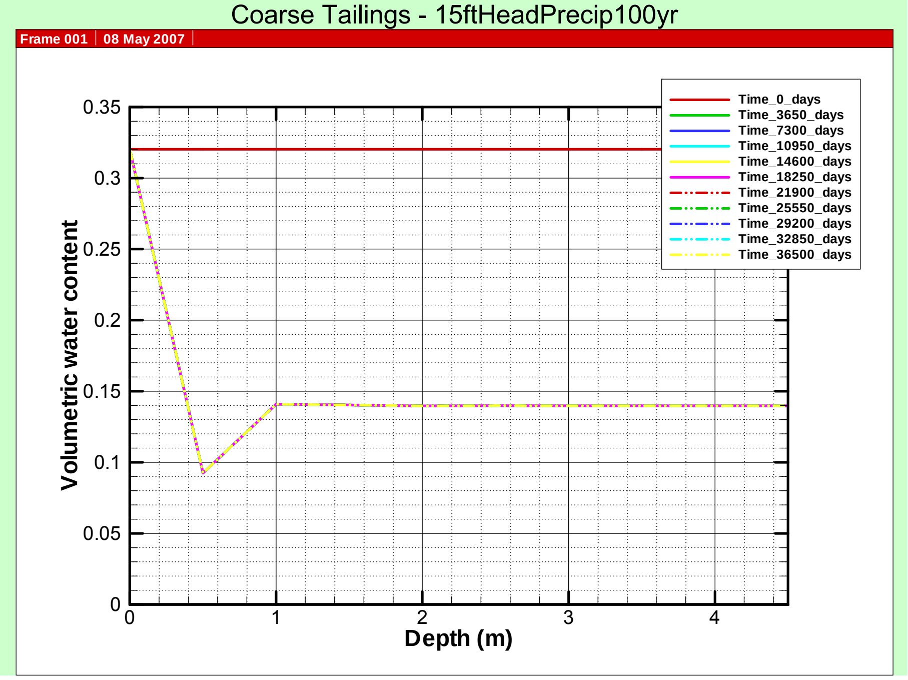
Coarse Tailings - 15ftHeadNoPrecip001yr



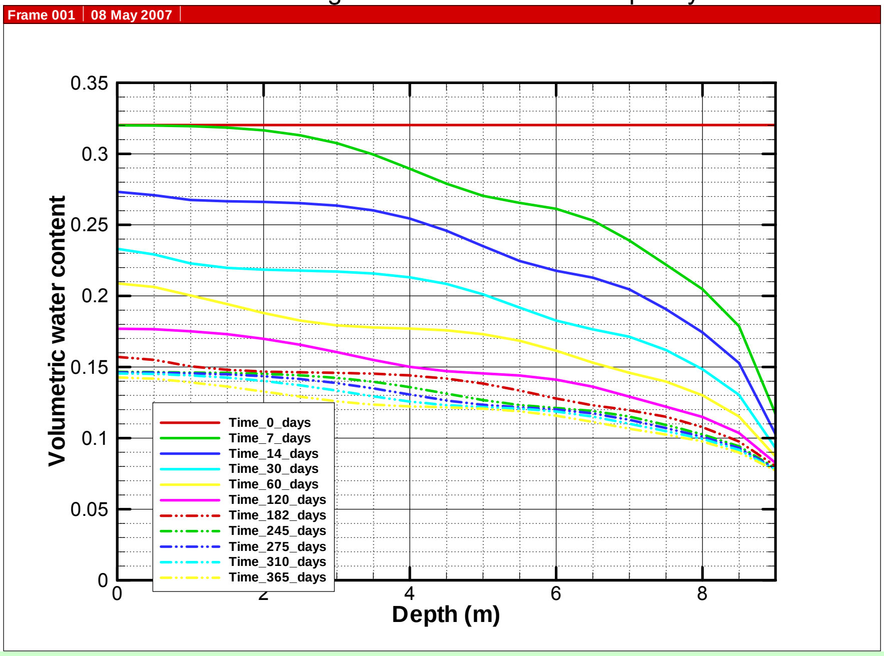
Coarse Tailings - 15ftHeadNoPrecip100yr



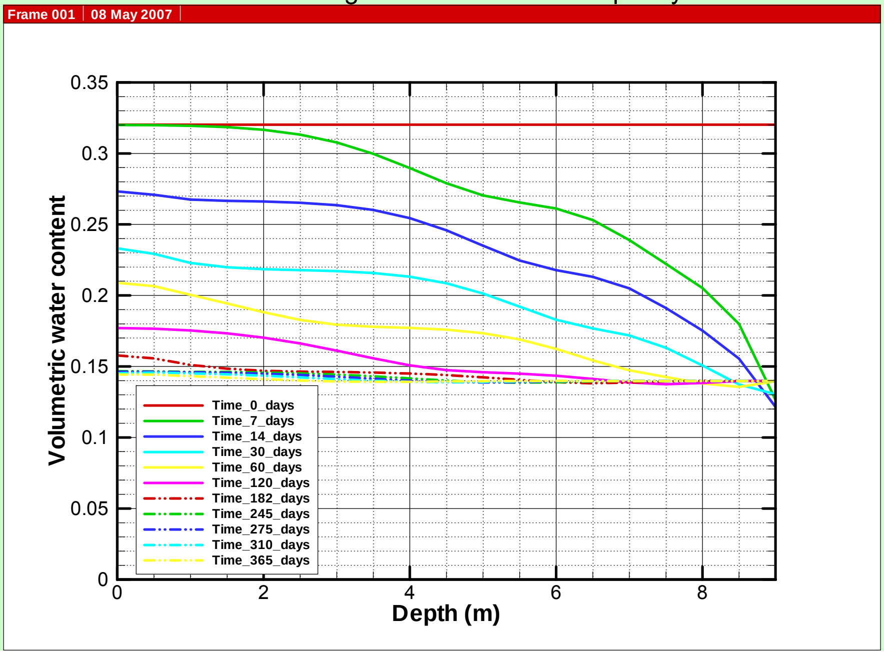

Coarse Tailings - 15ftHeadPrecip001yr

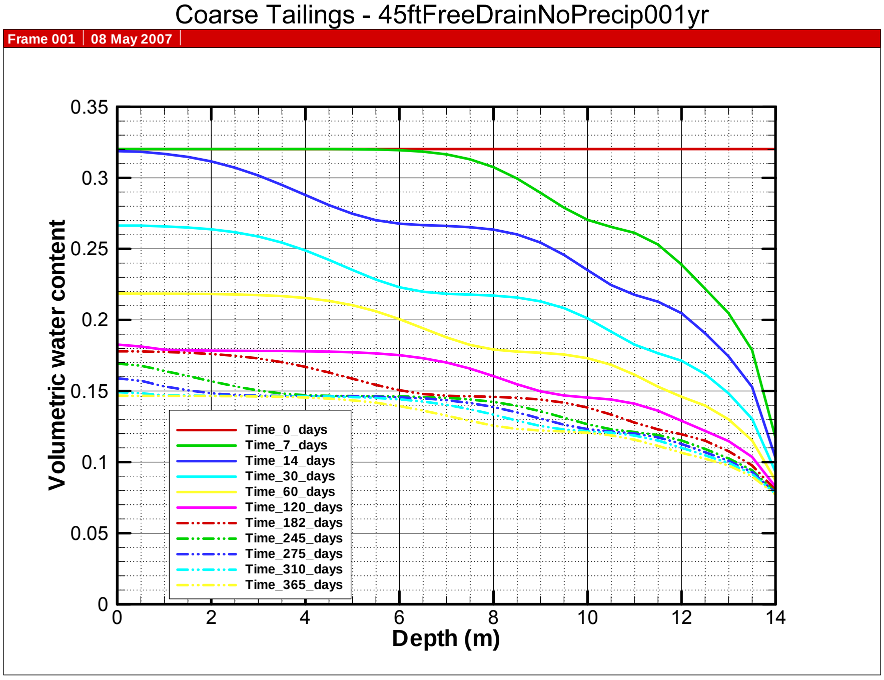

Coarse Tailings - 15ftHeadPrecip100yr

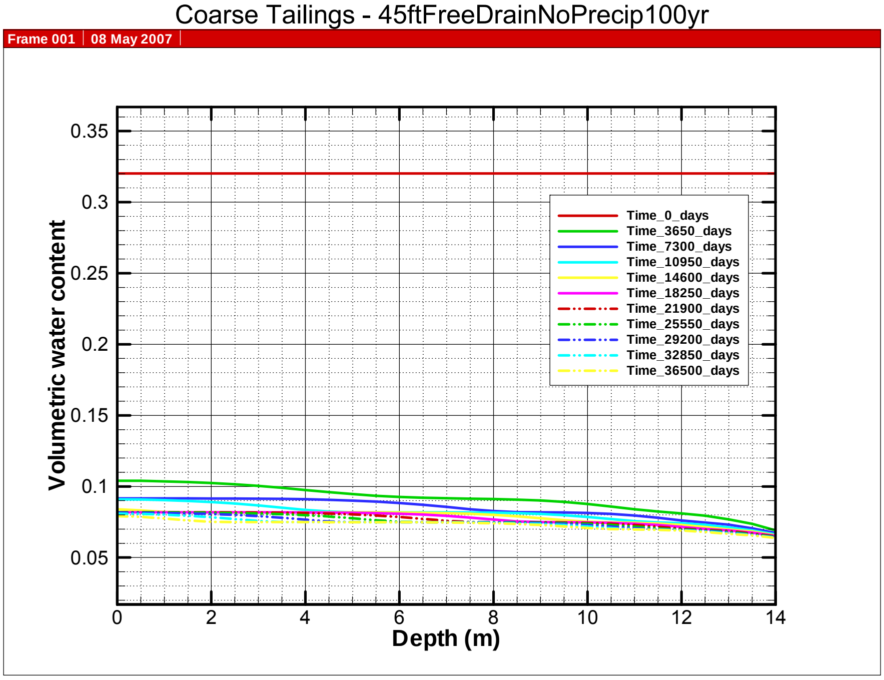
Coarse Tailings - 30ftFreeDrainNoPrecip001yr

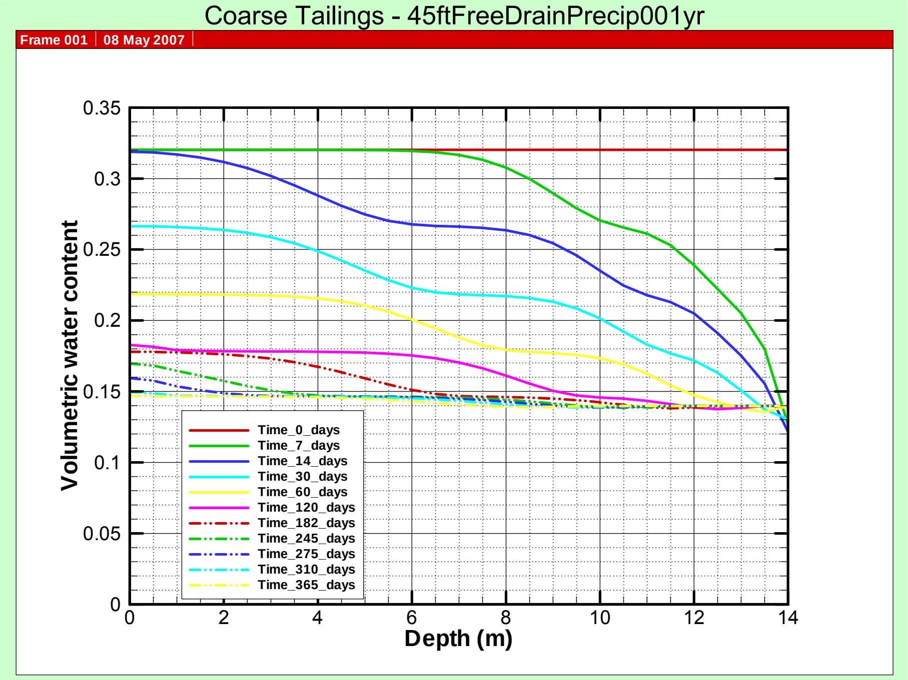


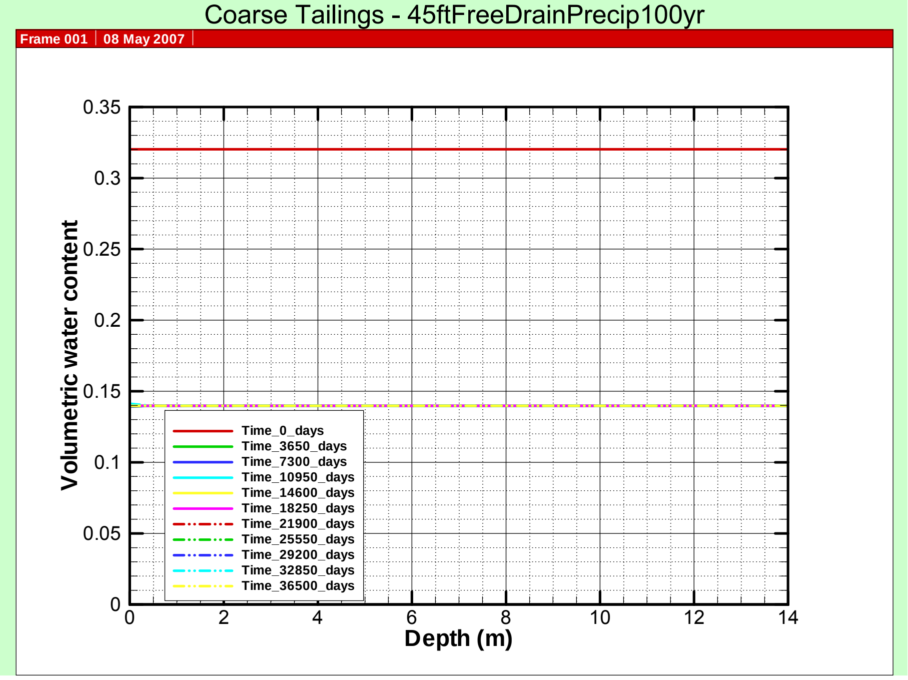
Coarse Tailings - 30ftFreeDrainPrecip001yr



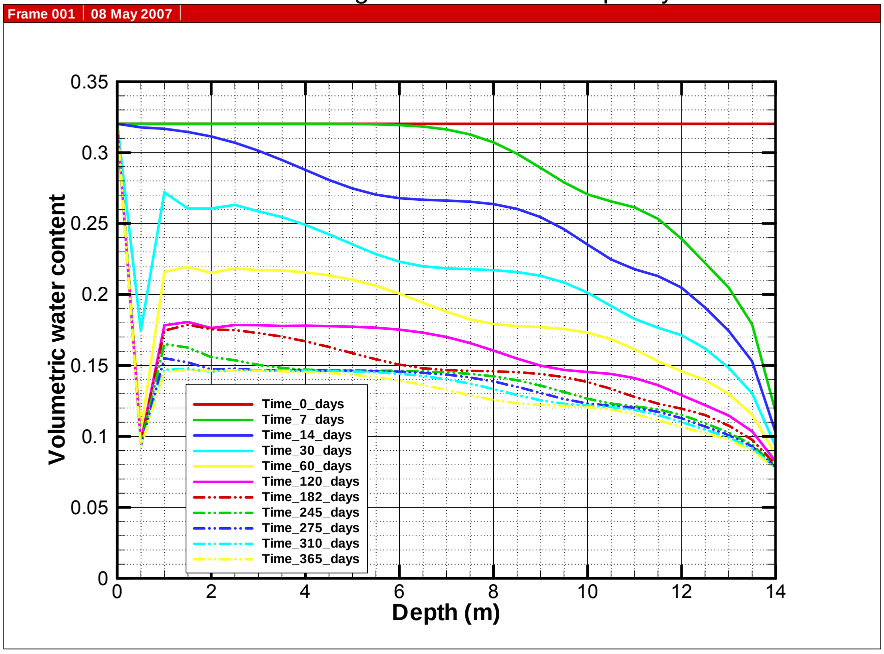

Coarse Tailings - 45ftFreeDrainNoPrecip001yr
Frame 001
08 May 2007
Volumetric water content
Depth (m)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
2
4
6
8
10
12
14
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days


Coarse Tailings - 45ftFreeDrainNoPrecip100yr
Frame 001
08 May 2007
Volumetric water content
Depth (m)
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
2
4
6
8
10
12
14
Time_0_days
Time_3650_days
Time_7300_days
Time_10950_days
Time_14600_days
Time_18250_days
Time_21900_days
Time_25550_days
Time_29200_days
Time_32850_days
Time_36500_days

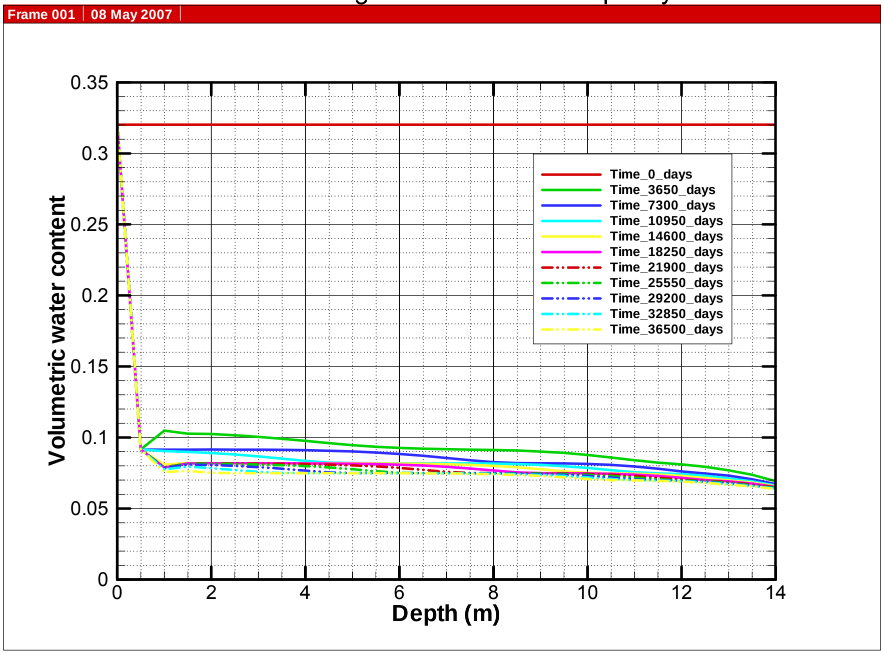

Coarse Tailings - 45ftFreeDrainPrecip001yr
Frame 001
08 May 2007
Volumetric water content
Depth (m)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
2
4
6
8
10
12
14
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days

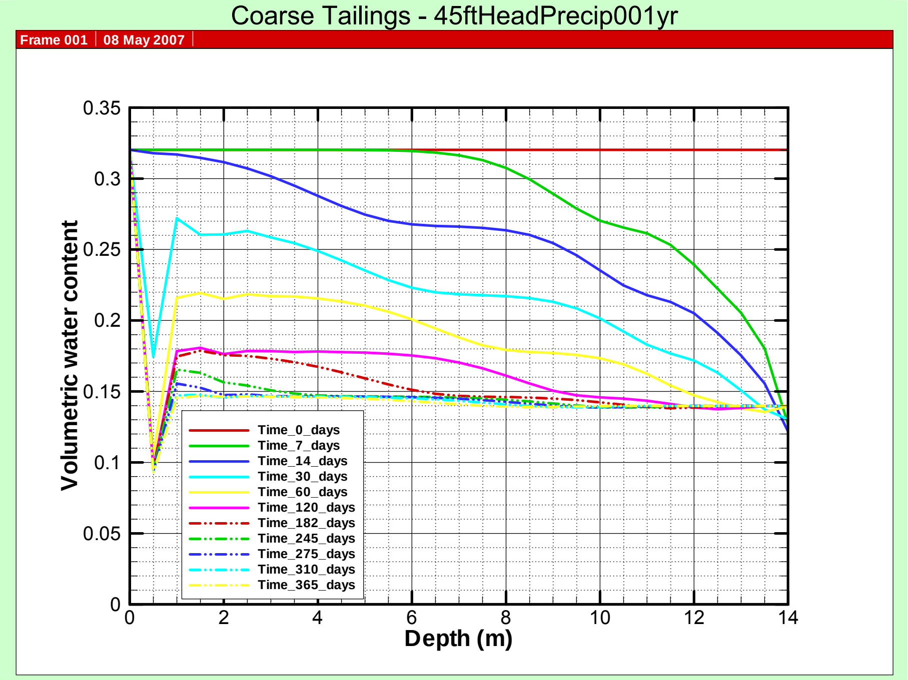

Coarse Tailings - 45ftFreeDrainPrecip100yr
Frame 001
08 May 2007
Volumetric water content
Depth (m)
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0
2
4
6
8
10
12
14
Time_0_days
Time_3650_days
Time_7300_days
Time_10950_days
Time_14600_days
Time_18250_days
Time_21900_days
Time_25550_days
Time_29200_days
Time_32850_days
Time_36500_days

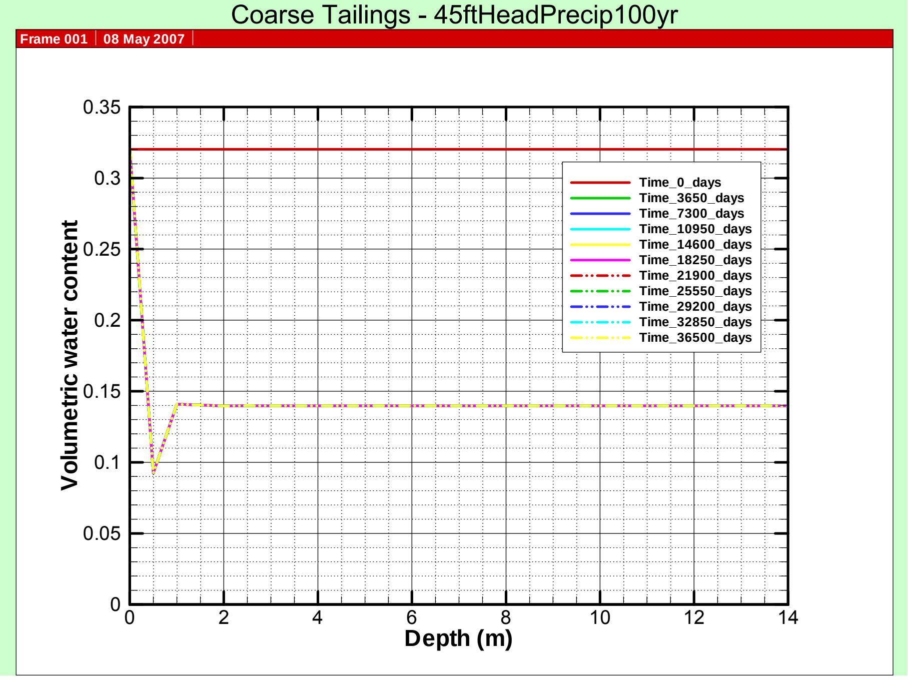
Coarse Tailings - 45ftHeadNoPrecip001yr



Coarse Tailings - 45ftHeadNoPrecip100yr




Coarse Tailings - 45ftHeadPrecip001yr
Frame 001 | 08 May 2007 |
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
2
4
6
8
10
12
14
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days


Coarse Tailings - 45ftHeadPrecip100yr
Frame 001 | 08 May 2007 |
Volumetric water content
0.35
0.3
0.25
0.2
0.15
0.1
0.05
0
Depth (m)
0
2
4
6
8
10
12
14
Time_0_days
Time_3650_days
Time_7300_days
Time_10950_days
Time_14600_days
Time_18250_days
Time_21900_days
Time_25550_days
Time_29200_days
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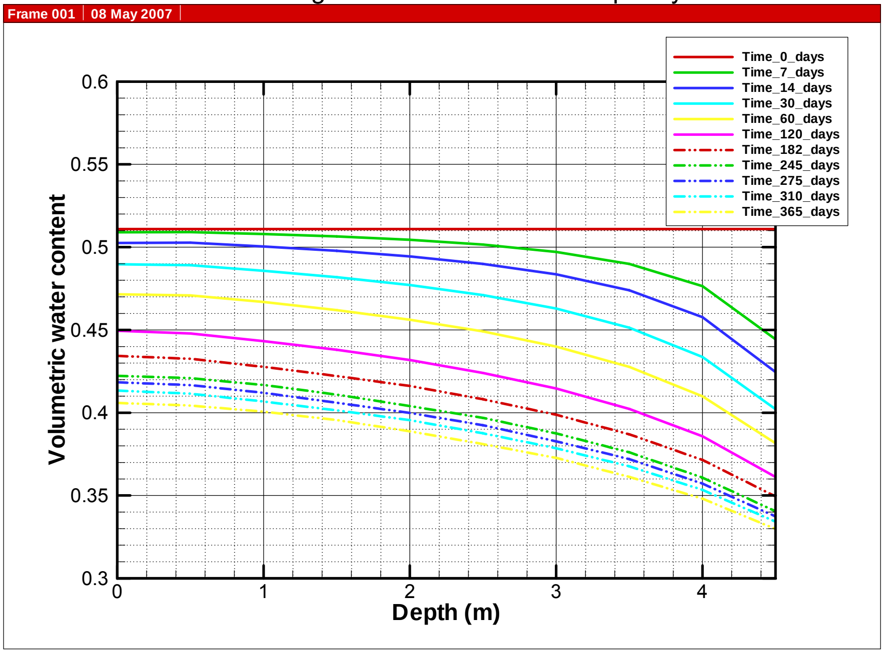
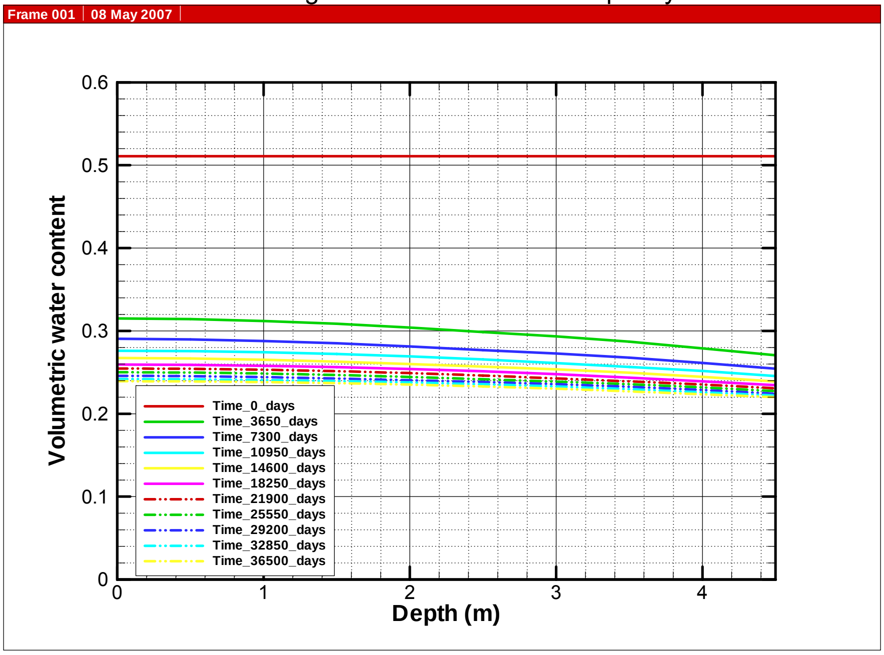
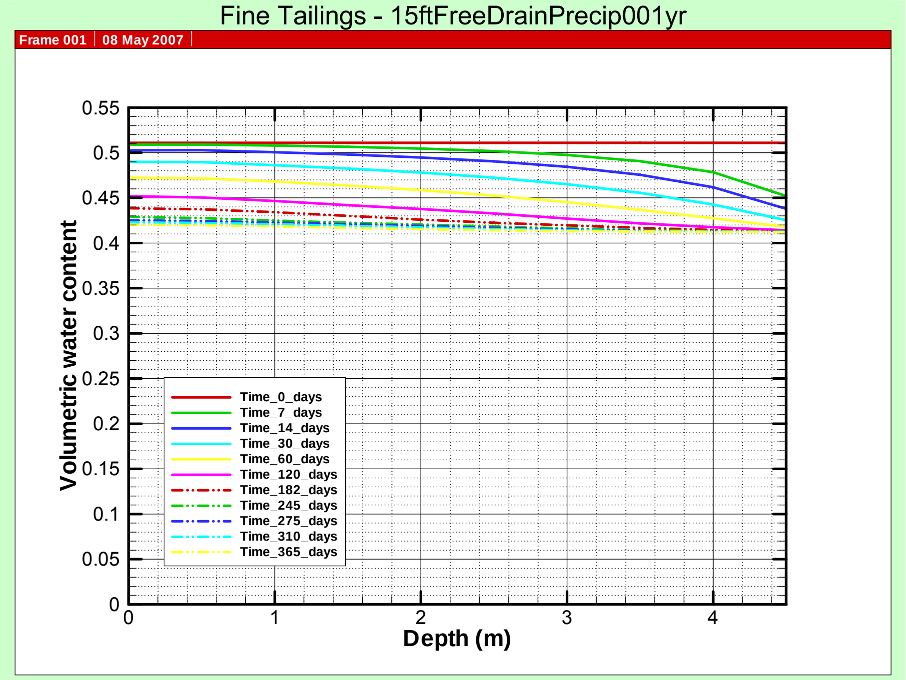
Time_36500_days

Fine Tailings - 15ftFreeDrainNoPrecip001yr

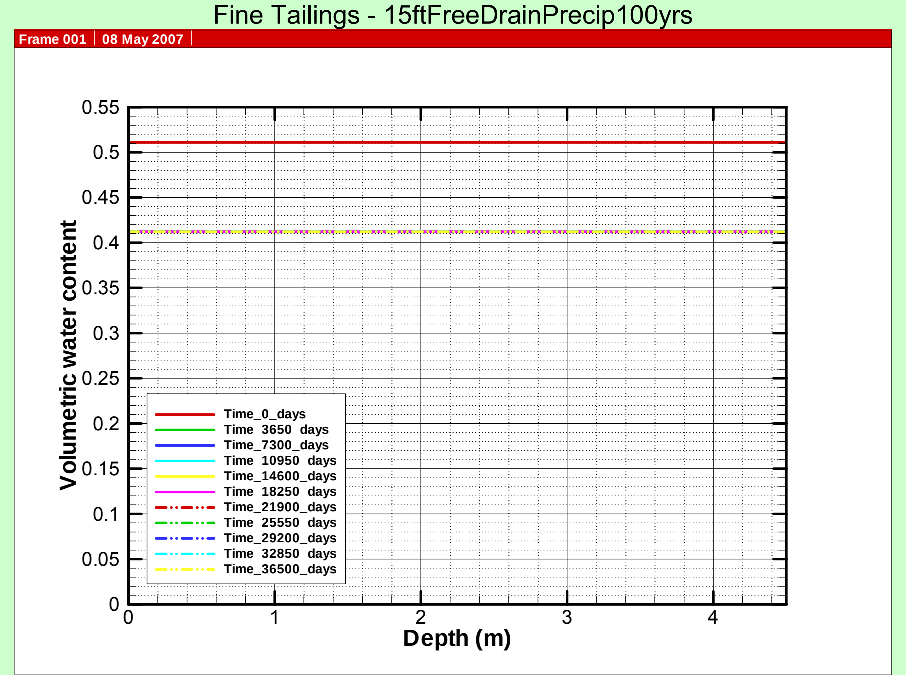


Fine Tailings - 15ftFreeDrainNoPrecip100yrs

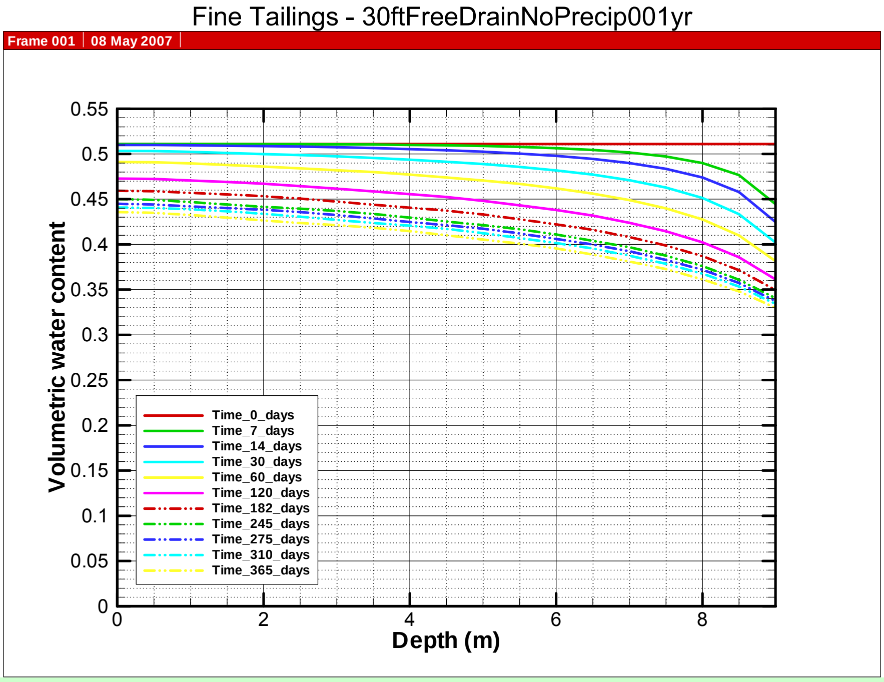


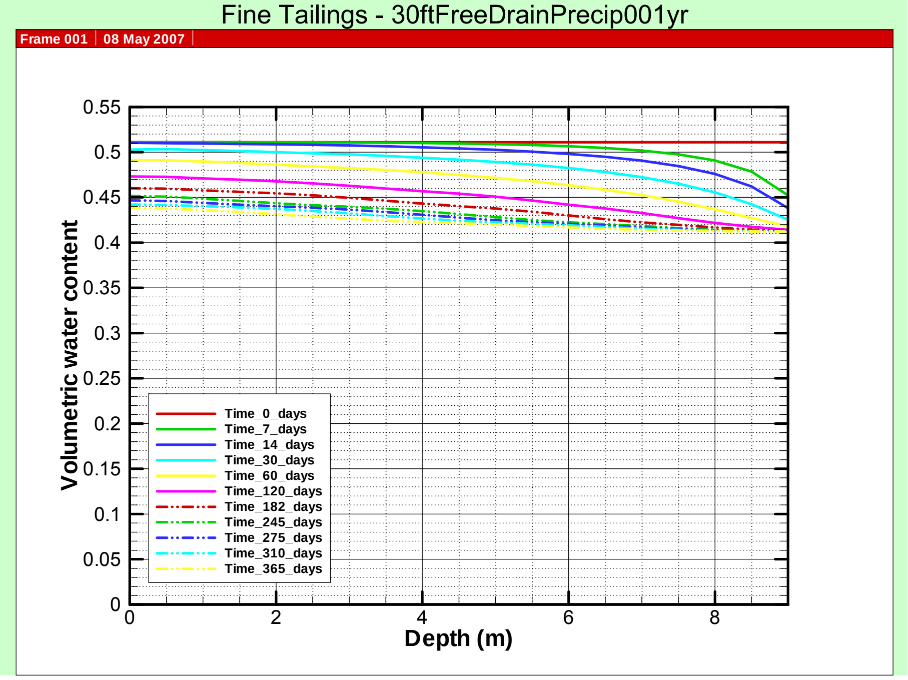


Fine Tailings - 15ftFreeDrainPrecip001yr

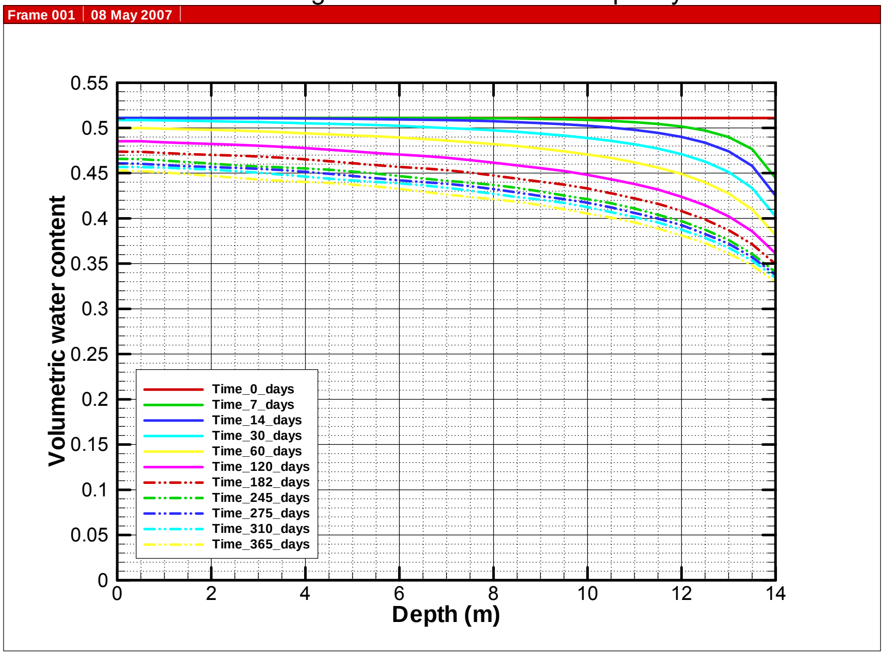


Fine Tailings - 15ftFreeDrainPrecip100yrs

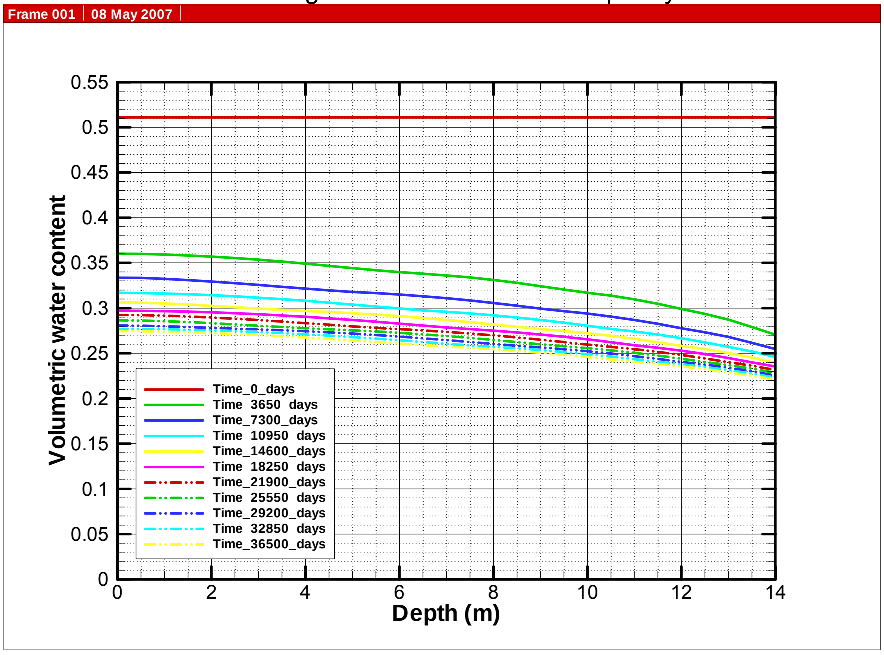

Fine Tailings - 30ftFreeDrainNoPrecip001yr
Frame 001
08 May 2007
Volumetric water content
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
Depth (m)
0
2
4
6
8
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days

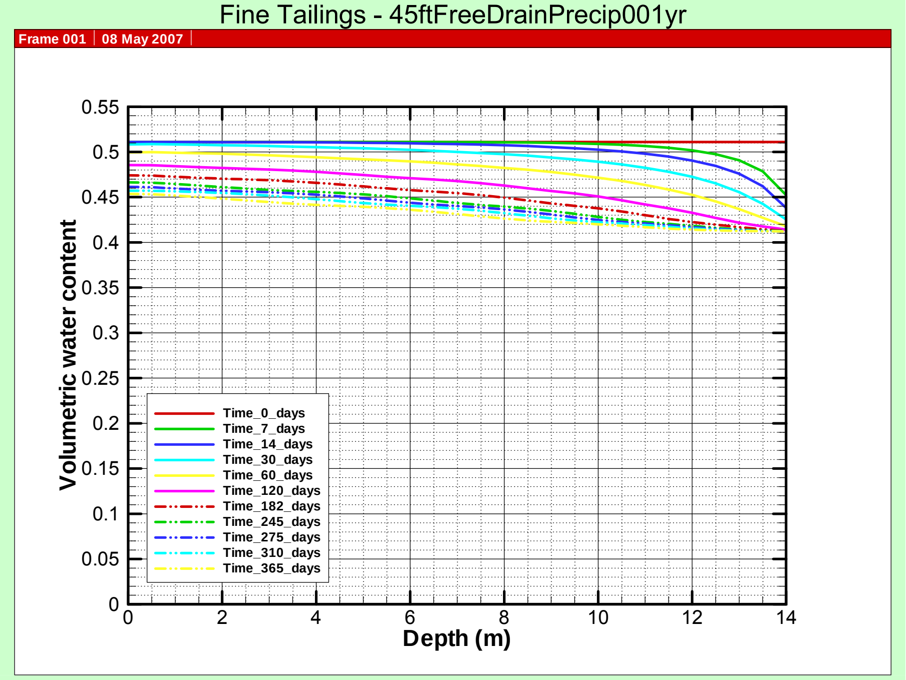

Fine Tailings - 30ftFreeDrainPrecip001yr
Frame 001
08 May 2007
Volumetric water content
0
0.05
0.1
0.15
0.2
0.25
0.3
0.35
0.4
0.45
0.5
0.55
Depth (m)
0
2
4
6
8
Time_0_days
Time_7_days
Time_14_days
Time_30_days
Time_60_days
Time_120_days
Time_182_days
Time_245_days
Time_275_days
Time_310_days
Time_365_days

Fine Tailings - 45ftFreeDrainNoPrecip001yr

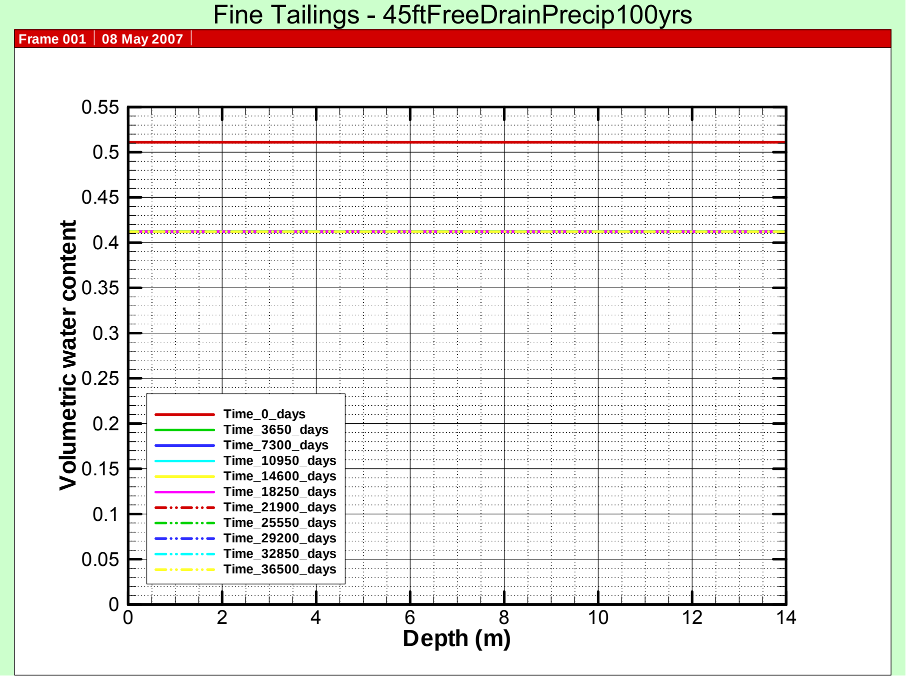


Fine Tailings - 45ftFreeDrainNoPrecip100yrs



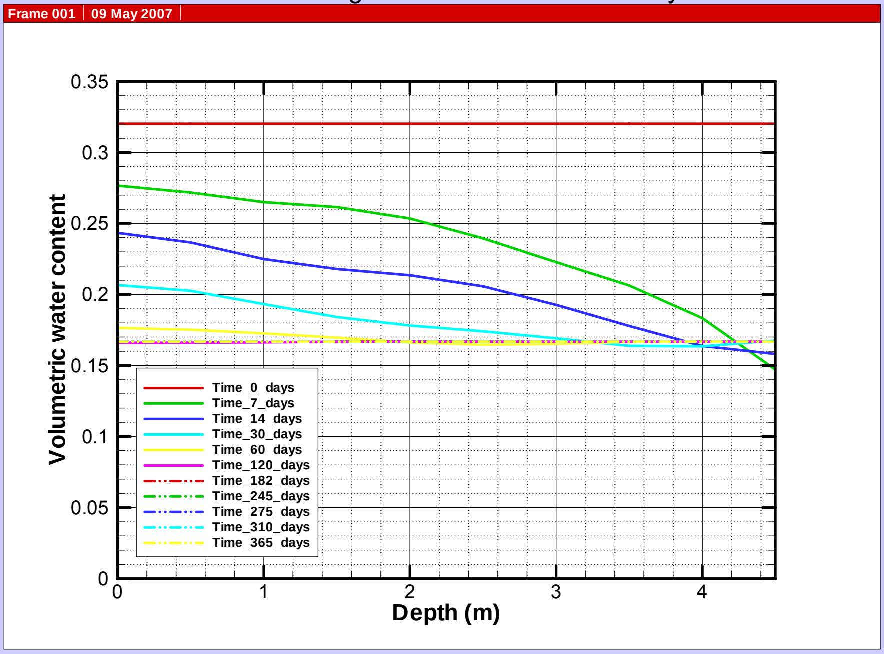


Fine Tailings - 45ftFreeDrainPrecip001yr

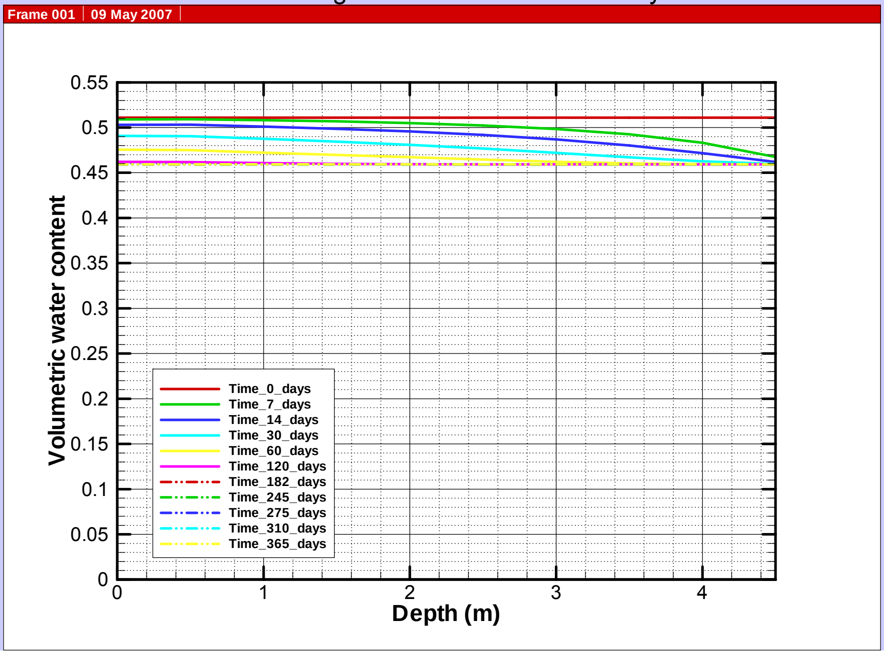


Fine Tailings - 45ftFreeDrainPrecip100yrs

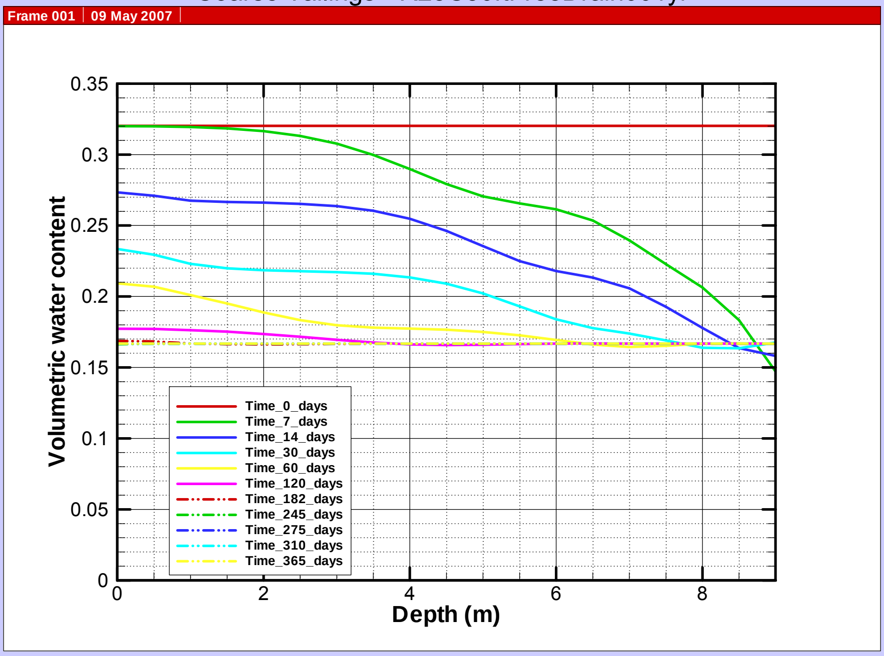
Coarse Tailings - R25C15ftFreeDrain001yr



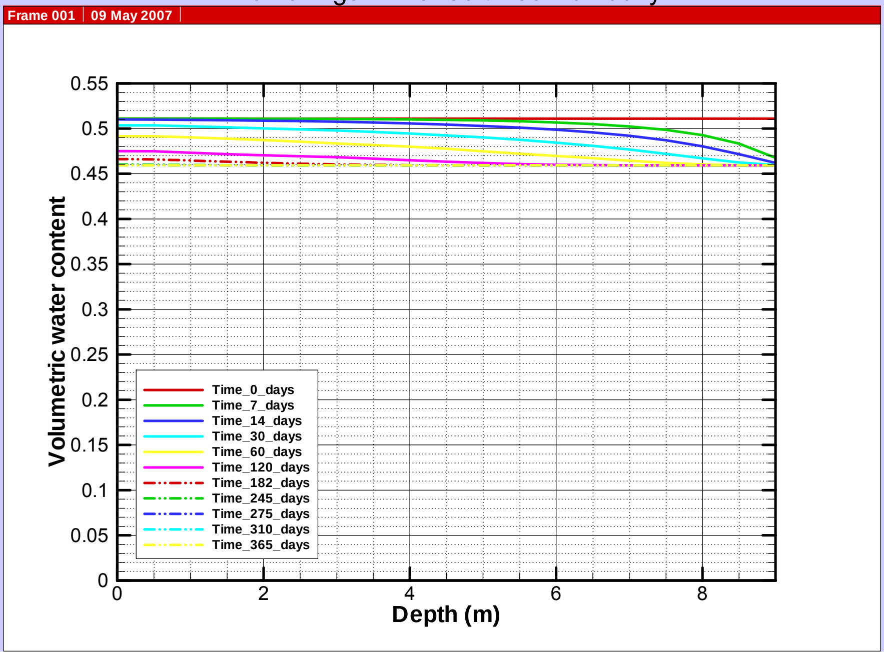
Fine Tailings - R25F15ftFreeDrain001yr

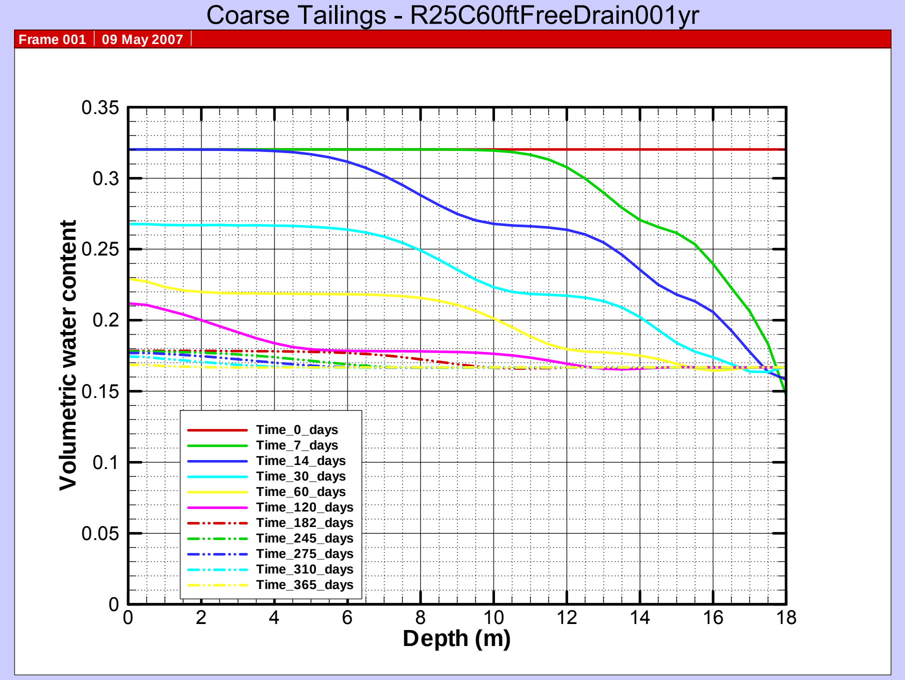


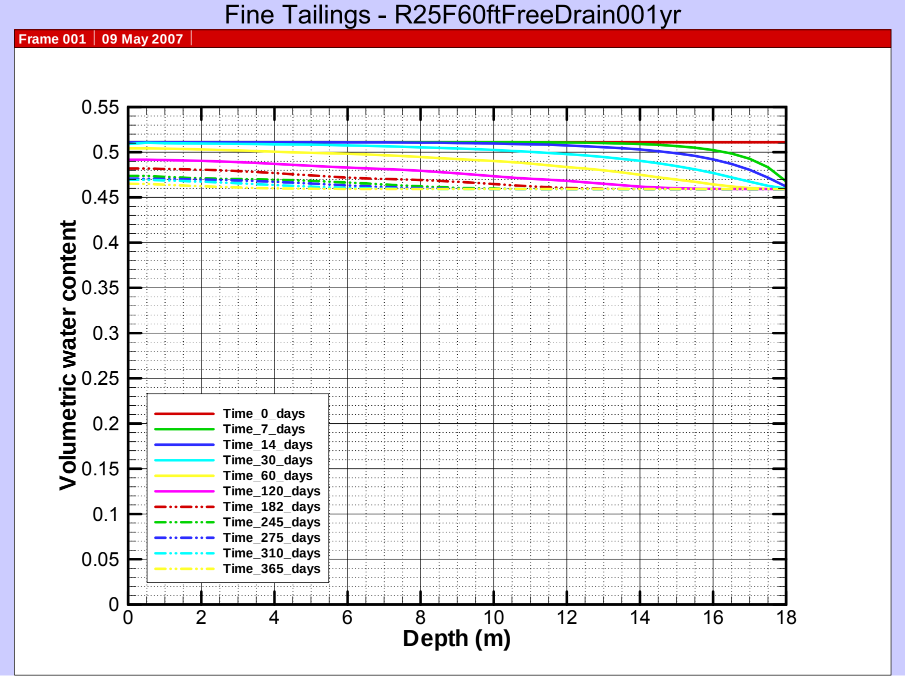
Coarse Tailings - R25C30ftFreeDrain001yr



Fine Tailings - R25F30ftFreeDrain001yr







4 Conclusions

The potential volumetric content of the coarse and fine tailings were assessed for a wide range of conditions, with column heights varied to simulate various lift heights during construction and development of the tailings embankment.

In general, the results show that the coarse tailings would be expected to drain down relatively rapidly (within a period of weeks to months) to a residual saturation of about 35 to 38 % (volumetric water content of about 0.17 to 0.19), with or without precipitation.

The fine tailings in contrast remain relatively saturated and do not drain down as rapidly as the coarse tailings. The results suggest that for the operational period, and for many years after active deposition ceases, the fine tailings will retain volumetric water content of about 0.45, i.e. a saturation of about 90 %. At about 100 years, the level of saturation is expected to decrease to about 0.4, i.e. a saturation of about 80 %.

5 References

Carsel, R.F., and Parrish, R. S. 1998. Developing joint probability distributions of soil water retention characteristics, Water Resour. Res, 24, 755-769.

Simunek, J., Sejna, M. and van Genuchten, M.Th. 1999. The HYDRUS-2D Software package for simulating the two-dimensional movement of water, heat, and multiple solutes in variably-saturated media, Version 2.0. U.S. Salinity Laboratory, Agricultural Research Services, U.S. Department of Agriculture, Riverside, California, USA, 227 pages.

Vogel, T., and M. Císlerová, On the reliability of unsaturated hydraulic conductivity calculated from the moisture retention curve, Transport in Porous Media, 3, 1-15, 1988.

Appendix D.2

Oxygen Transport Modelling Results

Coarse Tailings Oxygen Consumption Rates

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.001	0.002	0.001	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08
0.002	0.007	0.002	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08
0.007	0.023	0.008	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08
0.019	0.062	0.016	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08
0.043	0.141	0.032	7.26E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.27E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08
0.091	0.299	0.064	7.22E-08	7.23E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08	7.24E-08
0.181	0.593	0.1152	7.14E-08	7.17E-08	7.18E-08	7.18E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08
0.298	0.979	0.1202	7.04E-08	7.08E-08	7.1E-08	7.11E-08	7.11E-08	7.11E-08	7.11E-08	7.11E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08
0.421	1.381	0.1252	6.93E-08	7E-08	7.02E-08	7.03E-08	7.03E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08
0.549	1.800	0.1302	6.82E-08	6.9E-08	6.93E-08	6.95E-08	6.95E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08
0.681	2.236	0.1352	6.71E-08	6.81E-08	6.85E-08	6.86E-08	6.87E-08	6.88E-08	6.88E-08	6.88E-08	6.88E-08	6.88E-08	6.88E-08	6.88E-08	6.88E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08
0.819	2.687	0.1402	6.59E-08	6.71E-08	6.76E-08	6.78E-08	6.79E-08	6.79E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08
0.962	3.156	0.1452	6.47E-08	6.62E-08	6.67E-08	6.69E-08	6.7E-08	6.71E-08	6.71E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08
1.110	3.640	0.1502	6.35E-08	6.51E-08	6.57E-08	6.6E-08	6.61E-08	6.62E-08	6.63E-08	6.63E-08	6.63E-08	6.63E-08	6.63E-08	6.63E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08
1.262	4.141	0.1552	6.22E-08	6.41E-08	6.48E-08	6.51E-08	6.52E-08	6.53E-08	6.54E-08	6.54E-08	6.54E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08
1.420	4.658	0.1602	6.09E-08	6.3E-08	6.38E-08	6.41E-08	6.43E-08	6.44E-08	6.45E-08	6.45E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08
1.583	5.192	0.1652	5.96E-08	6.2E-08	6.28E-08	6.32E-08	6.34E-08	6.35E-08	6.36E-08	6.36E-08	6.36E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08
1.750	5.742	0.1702	5.83E-08	6.09E-08	6.18E-08	6.22E-08	6.24E-08	6.26E-08	6.26E-08	6.27E-08	6.27E-08	6.27E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08
1.923	6.309	0.1752	5.69E-08	5.98E-08	6.08E-08	6.12E-08	6.15E-08	6.16E-08	6.17E-08	6.18E-08	6.18E-08	6.18E-08	6.18E-08	6.18E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08
2.101	6.892	0.1802	5.55E-08	5.86E-08	5.97E-08	6.02E-08	6.05E-08	6.06E-08	6.07E-08	6.08E-08	6.08E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08
2.283	7.491	0.1852	5.41E-08	5.75E-08	5.87E-08	5.92E-08	5.95E-08	5.97E-08	5.98E-08	5.98E-08	5.99E-08	5.99E-08	5.99E-08	5.99E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08
2.471	8.107	0.1902	5.27E-08	5.63E-08	5.76E-08	5.82E-08	5.85E-08	5.87E-08	5.88E-08	5.89E-08	5.89E-08	5.89E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08
2.664	8.740	0.1952	5.13E-08	5.51E-08	5.65E-08	5.71E-08	5.75E-08	5.77E-08	5.78E-08	5.79E-08	5.79E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08	5.8E-08
2.862	9.388	0.2002	4.98E-08	5.4E-08	5.54E-08	5.61E-08	5.65E-08	5.67E-08	5.68E-08	5.69E-08	5.7E-08	5.7E-08	5.7E-08	5.7E-08	5.7E-08	5.7E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08
3.064	10.053	0.2052	4.84E-08	5.28E-08	5.43E-08	5.5E-08	5.54E-08	5.57E-08	5.58E-08	5.59E-08	5.6E-08	5.6E-08	5.6E-08	5.6E-08	5.6E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08
3.272	10.735	0.2102	4.69E-08	5.16E-08	5.32E-08	5.4E-08	5.44E-08	5.46E-08	5.48E-08	5.49E-08	5.5E-08	5.5E-08	5.5E-08	5.5E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08
3.485	11.432	0.2152	4.54E-08	5.03E-08	5.21E-08	5.29E-08	5.34E-08	5.36E-08	5.38E-08	5.39E-08	5.39E-08	5.4E-08	5.4E-08	5.4E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08
3.702	12.147	0.2202	4.39E-08	4.91E-08	5.1E-08	5.18E-08	5.23E-08	5.26E-08	5.27E-08	5.29E-08	5.29E-08	5.3E-08	5.3E-08	5.3E-08	5.3E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08
3.925	12.877	0.2252	4.25E-08	4.79E-08	4.98E-08	5.08E-08	5.13E-08	5.15E-08	5.17E-08	5.18E-08	5.19E-08	5.2E-08	5.2E-08	5.2E-08	5.2E-08	5.2E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08
4.153	13.624	0.2302	4.1E-08	4.67E-08	4.87E-08	4.97E-08	5.02E-08	5.05E-08	5.07E-08	5.08E-08	5.09E-08	5.09E-08	5.1E-08	5.1E-08	5.1E-08	5.1E-08	5.1E-08	5.1E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08
4.385	14.388	0.2352	3.95E-08	4.54E-08	4.76E-08	4.86E-08	4.91E-08	4.95E-08	4.97E-08	4.98E-08	4.99E-08	4.99E-08	5E-08	5E-08	5E-08	5E-08	5E-08	5E-08	5E-08	5E-08	5E-08	5E-08
4.623	15.168	0.2402	3.8E-08	4.42E-08	4.64E-08	4.75E-08	4.81E-08	4.84E-08	4.86E-08	4.88E-08	4.88E-08	4.89E-08	4.89E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08
4.866	15.964	0.2452	3.65E-08	4.29E-08	4.53E-08	4.64E-08	4.7E-08	4.74E-08	4.76E-08	4.77E-08	4.78E-08	4.79E-08	4.79E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08
5.114	16.777	0.2502	3.5E-08	4.17E-08	4.41E-08	4.53E-08	4.6E-08	4.63E-08	4.66E-08	4.67E-08	4.68E-08	4.69E-08	4.69E-08	4.69E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08
5.366	17.606	0.2552	3.36E-08	4.05E-08	4.3E-08	4.42E-08	4.49E-08	4.53E-08	4.55E-08	4.57E-08	4.58E-08	4.58E-08	4.59E-08	4.59E-08	4.59E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08
5.624	18.451	0.2602	3.21E-08	3.92E-08	4.19E-08	4.31E-08	4.38E-08	4.42E-08	4.45E-08	4.47E-08	4.48E-08	4.48E-08	4.49E-08	4.49E-08	4.49E-08	4.49E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08
5.887	19.313	0.2652	3.07E-08	3.8E-08	4.07E-08	4.21E-08	4.28E-08	4.32E-08	4.35E-08	4.36E-08	4.37E-08	4.38E-08	4.39E-08	4.39E-08	4.39E-08	4.39E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08
6.154	20.191	0.2702	2.93E-08	3.68E-08	3.96E-08	4.1E-08	4.17E-08	4.22E-08	4.24E-08	4.26E-08	4.27E-08	4.28E-08	4.29E-08	4.29E-08	4.29E-08	4.29E-08	4.29E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08
6.427	21.086	0.2752	2.79E-08	3.55E-08	3.85E-08	3.99E-08	4.07E-08	4.11E-08	4.14E-08	4.16E-08	4.17E-08	4.18E-08	4.19E-08	4.19E-08	4.19E-08	4.19E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08
6.705	21.997	0.2802	2.65E-08	3.43E-08	3.74E-08	3.88E-08	3.96E-08	4.01E-08	4.04E-08	4.06E-08	4.07E-08	4.08E-08	4.09E-08	4.09E-08	4.09E-08	4.09E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08
6.987	22.925	0.2852	2.51E-08	3.31E-08	3.62E-08	3.78E-08	3.86E-08	3.91E-08	3.94E-08	3.96E-08	3.97E-08	3.98E-08	3.99E-08	3.99E-08	3.99E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08
7.275	23.868	0.2902	2.38E-08	3.19E-08	3.51E-08	3.67E-08	3.76E-08	3.81E-08	3.84E-08	3.86E-08	3.87E-08	3.88E-08	3.89E-08	3.89E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08
7.568	24.829	0.2952	2.25E-08	3.07E-08	3.4E-08	3.57E-08	3.65E-08	3.71E-08	3.74E-08	3.76E-08	3.78E-08	3.78E-08	3.79E-08	3.79E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.8E-08	3.81E-08	3.81E-08
7.866	25.805	0.3002	2.12E-08	2.96E-08	3.29E-08	3.46E-08	3.55E-08	3.61E-08	3.64E-08	3.66E-08	3.68E-08	3.69E-08	3.69E-08	3.7E-08	3.7E-08	3.7E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08
8.168	26.799	0.3052	2E-08	2.84E-08	3.19E-08	3.36E-08	3.45E-08	3.51E-08	3.54E-08	3.57E-08	3.58E-08	3.59E-08	3.6E-08	3.6E-08	3.61E-08	3.61E-08	3.61E-08	3.61E-08	3.61E-08	3.61E-08	3.61E-08	3.61E-08
8.476	27.808	0.3102	1.88E-08	2.73E-08	3.08E-08	3.26E-08	3.35E-08	3.41E-08	3.45E-08	3.47E-08	3.49E-08	3.5E-08	3.5E-08	3.51E-08	3.51E-08	3.51E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08
8.789	28.834	0.3152	1.76E-08	2.62E-08	2.97E-08	3.15E-08	3.25E-08	3.31E-08	3.35E-08	3.38E-08	3.39E-08	3.4E-08	3.41E-08	3.41E-08	3.42E-08	3.42E-08	3.42E-08	3.42E-08	3.42E-08	3.43E-08	3.43E-08	3.43E-08
9.106	29.876	0.3202	1.65E-08	2.51E-08	2.87E-08	3.05E-08	3.16E-08	3.22E-08	3.26E-08	3.28E-08	3.3E-08	3.31E-08	3.32E-08	3.32E-08	3.32E-08	3.33E-08	3.33E-08	3.33E-08	3.33E-08	3.33E-08	3.33E-08	3.33E-08

Coarse Tailings Oxygen Consumption Rates

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
9.429	30.935	0.3252	1.54E-08	2.4E-08	2.77E-08	2.96E-08	3.06E-08	3.12E-08	3.16E-08	3.19E-08	3.21E-08	3.22E-08	3.22E-08	3.23E-08	3.23E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08
9.757	32.010	0.3302	1.43E-08	2.29E-08	2.67E-08	2.86E-08	2.97E-08	3.03E-08	3.07E-08	3.1E-08	3.11E-08	3.13E-08	3.13E-08	3.14E-08	3.14E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08
10.089	33.102	0.3352	1.33E-08	2.19E-08	2.57E-08	2.76E-08	2.87E-08	2.94E-08	2.98E-08	3.01E-08	3.02E-08	3.04E-08	3.04E-08	3.05E-08	3.05E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08
10.427	34.210	0.3402	1.23E-08	2.08E-08	2.47E-08	2.67E-08	2.78E-08	2.85E-08	2.89E-08	2.92E-08	2.94E-08	2.95E-08	2.96E-08	2.96E-08	2.97E-08	2.97E-08	2.97E-08	2.97E-08	2.97E-08	2.97E-08	2.98E-08	2.98E-08
10.770	35.334	0.3452	1.14E-08	1.98E-08	2.37E-08	2.57E-08	2.69E-08	2.76E-08	2.8E-08	2.83E-08	2.85E-08	2.86E-08	2.87E-08	2.87E-08	2.88E-08	2.88E-08	2.88E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08
11.118	36.475	0.3502	1.05E-08	1.89E-08	2.28E-08	2.48E-08	2.6E-08	2.67E-08	2.71E-08	2.74E-08	2.76E-08	2.77E-08	2.78E-08	2.79E-08	2.79E-08	2.8E-08	2.8E-08	2.8E-08	2.8E-08	2.8E-08	2.8E-08	2.8E-08
11.470	37.632	0.3552	9.68E-09	1.79E-08	2.18E-08	2.39E-08	2.51E-08	2.58E-08	2.63E-08	2.66E-08	2.68E-08	2.69E-08	2.7E-08	2.7E-08	2.71E-08	2.71E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08
11.828	38.805	0.3602	8.87E-09	1.7E-08	2.09E-08	2.3E-08	2.42E-08	2.5E-08	2.54E-08	2.57E-08	2.59E-08	2.61E-08	2.62E-08	2.62E-08	2.63E-08	2.63E-08	2.63E-08	2.63E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08
12.191	39.995	0.3652	8.12E-09	1.61E-08	2E-08	2.21E-08	2.34E-08	2.41E-08	2.46E-08	2.49E-08	2.51E-08	2.52E-08	2.53E-08	2.54E-08	2.55E-08	2.55E-08	2.55E-08	2.55E-08	2.55E-08	2.56E-08	2.56E-08	2.56E-08
12.558	41.202	0.3702	7.4E-09	1.52E-08	1.91E-08	2.13E-08	2.25E-08	2.33E-08	2.38E-08	2.41E-08	2.43E-08	2.44E-08	2.45E-08	2.46E-08	2.47E-08	2.47E-08	2.47E-08	2.47E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08
12.931	42.425	0.3752	6.73E-09	1.43E-08	1.83E-08	2.04E-08	2.17E-08	2.25E-08	2.3E-08	2.33E-08	2.35E-08	2.37E-08	2.38E-08	2.38E-08	2.39E-08	2.39E-08	2.39E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08
13.309	43.664	0.3802	6.1E-09	1.35E-08	1.74E-08	1.96E-08	2.09E-08	2.17E-08	2.22E-08	2.25E-08	2.27E-08	2.29E-08	2.3E-08	2.31E-08	2.31E-08	2.31E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08
13.691	44.919	0.3852	5.51E-09	1.27E-08	1.66E-08	1.88E-08	2.01E-08	2.09E-08	2.14E-08	2.18E-08	2.2E-08	2.21E-08	2.22E-08	2.23E-08	2.23E-08	2.24E-08	2.24E-08	2.24E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08
14.079	46.191	0.3902	4.96E-09	1.19E-08	1.58E-08	1.8E-08	1.93E-08	2.01E-08	2.06E-08	2.1E-08	2.12E-08	2.14E-08	2.15E-08	2.16E-08	2.16E-08	2.16E-08	2.17E-08	2.17E-08	2.17E-08	2.17E-08	2.17E-08	2.17E-08
14.472	47.480	0.3952	4.45E-09	1.12E-08	1.51E-08	1.73E-08	1.86E-08	1.94E-08	1.99E-08	2.03E-08	2.05E-08	2.06E-08	2.08E-08	2.08E-08	2.09E-08	2.09E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08
14.870	48.784	0.4002	3.98E-09	1.05E-08	1.43E-08	1.65E-08	1.78E-08	1.87E-08	1.92E-08	1.95E-08	1.98E-08	1.99E-08	2E-08	2.01E-08	2.02E-08	2.02E-08	2.02E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08
15.272	50.106	0.4052	3.55E-09	9.8E-09	1.36E-08	1.58E-08	1.71E-08	1.79E-08	1.85E-08	1.88E-08	1.91E-08	1.92E-08	1.93E-08	1.94E-08	1.95E-08	1.95E-08	1.96E-08	1.96E-08	1.96E-08	1.96E-08	1.96E-08	1.96E-08
15.680	51.443	0.4102	3.16E-09	9.14E-09	1.29E-08	1.51E-08	1.64E-08	1.72E-08	1.78E-08	1.82E-08	1.84E-08	1.86E-08	1.87E-08	1.87E-08	1.88E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.89E-08	1.9E-08
16.093	52.797	0.4152	2.79E-09	8.51E-09	1.22E-08	1.44E-08	1.57E-08	1.66E-08	1.71E-08	1.75E-08	1.77E-08	1.79E-08	1.8E-08	1.81E-08	1.81E-08	1.82E-08	1.82E-08	1.82E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08
16.510	54.168	0.4202	2.46E-09	7.91E-09	1.15E-08	1.37E-08	1.5E-08	1.59E-08	1.64E-08	1.68E-08	1.71E-08	1.72E-08	1.74E-08	1.74E-08	1.75E-08	1.75E-08	1.76E-08	1.76E-08	1.76E-08	1.76E-08	1.76E-08	1.77E-08
16.933	55.554	0.4252	2.16E-09	7.34E-09	1.09E-08	1.3E-08	1.44E-08	1.52E-08	1.58E-08	1.62E-08	1.64E-08	1.66E-08	1.67E-08	1.68E-08	1.69E-08	1.69E-08	1.7E-08	1.7E-08	1.7E-08	1.7E-08	1.7E-08	1.7E-08
17.361	56.958	0.4302	1.89E-09	6.8E-09	1.03E-08	1.24E-08	1.37E-08	1.46E-08	1.52E-08	1.56E-08	1.58E-08	1.6E-08	1.61E-08	1.62E-08	1.63E-08	1.63E-08	1.63E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08
17.793	58.377	0.4352	1.65E-09	6.28E-09	9.66E-09	1.18E-08	1.31E-08	1.4E-08	1.45E-08	1.49E-08	1.52E-08	1.54E-08	1.55E-08	1.56E-08	1.57E-08	1.57E-08	1.57E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08
18.231	59.813	0.4402	1.43E-09	5.79E-09	9.08E-09	1.12E-08	1.25E-08	1.34E-08	1.4E-08	1.44E-08	1.46E-08	1.48E-08	1.49E-08	1.5E-08	1.51E-08	1.51E-08	1.52E-08	1.52E-08	1.52E-08	1.52E-08	1.52E-08	1.52E-08
18.674	61.266	0.4452	1.24E-09	5.33E-09	8.53E-09	1.06E-08	1.19E-08	1.28E-08	1.34E-08	1.38E-08	1.4E-08	1.42E-08	1.43E-08	1.44E-08	1.45E-08	1.46E-08	1.46E-08	1.46E-08	1.46E-08	1.47E-08	1.47E-08	1.47E-08
19.122	62.735	0.4502	1.06E-09	4.9E-09	8E-09	1.01E-08	1.14E-08	1.22E-08	1.28E-08	1.32E-08	1.35E-08	1.37E-08	1.38E-08	1.39E-08	1.4E-08	1.4E-08	1.4E-08	1.41E-08	1.41E-08	1.41E-08	1.41E-08	1.41E-08
19.574	64.220	0.4552	9.11E-10	4.49E-09	7.5E-09	9.51E-09	1.08E-08	1.17E-08	1.23E-08	1.27E-08	1.29E-08	1.31E-08	1.33E-08	1.33E-08	1.34E-08	1.35E-08	1.35E-08	1.35E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08
20.032	65.721	0.4602	7.76E-10	4.1E-09	7.01E-09	8.99E-09	1.03E-08	1.12E-08	1.17E-08	1.21E-08	1.24E-08	1.26E-08	1.27E-08	1.28E-08	1.29E-08	1.29E-08	1.3E-08	1.3E-08	1.3E-08	1.3E-08	1.31E-08	1.31E-08
20.495	67.240	0.4652	6.59E-10	3.74E-09	6.54E-09	8.49E-09	9.78E-09	1.06E-08	1.12E-08	1.16E-08	1.19E-08	1.21E-08	1.22E-08	1.23E-08	1.24E-08	1.24E-08	1.25E-08	1.25E-08	1.25E-08	1.25E-08	1.26E-08	1.26E-08
20.962	68.774	0.4702	5.56E-10	3.4E-09	6.1E-09	8.01E-09	9.28E-09	1.01E-08	1.07E-08	1.11E-08	1.14E-08	1.16E-08	1.17E-08	1.18E-08	1.19E-08	1.19E-08	1.2E-08	1.2E-08	1.2E-08	1.21E-08	1.21E-08	1.21E-08
21.435	70.325	0.4752	4.68E-10	3.09E-09	5.68E-09	7.54E-09	8.8E-09	9.65E-09	1.02E-08	1.06E-08	1.09E-08	1.11E-08	1.12E-08	1.13E-08	1.14E-08	1.15E-08	1.15E-08	1.15E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08
21.913	71.892	0.4802	3.91E-10	2.8E-09	5.28E-09	7.09E-09	8.34E-09	9.18E-09	9.75E-09	1.02E-08	1.04E-08	1.06E-08	1.08E-08	1.09E-08	1.1E-08	1.1E-08	1.1E-08	1.11E-08	1.11E-08	1.11E-08	1.11E-08	1.11E-08
22.395	73.476	0.4852	3.26E-10	2.53E-09	4.9E-09	6.67E-09	7.89E-09	8.73E-09	9.3E-09	9.72E-09	9.99E-09	1.02E-08	1.03E-08	1.04E-08	1.05E-08	1.06E-08	1.06E-08	1.06E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08
22.883	75.076	0.4902	2.7E-10	2.28E-09	4.54E-09	6.26E-09	7.46E-09	8.29E-09	8.86E-09	9.28E-09	9.55E-09	9.75E-09	9.89E-09	9.99E-09	1.01E-08	1.01E-08	1.02E-08	1.02E-08	1.02E-08	1.02E-08	1.03E-08	1.03E-08
23.376	76.692	0.4952	2.22E-10	2.05E-09	4.2E-09	5.87E-09	7.05E-09	7.87E-09	8.43E-09	8.85E-09	9.13E-09	9.33E-09	9.47E-09	9.57E-09	9.65E-09	9.71E-09	9.75E-09	9.78E-09	9.81E-09	9.83E-09	9.84E-09	9.85E-09
23.875	78.328	0.5022	1.82E-10	1.83E-09	3.87E-09	5.49E-09	6.65E-09	7.46E-09	8.02E-09	8.44E-09	8.72E-09	8.92E-09	9.06E-09	9.17E-09	9.24E-09	9.3E-09	9.35E-09	9.38E-09	9.4E-09	9.42E-09	9.44E-09	9.45E-09
24.380	79.988	0.5092	1.48E-10	1.64E-09	3.57E-09	5.13E-09	6.27E-09	7.07E-09	7.63E-09	8.04E-09	8.32E-09	8.52E-09	8.66E-09	8.77E-09	8.85E-09	8.91E-09	8.95E-09	8.99E-09	9.01E-09	9.03E-09	9.04E-09	9.05E-09
24.893	81.670	0.5162	1.2E-10	1.46E-09	3.28E-09	4.79E-09	5.9E-09	6.68E-09	7.24E-09	7.66E-09	7.93E-09	8.13E-09	8.28E-09	8.39E-09	8.47E-09	8.53E-09	8.57E-09	8.61E-09	8.63E-09	8.65E-09	8.66E-09	8.67E-09
25.413	83.375	0.5232	9.61E-11	1.29E-09	3E-09	4.46E-09	5.54E-09	6.32E-09	6.87E-09	7.28E-09	7.56E-09	7.76E-09	7.91E-09	8.02E-09	8.1E-09	8.16E-09	8.2E-09	8.24E-09	8.26E-09	8.28E-09	8.3E-09	8.31E-09
25.939	85.103	0.5302	7.66E-11	1.14E-09	2.75E-09	4.15E-09	5.2E-09	5.96E-09	6.51E-09	6.92E-09	7.2E-09	7.4E-09	7.55E-09	7.66E-09	7.74E-09	7.8E-09	7.85E-09	7.88E-09	7.91E-09	7.93E-09	7.94E-09	7.95E-09
26.473	86.854	0.5372	6.07E-11	1.01E-09	2.51E-09	3.85E-09	4.88E-09	5.62E-09	6.16E-09	6.57E-09	6.85E-09	7.05E-09	7.2E-09	7.31E-09	7.39E-09	7.46E-09	7.5E-09	7.54E-09	7.56E-09	7.58E-09	7.6E-09	7.61E-09
27.014	88.628	0.5442	4.78E-11	8.86E-10	2.28E-09	3.57E-09	4.56E-09	5.3E-09	5.83E-09	6.24E-09	6.51E-09	6.72E-09	6.87E-09	6.98E-09	7.06E-09	7.12E-09	7.17E-09	7.2E-09	7.23E-09	7.25E-09	7.27E-09	7.28E-09
27.561	90.425	0.5512	3.73E-11	7.75E-10	2.08E-09	3.3E-09	4.27E-09	4.98E-09	5.51E-09	5.91E-09	6.19E-09	6.39E-09	6.54E-09	6.65E-09	6.74E-09	6.8E-09	6.85E-09	6.88E-09	6.91E-09	6.93E-09	6.95E-09	6.96E-09
28.116	92.244	0.5582	2.89E-11	6.76E-10	1.88E-09	3.05E-09	3.98E-09	4.68E-09	5.2E-09	5.6E-09	5.88E-09	6.08E-09	6.23E-09	6.34E-09	6.43E-09	6.49E-09	6.54E-09	6.58E-09	6.6E-09	6.62E-09	6.64E-09	6.65E-09
28.678	94.087	0.5652	2.23E-11	5.87E-10	1.7E-09	2.81E-09	3.71E-09	4.4E-09	4.91E-09	5.3E-09	5.58E-09	5.78E-09	5.93E-09	6.05E-09	6.13E-09	6.19E-09	6.24E-09	6.28E-09	6.31E-09	6.33E-09	6.34E-09	6.35E-09
29.247	95.953	0.5722	1.7E-11	5.07E-10	1.53E-09	2.58E-09	3.45E-09	4.12E-09	4.62E-09	5.02E-09	5.29E-09	5.49E-09	5.64E-09	5.76E-09	5.84E-09	5.91E-09	5.96E-09	5.99E-09	6.02E-09	6.04E-09	6.06E-09	6.07E-09
29.822	97.842	0.5792	1.29E-11	4.37E-10	1.38E-09	2.37E-09	3.21E-09	3.86E-09	4.35E-09	4.74E-09	5.01E-09	5.22E-09	5.37E-09	5.48E-09	5.57E-09	5.63E-09	5.68E-09	5.72E-09	5.75E-09	5.77E-09	5.79E-09	5.8E-09
30.405	99.754	0.5862	9.68E-12	3.75E-10	1.24E-09	2.17E-09	2.98E-09	3.61E-09	4.09E-09	4.48E-09	4.75E-09	4.95E-09	5.1E-09	5.22E-09	5.3E-09	5.37E-09	5.42E-09	5.46E-09	5.49E-09	5.51E-09	5.52E-09	5.54E-09
30.995	101.688	0.5932	7.22E-12	3.2E-10	1.1E-09	1.99E-09	2.76E-09	3.37E-09	3.85E-09	4.23E-09	4.5E-09	4.7E-09	4.85E-09	4.97E-09	5.05E-09	5.12E-09	5.17E-09	5.21E-09	5.23E-09	5.26E-09	5.27E-09	5.29E-09
31.591	103.646	0.6002	5.34E-12	2.73E-10	9.85E-10	1.81E-09	2.55E-09	3.15E-09	3.61E-09	3.99E-09	4.25E-09	4.45E-09	4.61E-09	4.72E-09	4.81E-09	4.88E-09	4.93E-09	4.97E-09	5E-09	5.02E-09	5.03E-09	5.05E-09
32.195	105.627	0.6072	3.92E-12	2.31E-10	8.76E-10	1.65E-09	2.36E-09	2.93E-09	3.39E-09	3.76E-09	4.02E-09	4.22E-09	4.38E-09	4.49E-09	4.58E-09	4.65E-09	4.7E-09	4.74E-09	4.77E-09	4.79E-09	4.81E-09	4.82E-09

Coarse Tailings Oxygen Consumption Rates

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
32.806	107.630	0.6142	2.85E-12	1.95E-10	7.77E-10	1.5E-09	2.17E-09	2.73E-09	3.18E-09	3.54E-09	3.8E-09	4E-09	4.16E-09	4.27E-09	4.36E-09	4.43E-09	4.48E-09	4.52E-09	4.55E-09	4.57E-09	4.59E-09	4.6E-09
33.423	109.657	0.6212	2.05E-12	1.63E-10	6.86E-10	1.36E-09	2E-09	2.54E-09	2.98E-09	3.34E-09	3.59E-09	3.79E-09	3.95E-09	4.06E-09	4.15E-09	4.22E-09	4.27E-09	4.31E-09	4.34E-09	4.36E-09	4.38E-09	4.39E-09
34.048	111.706	0.6282	1.47E-12	1.37E-10	6.05E-10	1.23E-09	1.84E-09	2.36E-09	2.78E-09	3.14E-09	3.4E-09	3.59E-09	3.75E-09	3.86E-09	3.95E-09	4.02E-09	4.07E-09	4.11E-09	4.14E-09	4.17E-09	4.18E-09	4.2E-09
34.680	113.779	0.6352	1.04E-12	1.14E-10	5.32E-10	1.11E-09	1.69E-09	2.19E-09	2.61E-09	2.95E-09	3.21E-09	3.41E-09	3.56E-09	3.68E-09	3.77E-09	3.83E-09	3.89E-09	3.93E-09	3.96E-09	3.98E-09	4E-09	4.01E-09
35.319	115.874	0.6422	7.28E-13	9.4E-11	4.66E-10	1E-09	1.55E-09	2.03E-09	2.44E-09	2.78E-09	3.03E-09	3.23E-09	3.38E-09	3.5E-09	3.59E-09	3.66E-09	3.71E-09	3.75E-09	3.78E-09	3.8E-09	3.82E-09	3.83E-09
35.964	117.993	0.6492	5.06E-13	7.74E-11	4.06E-10	9.01E-10	1.42E-09	1.88E-09	2.28E-09	2.61E-09	2.86E-09	3.06E-09	3.21E-09	3.33E-09	3.42E-09	3.49E-09	3.54E-09	3.58E-09	3.61E-09	3.64E-09	3.65E-09	3.67E-09
36.617	120.134	0.6562	3.49E-13	6.34E-11	3.54E-10	8.09E-10	1.3E-09	1.75E-09	2.13E-09	2.46E-09	2.71E-09	2.9E-09	3.05E-09	3.17E-09	3.26E-09	3.33E-09	3.39E-09	3.43E-09	3.46E-09	3.48E-09	3.5E-09	3.51E-09
37.283	122.320	0.6762	2.37E-13	5.16E-11	3.06E-10	7.24E-10	1.18E-09	1.61E-09	1.99E-09	2.31E-09	2.56E-09	2.75E-09	2.9E-09	3.02E-09	3.11E-09	3.18E-09	3.24E-09	3.28E-09	3.31E-09	3.33E-09	3.35E-09	3.36E-09
37.969	124.571	0.6962	1.58E-13	4.16E-11	2.64E-10	6.45E-10	1.08E-09	1.49E-09	1.85E-09	2.18E-09	2.42E-09	2.61E-09	2.76E-09	2.88E-09	2.97E-09	3.04E-09	3.09E-09	3.14E-09	3.17E-09	3.19E-09	3.21E-09	3.22E-09
38.676	126.888	0.7162	1.04E-13	3.32E-11	2.26E-10	5.73E-10	9.8E-10	1.38E-09	1.73E-09	2.05E-09	2.29E-09	2.48E-09	2.63E-09	2.75E-09	2.84E-09	2.91E-09	2.96E-09	3E-09	3.03E-09	3.06E-09	3.08E-09	3.09E-09
39.402	129.271	0.7362	6.67E-14	2.62E-11	1.92E-10	5.08E-10	8.89E-10	1.27E-09	1.61E-09	1.92E-09	2.16E-09	2.35E-09	2.5E-09	2.62E-09	2.71E-09	2.78E-09	2.84E-09	2.88E-09	2.91E-09	2.93E-09	2.95E-09	2.97E-09
40.148	131.719	0.7562	4.21E-14	2.05E-11	1.63E-10	4.48E-10	8.06E-10	1.17E-09	1.51E-09	1.81E-09	2.05E-09	2.24E-09	2.39E-09	2.5E-09	2.6E-09	2.67E-09	2.72E-09	2.76E-09	2.79E-09	2.82E-09	2.84E-09	2.85E-09
40.914	134.233	0.7762	2.61E-14	1.59E-11	1.37E-10	3.95E-10	7.31E-10	1.08E-09	1.41E-09	1.71E-09	1.94E-09	2.13E-09	2.28E-09	2.4E-09	2.49E-09	2.56E-09	2.61E-09	2.66E-09	2.69E-09	2.71E-09	2.73E-09	2.75E-09
41.700	136.812	0.7962	1.59E-14	1.22E-11	1.15E-10	3.49E-10	6.64E-10	1E-09	1.32E-09	1.61E-09	1.84E-09	2.03E-09	2.18E-09	2.3E-09	2.39E-09	2.46E-09	2.52E-09	2.56E-09	2.59E-09	2.62E-09	2.63E-09	2.65E-09
42.507	139.457	0.8162	9.45E-15	9.32E-12	9.69E-11	3.08E-10	6.05E-10	9.28E-10	1.24E-09	1.53E-09	1.76E-09	1.95E-09	2.09E-09	2.21E-09	2.3E-09	2.38E-09	2.43E-09	2.47E-09	2.51E-09	2.53E-09	2.55E-09	2.56E-09
43.333	142.168	0.8362	5.52E-15	7.07E-12	8.16E-11	2.74E-10	5.54E-10	8.66E-10	1.17E-09	1.46E-09	1.68E-09	1.87E-09	2.02E-09	2.14E-09	2.23E-09	2.3E-09	2.36E-09	2.4E-09	2.43E-09	2.46E-09	2.47E-09	2.49E-09
44.179	144.944	0.8562	3.16E-15	5.36E-12	6.91E-11	2.45E-10	5.11E-10	8.14E-10	1.11E-09	1.39E-09	1.62E-09	1.81E-09	1.96E-09	2.07E-09	2.17E-09	2.24E-09	2.29E-09	2.33E-09	2.37E-09	2.39E-09	2.41E-09	2.43E-09
45.045	147.786	0.8762	1.79E-15	4.1E-12	5.95E-11	2.22E-10	4.77E-10	7.72E-10	1.06E-09	1.35E-09	1.57E-09	1.75E-09	1.9E-09	2.02E-09	2.11E-09	2.19E-09	2.24E-09	2.28E-09	2.32E-09	2.34E-09	2.36E-09	2.37E-09
45.931	150.693	0.8962	1.02E-15	3.24E-12	5.25E-11	2.06E-10	4.52E-10	7.41E-10	1.03E-09	1.31E-09	1.53E-09	1.72E-09	1.86E-09	1.98E-09	2.08E-09	2.15E-09	2.2E-09	2.24E-09	2.28E-09	2.3E-09	2.32E-09	2.34E-09
46.838	153.666	0.9162	6.22E-16	2.71E-12	4.8E-11	1.95E-10	4.35E-10	7.21E-10	1.01E-09	1.28E-09	1.51E-09	1.69E-09	1.84E-09	1.96E-09	2.05E-09	2.12E-09	2.18E-09	2.22E-09	2.25E-09	2.28E-09	2.3E-09	2.31E-09
47.616	156.221	0.64134	4.97E-16	2.53E-12	4.65E-11	1.91E-10	4.3E-10	7.13E-10	9.99E-10	1.28E-09	1.5E-09	1.68E-09	1.83E-09	1.95E-09	2.04E-09	2.11E-09	2.17E-09	2.21E-09	2.24E-09	2.27E-09	2.29E-09	2.3E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			21	22	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
0.001	0.002	0.001	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	0	0	0	0	0	0	0
0.002	0.007	0.002	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	0	0	0	0	0	0	0
0.007	0.023	0.008	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	7.3E-08	0	0	0	0	0	0	0
0.019	0.062	0.016	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	7.29E-08	0	0	0	0	0	0	0
0.043	0.141	0.032	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	7.28E-08	0	0	0	0	0	0	0
0.091	0.299	0.064	7.24E-08	7.24E-08	7.24E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	7.25E-08	0	0	0	0	0	0	0
0.181	0.593	0.1152	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	7.19E-08	0	0	0	0	0	0	0
0.298	0.979	0.1202	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	7.12E-08	0	0	0	0	0	0	0
0.421	1.381	0.1252	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	7.04E-08	0	0	0	0	0	0
0.549	1.800	0.1302	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.96E-08	6.97E-08	0	0	0	0	0	0
0.681	2.236	0.1352	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	6.89E-08	0	0	0	0	0	0
0.819	2.687	0.1402	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.8E-08	6.81E-08	0	0	0	0	0	0
0.962	3.156	0.1452	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.72E-08	6.74E-08	0	0	0	0	0
1.110	3.640	0.1502	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.64E-08	6.65E-08	0	0	0	0	0
1.262	4.141	0.1552	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.55E-08	6.57E-08	0	0	0	0	0
1.420	4.658	0.1602	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.46E-08	6.48E-08	6.48E-08	0	0	0	0
1.583	5.192	0.1652	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.37E-08	6.39E-08	6.39E-08	0	0	0	0
1.750	5.742	0.1702	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.28E-08	6.3E-08	6.3E-08	0	0	0	0
1.923	6.309	0.1752	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.2E-08	6.21E-08	6.25E-08	0	0	0
2.101	6.892	0.1802	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.09E-08	6.1E-08	6.11E-08	6.11E-08	6.16E-08	0	0	0
2.283	7.491	0.1852	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6E-08	6.01E-08	6.02E-08	6.06E-08	0	0	0
2.471	8.107	0.1902	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.9E-08	5.92E-08	5.92E-08	5.97E-08	6.01E-08	0	0
2.664	8.740	0.1952	5.8E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.81E-08	5.82E-08	5.82E-08	5.87E-08	5.91E-08	0	0
2.862	9.388	0.2002	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.71E-08	5.72E-08	5.72E-08	5.77E-08	5.81E-08	0	0
3.064	10.053	0.2052	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.61E-08	5.62E-08	5.62E-08	5.67E-08	5.71E-08	5.74E-08	0
3.272	10.735	0.2102	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.51E-08	5.52E-08	5.52E-08	5.57E-08	5.61E-08	5.64E-08	0
3.485	11.432	0.2152	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.41E-08	5.42E-08	5.42E-08	5.47E-08	5.5E-08	5.54E-08	5.6E-08
3.702	12.147	0.2202	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.31E-08	5.32E-08	5.32E-08	5.36E-08	5.4E-08	5.44E-08	5.49E-08
3.925	12.877	0.2252	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.21E-08	5.22E-08	5.22E-08	5.26E-08	5.3E-08	5.33E-08	5.39E-08
4.153	13.624	0.2302	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.11E-08	5.12E-08	5.12E-08	5.16E-08	5.19E-08	5.23E-08	5.28E-08
4.385	14.388	0.2352	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.01E-08	5.02E-08	5.02E-08	5.06E-08	5.09E-08	5.13E-08	5.18E-08
4.623	15.168	0.2402	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.9E-08	4.91E-08	4.92E-08	4.92E-08	4.95E-08	4.99E-08	5.02E-08	5.07E-08
4.866	15.964	0.2452	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.8E-08	4.81E-08	4.82E-08	4.85E-08	4.88E-08	4.92E-08	4.97E-08
5.114	16.777	0.2502	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.7E-08	4.71E-08	4.71E-08	4.75E-08	4.78E-08	4.81E-08	4.86E-08
5.366	17.606	0.2552	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.6E-08	4.61E-08	4.61E-08	4.65E-08	4.68E-08	4.71E-08	4.75E-08
5.624	18.451	0.2602	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.5E-08	4.51E-08	4.51E-08	4.54E-08	4.57E-08	4.61E-08	4.65E-08
5.887	19.313	0.2652	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.4E-08	4.41E-08	4.41E-08	4.44E-08	4.47E-08	4.5E-08	4.55E-08
6.154	20.191	0.2702	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.3E-08	4.31E-08	4.31E-08	4.34E-08	4.37E-08	4.4E-08	4.44E-08
6.427	21.086	0.2752	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.2E-08	4.21E-08	4.21E-08	4.24E-08	4.27E-08	4.3E-08	4.34E-08
6.705	21.997	0.2802	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.1E-08	4.11E-08	4.11E-08	4.14E-08	4.17E-08	4.19E-08	4.23E-08
6.987	22.925	0.2852	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4E-08	4.01E-08	4.01E-08	4.04E-08	4.07E-08	4.09E-08	4.13E-08
7.275	23.868	0.2902	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.9E-08	3.91E-08	3.91E-08	3.94E-08	3.97E-08	3.99E-08	4.03E-08
7.568	24.829	0.2952	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.81E-08	3.84E-08	3.87E-08	3.89E-08	3.93E-08
7.866	25.805	0.3002	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.71E-08	3.72E-08	3.72E-08	3.74E-08	3.77E-08	3.79E-08	3.83E-08
8.168	26.799	0.3052	3.61E-08	3.61E-08	3.61E-08	3.61E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.62E-08	3.65E-08	3.67E-08	3.7E-08	3.73E-08
8.476	27.808	0.3102	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.52E-08	3.53E-08	3.53E-08	3.55E-08	3.57E-08	3.6E-08	3.63E-08
8.789	28.834	0.3152	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.43E-08	3.46E-08	3.48E-08	3.5E-08	3.54E-08
9.106	29.876	0.3202	3.33E-08	3.33E-08	3.33E-08	3.33E-08	3.33E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.34E-08	3.36E-08	3.39E-08	3.41E-08	3.44E-08

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			21	22	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
9.429	30.935	0.3252	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.24E-08	3.25E-08	3.25E-08	3.27E-08	3.29E-08	3.32E-08	3.34E-08
9.757	32.010	0.3302	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.15E-08	3.16E-08	3.16E-08	3.18E-08	3.2E-08	3.22E-08	3.25E-08
10.089	33.102	0.3352	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.06E-08	3.07E-08	3.07E-08	3.07E-08	3.09E-08	3.11E-08	3.13E-08	3.16E-08
10.427	34.210	0.3402	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	2.98E-08	3E-08	3.02E-08	3.04E-08	3.07E-08
10.770	35.334	0.3452	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.89E-08	2.9E-08	2.9E-08	2.91E-08	2.93E-08	2.95E-08	2.98E-08
11.118	36.475	0.3502	2.8E-08	2.8E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.81E-08	2.83E-08	2.85E-08	2.87E-08	2.89E-08
11.470	37.632	0.3552	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.72E-08	2.73E-08	2.73E-08	2.74E-08	2.76E-08	2.78E-08	2.8E-08
11.828	38.805	0.3602	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.64E-08	2.66E-08	2.68E-08	2.7E-08	2.72E-08
12.191	39.995	0.3652	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.56E-08	2.58E-08	2.59E-08	2.61E-08	2.63E-08
12.558	41.202	0.3702	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.48E-08	2.5E-08	2.51E-08	2.53E-08	2.55E-08
12.931	42.425	0.3752	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.4E-08	2.41E-08	2.42E-08	2.43E-08	2.45E-08	2.47E-08
13.309	43.664	0.3802	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.32E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.33E-08	2.34E-08	2.36E-08	2.37E-08	2.39E-08
13.691	44.919	0.3852	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.25E-08	2.27E-08	2.28E-08	2.3E-08	2.31E-08
14.079	46.191	0.3902	2.17E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.18E-08	2.19E-08	2.2E-08	2.22E-08	2.24E-08
14.472	47.480	0.3952	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.1E-08	2.11E-08	2.11E-08	2.12E-08	2.13E-08	2.15E-08	2.16E-08
14.870	48.784	0.4002	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.03E-08	2.04E-08	2.04E-08	2.05E-08	2.06E-08	2.07E-08	2.09E-08
15.272	50.106	0.4052	1.96E-08	1.96E-08	1.96E-08	1.96E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.97E-08	1.98E-08	1.99E-08	2E-08	2.02E-08
15.680	51.443	0.4102	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.9E-08	1.91E-08	1.92E-08	1.93E-08	1.95E-08
16.093	52.797	0.4152	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.83E-08	1.84E-08	1.85E-08	1.87E-08	1.88E-08
16.510	54.168	0.4202	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.77E-08	1.78E-08	1.79E-08	1.8E-08	1.82E-08
16.933	55.554	0.4252	1.7E-08	1.7E-08	1.7E-08	1.7E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.71E-08	1.72E-08	1.73E-08	1.74E-08	1.75E-08
17.361	56.958	0.4302	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.64E-08	1.65E-08	1.65E-08	1.65E-08	1.66E-08	1.68E-08	1.69E-08
17.793	58.377	0.4352	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.58E-08	1.59E-08	1.59E-08	1.59E-08	1.6E-08	1.61E-08	1.63E-08
18.231	59.813	0.4402	1.52E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.54E-08	1.54E-08	1.55E-08	1.57E-08
18.674	61.266	0.4452	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.47E-08	1.48E-08	1.49E-08	1.5E-08	1.51E-08
19.122	62.735	0.4502	1.41E-08	1.41E-08	1.41E-08	1.41E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.42E-08	1.43E-08	1.44E-08	1.45E-08
19.574	64.220	0.4552	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.36E-08	1.37E-08	1.38E-08	1.39E-08	1.4E-08
20.032	65.721	0.4602	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.31E-08	1.32E-08	1.32E-08	1.33E-08	1.34E-08
20.495	67.240	0.4652	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.26E-08	1.27E-08	1.27E-08	1.28E-08	1.29E-08
20.962	68.774	0.4702	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.21E-08	1.22E-08	1.22E-08	1.23E-08	1.24E-08
21.435	70.325	0.4752	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.16E-08	1.17E-08	1.18E-08	1.18E-08	1.19E-08
21.913	71.892	0.4802	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.13E-08	1.14E-08	1.15E-08
22.395	73.476	0.4852	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.08E-08	1.08E-08	1.09E-08	1.1E-08
22.883	75.076	0.4902	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.03E-08	1.04E-08	1.05E-08	1.05E-08
23.376	76.692	0.4952	9.86E-09	9.86E-09	9.87E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.88E-09	9.89E-09	9.89E-09	9.92E-09	9.98E-09	1E-08	1.01E-08
23.875	78.328	0.5022	9.45E-09	9.46E-09	9.47E-09	9.47E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.48E-09	9.49E-09	9.52E-09	9.57E-09	9.63E-09	9.7E-09
24.380	79.988	0.5092	9.06E-09	9.07E-09	9.08E-09	9.08E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.09E-09	9.12E-09	9.17E-09	9.23E-09	9.3E-09
24.893	81.670	0.5162	8.68E-09	8.69E-09	8.7E-09	8.7E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.71E-09	8.74E-09	8.79E-09	8.85E-09	8.91E-09
25.413	83.375	0.5232	8.32E-09	8.32E-09	8.33E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.34E-09	8.35E-09	8.35E-09	8.37E-09	8.42E-09	8.47E-09	8.53E-09
25.939	85.103	0.5302	7.96E-09	7.97E-09	7.98E-09	7.98E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	7.99E-09	8.02E-09	8.06E-09	8.11E-09	8.17E-09
26.473	86.854	0.5372	7.62E-09	7.62E-09	7.63E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.64E-09	7.65E-09	7.65E-09	7.67E-09	7.71E-09	7.76E-09	7.82E-09
27.014	88.628	0.5442	7.29E-09	7.29E-09	7.3E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.31E-09	7.32E-09	7.32E-09	7.34E-09	7.38E-09	7.42E-09	7.48E-09
27.561	90.425	0.5512	6.97E-09	6.97E-09	6.98E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	6.99E-09	7E-09	7E-09	7E-09	7.02E-09	7.05E-09	7.1E-09	7.15E-09
28.116	92.244	0.5582	6.66E-09	6.67E-09	6.68E-09	6.68E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.69E-09	6.71E-09	6.74E-09	6.78E-09	6.83E-09
28.678	94.087	0.5652	6.36E-09	6.37E-09	6.38E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.39E-09	6.4E-09	6.41E-09	6.44E-09	6.48E-09	6.53E-09
29.247	95.953	0.5722	6.08E-09	6.09E-09	6.1E-09	6.1E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.11E-09	6.13E-09	6.16E-09	6.19E-09	6.24E-09
29.822	97.842	0.5792	5.81E-09	5.81E-09	5.82E-09	5.83E-09	5.83E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.84E-09	5.85E-09	5.88E-09	5.92E-09	5.96E-09
30.405	99.754	0.5862	5.55E-09	5.55E-09	5.56E-09	5.57E-09	5.57E-09	5.57E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.58E-09	5.59E-09	5.62E-09	5.65E-09	5.69E-09
30.995	101.688	0.5932	5.3E-09	5.3E-09	5.31E-09	5.32E-09	5.32E-09	5.32E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.33E-09	5.34E-09	5.36E-09	5.4E-09	5.43E-09
31.591	103.646	0.6002	5.06E-09	5.06E-09	5.07E-09	5.08E-09	5.08E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.09E-09	5.1E-09	5.12E-09	5.15E-09	5.19E-09
32.195	105.627	0.6072	4.83E-09	4.84E-09	4.85E-09	4.85E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.86E-09	4.87E-09	4.89E-09	4.92E-09	4.95E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			21	22	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
32.806	107.630	0.6142	4.61E-09	4.62E-09	4.63E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.64E-09	4.65E-09	4.67E-09	4.7E-09	4.73E-09
33.423	109.657	0.6212	4.4E-09	4.41E-09	4.42E-09	4.43E-09	4.43E-09	4.43E-09	4.43E-09	4.43E-09	4.43E-09	4.44E-09	4.44E-09	4.44E-09	4.44E-09	4.44E-09	4.44E-09	4.44E-09	4.44E-09	4.46E-09	4.49E-09	4.52E-09
34.048	111.706	0.6282	4.21E-09	4.21E-09	4.23E-09	4.23E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.24E-09	4.25E-09	4.27E-09	4.29E-09	4.32E-09
34.680	113.779	0.6352	4.02E-09	4.03E-09	4.04E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.05E-09	4.06E-09	4.08E-09	4.1E-09	4.13E-09
35.319	115.874	0.6422	3.84E-09	3.85E-09	3.86E-09	3.87E-09	3.87E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.88E-09	3.9E-09	3.92E-09	3.95E-09
35.964	117.993	0.6492	3.68E-09	3.69E-09	3.7E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.71E-09	3.72E-09	3.73E-09	3.75E-09	3.78E-09
36.617	120.134	0.6562	3.52E-09	3.53E-09	3.54E-09	3.55E-09	3.55E-09	3.55E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.56E-09	3.57E-09	3.59E-09	3.62E-09
37.283	122.320	0.6762	3.38E-09	3.38E-09	3.39E-09	3.4E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.41E-09	3.43E-09	3.44E-09	3.47E-09
37.969	124.571	0.6962	3.23E-09	3.24E-09	3.25E-09	3.26E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.27E-09	3.28E-09	3.3E-09	3.32E-09
38.676	126.888	0.7162	3.1E-09	3.11E-09	3.12E-09	3.13E-09	3.13E-09	3.13E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.14E-09	3.15E-09	3.17E-09	3.19E-09
39.402	129.271	0.7362	2.98E-09	2.99E-09	3E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.01E-09	3.02E-09	3.03E-09	3.04E-09	3.06E-09
40.148	131.719	0.7562	2.86E-09	2.87E-09	2.88E-09	2.89E-09	2.89E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.9E-09	2.91E-09	2.92E-09	2.94E-09
40.914	134.233	0.7762	2.76E-09	2.76E-09	2.78E-09	2.78E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.79E-09	2.8E-09	2.82E-09	2.83E-09
41.700	136.812	0.7962	2.66E-09	2.67E-09	2.68E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.69E-09	2.7E-09	2.7E-09	2.71E-09	2.72E-09	2.74E-09
42.507	139.457	0.8162	2.57E-09	2.58E-09	2.59E-09	2.6E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.61E-09	2.62E-09	2.63E-09	2.65E-09
43.333	142.168	0.8362	2.5E-09	2.51E-09	2.52E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.53E-09	2.54E-09	2.54E-09	2.56E-09	2.57E-09
44.179	144.944	0.8562	2.44E-09	2.44E-09	2.46E-09	2.46E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.47E-09	2.48E-09	2.49E-09	2.51E-09
45.045	147.786	0.8762	2.39E-09	2.39E-09	2.41E-09	2.41E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.42E-09	2.43E-09	2.44E-09	2.46E-09
45.931	150.693	0.8962	2.35E-09	2.36E-09	2.37E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.38E-09	2.39E-09	2.4E-09	2.42E-09
46.838	153.666	0.9162	2.32E-09	2.33E-09	2.34E-09	2.35E-09	2.35E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.36E-09	2.37E-09	2.38E-09	2.39E-09
47.616	156.221	0.64134	2.31E-09	2.32E-09	2.33E-09	2.34E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.35E-09	2.36E-09	2.37E-09	2.38E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135
0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.002	0.007	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.007	0.023	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.019	0.062	0.016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.043	0.141	0.032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.091	0.299	0.064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.181	0.593	0.1152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.298	0.979	0.1202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.421	1.381	0.1252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.549	1.800	0.1302	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.681	2.236	0.1352	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.819	2.687	0.1402	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.962	3.156	0.1452	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.110	3.640	0.1502	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.262	4.141	0.1552	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.420	4.658	0.1602	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.583	5.192	0.1652	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.750	5.742	0.1702	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
1.923	6.309	0.1752	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.101	6.892	0.1802	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.283	7.491	0.1852	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.471	8.107	0.1902	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.664	8.740	0.1952	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
2.862	9.388	0.2002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.064	10.053	0.2052	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.272	10.735	0.2102	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.485	11.432	0.2152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.702	12.147	0.2202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
3.925	12.877	0.2252	5.44E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.153	13.624	0.2302	5.33E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.385	14.388	0.2352	5.22E-08	5.28E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.623	15.168	0.2402	5.12E-08	5.17E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
4.866	15.964	0.2452	5.01E-08	5.06E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.114	16.777	0.2502	4.9E-08	4.95E-08	5E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.366	17.606	0.2552	4.8E-08	4.85E-08	4.89E-08	4.97E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.624	18.451	0.2602	4.69E-08	4.74E-08	4.78E-08	4.86E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
5.887	19.313	0.2652	4.59E-08	4.63E-08	4.67E-08	4.75E-08	4.81E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.154	20.191	0.2702	4.48E-08	4.53E-08	4.57E-08	4.64E-08	4.7E-08	4.75E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.427	21.086	0.2752	4.38E-08	4.42E-08	4.46E-08	4.53E-08	4.59E-08	4.64E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0
6.705	21.997	0.2802	4.27E-08	4.32E-08	4.36E-08	4.42E-08	4.48E-08	4.53E-08	4.59E-08	0	0	0	0	0	0	0	0	0	0	0	0	0
6.987	22.925	0.2852	4.17E-08	4.21E-08	4.25E-08	4.32E-08	4.37E-08	4.42E-08	4.48E-08	4.53E-08	0	0	0	0	0	0	0	0	0	0	0	0
7.275	23.868	0.2902	4.07E-08	4.11E-08	4.15E-08	4.21E-08	4.26E-08	4.31E-08	4.37E-08	4.42E-08	0	0	0	0	0	0	0	0	0	0	0	0
7.568	24.829	0.2952	3.97E-08	4.01E-08	4.04E-08	4.11E-08	4.16E-08	4.2E-08	4.26E-08	4.31E-08	4.36E-08	4.37E-08	0	0	0	0	0	0	0	0	0	0
7.866	25.805	0.3002	3.86E-08	3.9E-08	3.94E-08	4E-08	4.05E-08	4.09E-08	4.15E-08	4.2E-08	4.25E-08	4.26E-08	4.32E-08	0	0	0	0	0	0	0	0	0
8.168	26.799	0.3052	3.76E-08	3.8E-08	3.84E-08	3.9E-08	3.95E-08	3.99E-08	4.04E-08	4.09E-08	4.14E-08	4.15E-08	4.21E-08	0	0	0	0	0	0	0	0	0
8.476	27.808	0.3102	3.67E-08	3.7E-08	3.74E-08	3.79E-08	3.84E-08	3.88E-08	3.94E-08	3.98E-08	4.03E-08	4.04E-08	4.1E-08	4.14E-08	0	0	0	0	0	0	0	0
8.789	28.834	0.3152	3.57E-08	3.6E-08	3.64E-08	3.69E-08	3.74E-08	3.78E-08	3.83E-08	3.87E-08	3.93E-08	3.93E-08	3.99E-08	4.03E-08	4.1E-08	0	0	0	0	0	0	0
9.106	29.876	0.3202	3.47E-08	3.51E-08	3.54E-08	3.59E-08	3.64E-08	3.68E-08	3.73E-08	3.77E-08	3.82E-08	3.82E-08	3.88E-08	3.92E-08	3.99E-08	4.04E-08	0	0	0	0	0	0

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135
9.429	30.935	0.3252	3.38E-08	3.41E-08	3.44E-08	3.49E-08	3.54E-08	3.58E-08	3.62E-08	3.67E-08	3.71E-08	3.72E-08	3.77E-08	3.82E-08	3.88E-08	3.93E-08	3.98E-08	0	0	0	0	0
9.757	32.010	0.3302	3.28E-08	3.31E-08	3.35E-08	3.4E-08	3.44E-08	3.48E-08	3.52E-08	3.56E-08	3.61E-08	3.61E-08	3.67E-08	3.71E-08	3.77E-08	3.82E-08	3.87E-08	3.92E-08	0	0	0	0
10.089	33.102	0.3352	3.19E-08	3.22E-08	3.25E-08	3.3E-08	3.34E-08	3.38E-08	3.42E-08	3.46E-08	3.51E-08	3.51E-08	3.56E-08	3.6E-08	3.66E-08	3.71E-08	3.76E-08	3.81E-08	3.83E-08	0	0	0
10.427	34.210	0.3402	3.1E-08	3.13E-08	3.16E-08	3.2E-08	3.24E-08	3.28E-08	3.32E-08	3.36E-08	3.4E-08	3.41E-08	3.46E-08	3.5E-08	3.55E-08	3.6E-08	3.65E-08	3.7E-08	3.72E-08	3.8E-08	0	0
10.770	35.334	0.3452	3.01E-08	3.04E-08	3.06E-08	3.11E-08	3.15E-08	3.18E-08	3.23E-08	3.26E-08	3.3E-08	3.31E-08	3.36E-08	3.4E-08	3.45E-08	3.5E-08	3.54E-08	3.59E-08	3.61E-08	3.69E-08	3.75E-08	0
11.118	36.475	0.3502	2.92E-08	2.95E-08	2.97E-08	3.02E-08	3.06E-08	3.09E-08	3.13E-08	3.17E-08	3.21E-08	3.21E-08	3.26E-08	3.3E-08	3.35E-08	3.39E-08	3.44E-08	3.49E-08	3.51E-08	3.58E-08	3.64E-08	3.69E-08
11.470	37.632	0.3552	2.83E-08	2.86E-08	2.88E-08	2.93E-08	2.96E-08	3E-08	3.04E-08	3.07E-08	3.11E-08	3.11E-08	3.16E-08	3.2E-08	3.25E-08	3.29E-08	3.34E-08	3.38E-08	3.4E-08	3.47E-08	3.53E-08	3.58E-08
11.828	38.805	0.3602	2.74E-08	2.77E-08	2.8E-08	2.84E-08	2.87E-08	2.91E-08	2.94E-08	2.98E-08	3.01E-08	3.02E-08	3.06E-08	3.1E-08	3.15E-08	3.19E-08	3.23E-08	3.28E-08	3.3E-08	3.37E-08	3.42E-08	3.47E-08
12.191	39.995	0.3652	2.66E-08	2.69E-08	2.71E-08	2.75E-08	2.78E-08	2.82E-08	2.85E-08	2.89E-08	2.92E-08	2.92E-08	2.97E-08	3.01E-08	3.05E-08	3.09E-08	3.13E-08	3.18E-08	3.2E-08	3.26E-08	3.31E-08	3.36E-08
12.558	41.202	0.3702	2.58E-08	2.6E-08	2.63E-08	2.66E-08	2.7E-08	2.73E-08	2.76E-08	2.8E-08	2.83E-08	2.83E-08	2.88E-08	2.91E-08	2.95E-08	2.99E-08	3.04E-08	3.08E-08	3.1E-08	3.16E-08	3.21E-08	3.26E-08
12.931	42.425	0.3752	2.49E-08	2.52E-08	2.54E-08	2.58E-08	2.61E-08	2.64E-08	2.67E-08	2.71E-08	2.74E-08	2.74E-08	2.79E-08	2.82E-08	2.86E-08	2.9E-08	2.94E-08	2.98E-08	3E-08	3.06E-08	3.11E-08	3.15E-08
13.309	43.664	0.3802	2.41E-08	2.44E-08	2.46E-08	2.5E-08	2.53E-08	2.56E-08	2.59E-08	2.62E-08	2.65E-08	2.65E-08	2.7E-08	2.73E-08	2.77E-08	2.81E-08	2.84E-08	2.88E-08	2.9E-08	2.96E-08	3.01E-08	3.05E-08
13.691	44.919	0.3852	2.34E-08	2.36E-08	2.38E-08	2.42E-08	2.45E-08	2.47E-08	2.5E-08	2.54E-08	2.57E-08	2.56E-08	2.61E-08	2.64E-08	2.68E-08	2.71E-08	2.75E-08	2.79E-08	2.81E-08	2.87E-08	2.91E-08	2.95E-08
14.079	46.191	0.3902	2.26E-08	2.28E-08	2.3E-08	2.34E-08	2.36E-08	2.39E-08	2.42E-08	2.45E-08	2.48E-08	2.48E-08	2.52E-08	2.55E-08	2.59E-08	2.62E-08	2.66E-08	2.7E-08	2.71E-08	2.77E-08	2.81E-08	2.86E-08
14.472	47.480	0.3952	2.18E-08	2.21E-08	2.23E-08	2.26E-08	2.29E-08	2.31E-08	2.34E-08	2.37E-08	2.4E-08	2.4E-08	2.44E-08	2.47E-08	2.5E-08	2.54E-08	2.57E-08	2.61E-08	2.62E-08	2.68E-08	2.72E-08	2.76E-08
14.870	48.784	0.4002	2.11E-08	2.13E-08	2.15E-08	2.18E-08	2.21E-08	2.24E-08	2.26E-08	2.29E-08	2.32E-08	2.31E-08	2.36E-08	2.39E-08	2.42E-08	2.45E-08	2.48E-08	2.52E-08	2.53E-08	2.59E-08	2.63E-08	2.67E-08
15.272	50.106	0.4052	2.04E-08	2.06E-08	2.08E-08	2.11E-08	2.13E-08	2.16E-08	2.18E-08	2.21E-08	2.24E-08	2.24E-08	2.27E-08	2.3E-08	2.33E-08	2.37E-08	2.4E-08	2.43E-08	2.45E-08	2.5E-08	2.54E-08	2.58E-08
15.680	51.443	0.4102	1.97E-08	1.99E-08	2.01E-08	2.03E-08	2.06E-08	2.08E-08	2.11E-08	2.14E-08	2.16E-08	2.16E-08	2.2E-08	2.22E-08	2.25E-08	2.29E-08	2.32E-08	2.35E-08	2.36E-08	2.41E-08	2.45E-08	2.49E-08
16.093	52.797	0.4152	1.9E-08	1.92E-08	1.94E-08	1.96E-08	1.99E-08	2.01E-08	2.04E-08	2.06E-08	2.09E-08	2.08E-08	2.12E-08	2.15E-08	2.18E-08	2.21E-08	2.24E-08	2.27E-08	2.28E-08	2.33E-08	2.37E-08	2.4E-08
16.510	54.168	0.4202	1.83E-08	1.85E-08	1.87E-08	1.89E-08	1.92E-08	1.94E-08	1.96E-08	1.99E-08	2.01E-08	2.01E-08	2.04E-08	2.07E-08	2.1E-08	2.13E-08	2.16E-08	2.19E-08	2.2E-08	2.25E-08	2.28E-08	2.31E-08
16.933	55.554	0.4252	1.77E-08	1.78E-08	1.8E-08	1.83E-08	1.85E-08	1.87E-08	1.89E-08	1.92E-08	1.94E-08	1.94E-08	1.97E-08	2E-08	2.02E-08	2.05E-08	2.08E-08	2.11E-08	2.12E-08	2.17E-08	2.2E-08	2.23E-08
17.361	56.958	0.4302	1.7E-08	1.72E-08	1.74E-08	1.76E-08	1.78E-08	1.8E-08	1.82E-08	1.85E-08	1.87E-08	1.87E-08	1.9E-08	1.93E-08	1.95E-08	1.98E-08	2E-08	2.03E-08	2.04E-08	2.09E-08	2.12E-08	2.15E-08
17.793	58.377	0.4352	1.64E-08	1.66E-08	1.67E-08	1.7E-08	1.72E-08	1.74E-08	1.76E-08	1.78E-08	1.8E-08	1.8E-08	1.83E-08	1.85E-08	1.88E-08	1.9E-08	1.93E-08	1.96E-08	1.97E-08	2.01E-08	2.04E-08	2.07E-08
18.231	59.813	0.4402	1.58E-08	1.6E-08	1.61E-08	1.63E-08	1.65E-08	1.67E-08	1.69E-08	1.71E-08	1.74E-08	1.73E-08	1.76E-08	1.79E-08	1.81E-08	1.83E-08	1.86E-08	1.88E-08	1.9E-08	1.94E-08	1.97E-08	2E-08
18.674	61.266	0.4452	1.52E-08	1.54E-08	1.55E-08	1.57E-08	1.59E-08	1.61E-08	1.63E-08	1.65E-08	1.67E-08	1.67E-08	1.7E-08	1.72E-08	1.74E-08	1.77E-08	1.79E-08	1.81E-08	1.83E-08	1.86E-08	1.89E-08	1.92E-08
19.122	62.735	0.4502	1.46E-08	1.48E-08	1.49E-08	1.51E-08	1.53E-08	1.55E-08	1.57E-08	1.59E-08	1.61E-08	1.6E-08	1.63E-08	1.65E-08	1.68E-08	1.7E-08	1.72E-08	1.75E-08	1.76E-08	1.79E-08	1.82E-08	1.85E-08
19.574	64.220	0.4552	1.41E-08	1.42E-08	1.43E-08	1.46E-08	1.47E-08	1.49E-08	1.51E-08	1.53E-08	1.55E-08	1.54E-08	1.57E-08	1.59E-08	1.61E-08	1.63E-08	1.66E-08	1.68E-08	1.69E-08	1.72E-08	1.75E-08	1.78E-08
20.032	65.721	0.4602	1.36E-08	1.37E-08	1.38E-08	1.4E-08	1.42E-08	1.43E-08	1.45E-08	1.47E-08	1.49E-08	1.48E-08	1.51E-08	1.53E-08	1.55E-08	1.57E-08	1.59E-08	1.61E-08	1.62E-08	1.66E-08	1.69E-08	1.71E-08
20.495	67.240	0.4652	1.3E-08	1.32E-08	1.33E-08	1.34E-08	1.36E-08	1.38E-08	1.39E-08	1.41E-08	1.43E-08	1.43E-08	1.45E-08	1.47E-08	1.49E-08	1.51E-08	1.53E-08	1.55E-08	1.56E-08	1.59E-08	1.62E-08	1.64E-08
20.962	68.774	0.4702	1.25E-08	1.26E-08	1.27E-08	1.29E-08	1.31E-08	1.32E-08	1.34E-08	1.36E-08	1.37E-08	1.37E-08	1.39E-08	1.41E-08	1.43E-08	1.45E-08	1.47E-08	1.49E-08	1.5E-08	1.53E-08	1.56E-08	1.58E-08
21.435	70.325	0.4752	1.2E-08	1.21E-08	1.22E-08	1.24E-08	1.26E-08	1.27E-08	1.29E-08	1.3E-08	1.32E-08	1.31E-08	1.34E-08	1.36E-08	1.38E-08	1.39E-08	1.41E-08	1.43E-08	1.44E-08	1.47E-08	1.49E-08	1.52E-08
21.913	71.892	0.4802	1.15E-08	1.17E-08	1.18E-08	1.19E-08	1.21E-08	1.22E-08	1.24E-08	1.25E-08	1.27E-08	1.26E-08	1.29E-08	1.3E-08	1.32E-08	1.34E-08	1.36E-08	1.37E-08	1.38E-08	1.41E-08	1.44E-08	1.46E-08
22.395	73.476	0.4852	1.11E-08	1.12E-08	1.13E-08	1.14E-08	1.16E-08	1.17E-08	1.19E-08	1.2E-08	1.22E-08	1.21E-08	1.23E-08	1.25E-08	1.27E-08	1.28E-08	1.3E-08	1.32E-08	1.33E-08	1.35E-08	1.38E-08	1.4E-08
22.883	75.076	0.4902	1.06E-08	1.07E-08	1.08E-08	1.1E-08	1.11E-08	1.13E-08	1.14E-08	1.15E-08	1.17E-08	1.16E-08	1.18E-08	1.2E-08	1.22E-08	1.23E-08	1.25E-08	1.27E-08	1.27E-08	1.3E-08	1.32E-08	1.34E-08
23.376	76.692	0.4952	1.02E-08	1.03E-08	1.04E-08	1.05E-08	1.07E-08	1.08E-08	1.09E-08	1.11E-08	1.12E-08	1.11E-08	1.13E-08	1.15E-08	1.17E-08	1.18E-08	1.2E-08	1.21E-08	1.22E-08	1.25E-08	1.27E-08	1.29E-08
23.875	78.328	0.5022	9.79E-09	9.88E-09	9.95E-09	1.01E-08	1.02E-08	1.03E-08	1.05E-08	1.06E-08	1.07E-08	1.07E-08	1.09E-08	1.1E-08	1.12E-08	1.13E-08	1.15E-08	1.16E-08	1.17E-08	1.19E-08	1.21E-08	1.23E-08
24.380	79.988	0.5092	9.38E-09	9.47E-09	9.54E-09	9.67E-09	9.8E-09	9.92E-09	1E-08	1.02E-08	1.03E-08	1.02E-08	1.04E-08	1.06E-08	1.07E-08	1.09E-08	1.1E-08	1.12E-08	1.12E-08	1.14E-08	1.16E-08	1.18E-08
24.893	81.670	0.5162	8.99E-09	9.07E-09	9.14E-09	9.26E-09	9.38E-09	9.5E-09	9.61E-09	9.73E-09	9.85E-09	9.81E-09	9.98E-09	1.01E-08	1.03E-08	1.04E-08	1.05E-08	1.07E-08	1.08E-08	1.1E-08	1.12E-08	1.13E-08
25.413	83.375	0.5232	8.61E-09	8.68E-09	8.75E-09	8.87E-09	8.98E-09	9.1E-09	9.2E-09	9.32E-09	9.43E-09	9.39E-09	9.56E-09	9.7E-09	9.83E-09	9.96E-09	1.01E-08	1.02E-08	1.03E-08	1.05E-08	1.07E-08	1.08E-08
25.939	85.103	0.5302	8.24E-09	8.31E-09	8.37E-09	8.49E-09	8.6E-09	8.7E-09	8.81E-09	8.92E-09	9.03E-09	8.99E-09	9.15E-09	9.28E-09	9.41E-09	9.53E-09	9.66E-09	9.79E-09	9.86E-09	1E-08	1.02E-08	1.04E-08
26.473	86.854	0.5372	7.88E-09	7.95E-09	8.01E-09	8.12E-09	8.23E-09	8.33E-09	8.43E-09	8.53E-09	8.64E-09	8.6E-09	8.75E-09	8.88E-09	9E-09	9.12E-09	9.24E-09	9.37E-09	9.43E-09	9.6E-09	9.77E-09	9.92E-09
27.014	88.628	0.5442	7.54E-09	7.61E-09	7.66E-09	7.76E-09	7.87E-09	7.96E-09	8.06E-09	8.16E-09	8.26E-09	8.22E-09	8.36E-09	8.49E-09	8.61E-09	8.72E-09	8.84E-09	8.96E-09	9.02E-09	9.18E-09	9.34E-09	9.48E-09
27.561	90.425	0.5512	7.21E-09	7.27E-09	7.32E-09	7.42E-09	7.52E-09	7.61E-09	7.71E-09	7.8E-09	7.9E-09	7.86E-09	8E-09	8.12E-09	8.23E-09	8.34E-09	8.45E-09	8.56E-09	8.62E-09	8.78E-09	8.93E-09	9.06E-09
28.116	92.244	0.5582	6.89E-09	6.95E-09	7E-09	7.09E-09	7.19E-09	7.28E-09	7.36E-09	7.45E-09	7.55E-09	7.51E-09	7.64E-09	7.76E-09	7.87E-09	7.97E-09	8.07E-09	8.18E-09	8.24E-09	8.38E-09	8.53E-09	8.66E-09
28.678	94.087	0.5652	6.58E-09	6.64E-09	6.69E-09	6.78E-09	6.87E-09	6.95E-09	7.04E-09	7.12E-09	7.21E-09	7.18E-09	7.3E-09	7.41E-09	7.51E-09	7.61E-09	7.71E-09	7.82E-09	7.87E-09	8.01E-09	8.15E-09	8.27E-09
29.247	95.953	0.5722	6.29E-09	6.34E-09	6.39E-09	6.47E-09	6.56E-09	6.64E-09	6.72E-09	6.8E-09	6.89E-09	6.85E-09	6.97E-09	7.08E-09	7.18E-09	7.27E-09	7.37E-09	7.47E-09	7.52E-09	7.65E-09	7.78E-09	7.9E-09
29.822	97.842	0.5792	6.01E-09	6.06E-09	6.1E-09	6.18E-09	6.26E-09	6.34E-09	6.42E-09	6.5E-09	6.58E-09	6.54E-09	6.65E-09	6.76E-09	6.85E-09	6.94E-09	7.04E-09	7.13E-09	7.18E-09	7.3E-09	7.43E-09	7.54E-09
30.405	99.754	0.5862	5.74E-09	5.79E-09	5.82E-09	5.9E-09	5.98E-09	6.05E-09	6.13E-09	6.2E-09	6.28E-09	6.25E-09	6.35E-09	6.45E-09	6.54E-09	6.63E-09	6.72E-09	6.81E-09	6.85E-09	6.97E-09	7.09E-09	7.2E-09
30.995	101.688	0.5932	5.48E-09	5.53E-09	5.56E-09	5.63E-09	5.71E-09	5.78E-09	5.85E-09	5.92E-09	6E-09	5.96E-09	6.06E-09	6.16E-09	6.25E-09	6.33E-09	6.41E-09	6.5E-09	6.54E-09	6.65E-09	6.77E-09	6.88E-09
31.591	103.646	0.6002	5.23E-09	5.28E-09	5.31E-09	5.38E-09	5.45E-09	5.52E-09	5.59E-09	5.65E-09	5.72E-09	5.69E-09	5.79E-09	5.88E-09	5.96E-09	6.04E-09	6.12E-09	6.2E-09	6.24E-09	6.35E-09	6.46E-09	6.56E-09
32.195	105.627	0.6072	4.99E-09	5.04E-09	5.07E-09	5.13E-09	5.2E-09	5.27E-09	5.33E-09	5.4E-09	5.46E-09	5.44E-09	5.52E-09	5.61E-09	5.69E-09	5.77E-09	5.85E-09	5.92E-09	5.96E-09	6.06E-09	6.17E-09	6.27E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135
32.806	107.630	0.6142	4.77E-09	4.81E-09	4.84E-09	4.9E-09	4.97E-09	5.03E-09	5.09E-09	5.15E-09	5.22E-09	5.19E-09	5.27E-09	5.36E-09	5.43E-09	5.51E-09	5.58E-09	5.66E-09	5.69E-09	5.79E-09	5.89E-09	5.98E-09
33.423	109.657	0.6212	4.55E-09	4.59E-09	4.62E-09	4.68E-09	4.74E-09	4.8E-09	4.86E-09	4.92E-09	4.98E-09	4.96E-09	5.04E-09	5.12E-09	5.19E-09	5.26E-09	5.33E-09	5.4E-09	5.43E-09	5.52E-09	5.62E-09	5.71E-09
34.048	111.706	0.6282	4.35E-09	4.39E-09	4.41E-09	4.47E-09	4.53E-09	4.59E-09	4.64E-09	4.7E-09	4.76E-09	4.73E-09	4.81E-09	4.89E-09	4.96E-09	5.02E-09	5.09E-09	5.16E-09	5.19E-09	5.28E-09	5.37E-09	5.45E-09
34.680	113.779	0.6352	4.16E-09	4.2E-09	4.22E-09	4.27E-09	4.33E-09	4.38E-09	4.44E-09	4.49E-09	4.55E-09	4.52E-09	4.6E-09	4.67E-09	4.74E-09	4.8E-09	4.86E-09	4.93E-09	4.96E-09	5.04E-09	5.13E-09	5.21E-09
35.319	115.874	0.6422	3.98E-09	4.01E-09	4.03E-09	4.08E-09	4.14E-09	4.19E-09	4.24E-09	4.3E-09	4.35E-09	4.32E-09	4.39E-09	4.46E-09	4.53E-09	4.59E-09	4.65E-09	4.71E-09	4.74E-09	4.82E-09	4.9E-09	4.98E-09
35.964	117.993	0.6492	3.81E-09	3.84E-09	3.86E-09	3.91E-09	3.96E-09	4.01E-09	4.06E-09	4.11E-09	4.16E-09	4.14E-09	4.2E-09	4.27E-09	4.33E-09	4.39E-09	4.45E-09	4.51E-09	4.54E-09	4.61E-09	4.69E-09	4.77E-09
36.617	120.134	0.6562	3.65E-09	3.68E-09	3.7E-09	3.74E-09	3.79E-09	3.84E-09	3.89E-09	3.93E-09	3.98E-09	3.96E-09	4.02E-09	4.09E-09	4.15E-09	4.2E-09	4.26E-09	4.32E-09	4.34E-09	4.41E-09	4.49E-09	4.56E-09
37.283	122.320	0.6762	3.49E-09	3.52E-09	3.54E-09	3.58E-09	3.63E-09	3.68E-09	3.72E-09	3.77E-09	3.82E-09	3.79E-09	3.85E-09	3.92E-09	3.97E-09	4.03E-09	4.08E-09	4.14E-09	4.16E-09	4.23E-09	4.3E-09	4.37E-09
37.969	124.571	0.6962	3.35E-09	3.38E-09	3.39E-09	3.43E-09	3.48E-09	3.53E-09	3.57E-09	3.61E-09	3.66E-09	3.64E-09	3.69E-09	3.75E-09	3.81E-09	3.86E-09	3.91E-09	3.96E-09	3.99E-09	4.05E-09	4.12E-09	4.19E-09
38.676	126.888	0.7162	3.21E-09	3.24E-09	3.25E-09	3.29E-09	3.34E-09	3.38E-09	3.42E-09	3.46E-09	3.51E-09	3.49E-09	3.54E-09	3.6E-09	3.65E-09	3.7E-09	3.75E-09	3.8E-09	3.82E-09	3.88E-09	3.95E-09	4.01E-09
39.402	129.271	0.7362	3.08E-09	3.11E-09	3.12E-09	3.16E-09	3.2E-09	3.24E-09	3.29E-09	3.33E-09	3.37E-09	3.35E-09	3.4E-09	3.45E-09	3.5E-09	3.55E-09	3.6E-09	3.65E-09	3.67E-09	3.72E-09	3.79E-09	3.85E-09
40.148	131.719	0.7562	2.96E-09	2.99E-09	3E-09	3.04E-09	3.08E-09	3.12E-09	3.16E-09	3.2E-09	3.24E-09	3.22E-09	3.26E-09	3.32E-09	3.37E-09	3.41E-09	3.46E-09	3.51E-09	3.53E-09	3.58E-09	3.64E-09	3.7E-09
40.914	134.233	0.7762	2.85E-09	2.88E-09	2.89E-09	2.93E-09	2.97E-09	3E-09	3.04E-09	3.08E-09	3.12E-09	3.1E-09	3.14E-09	3.19E-09	3.24E-09	3.29E-09	3.33E-09	3.38E-09	3.4E-09	3.45E-09	3.51E-09	3.57E-09
41.700	136.812	0.7962	2.76E-09	2.78E-09	2.79E-09	2.82E-09	2.86E-09	2.9E-09	2.93E-09	2.97E-09	3.01E-09	2.99E-09	3.03E-09	3.08E-09	3.13E-09	3.17E-09	3.22E-09	3.26E-09	3.28E-09	3.33E-09	3.38E-09	3.44E-09
42.507	139.457	0.8162	2.67E-09	2.69E-09	2.7E-09	2.73E-09	2.77E-09	2.81E-09	2.84E-09	2.87E-09	2.91E-09	2.89E-09	2.94E-09	2.98E-09	3.03E-09	3.07E-09	3.11E-09	3.15E-09	3.17E-09	3.22E-09	3.27E-09	3.33E-09
43.333	142.168	0.8362	2.59E-09	2.61E-09	2.62E-09	2.65E-09	2.69E-09	2.72E-09	2.76E-09	2.79E-09	2.83E-09	2.81E-09	2.85E-09	2.9E-09	2.94E-09	2.98E-09	3.02E-09	3.06E-09	3.08E-09	3.12E-09	3.18E-09	3.23E-09
44.179	144.944	0.8562	2.53E-09	2.55E-09	2.56E-09	2.59E-09	2.62E-09	2.65E-09	2.69E-09	2.72E-09	2.75E-09	2.74E-09	2.78E-09	2.82E-09	2.87E-09	2.91E-09	2.94E-09	2.98E-09	3E-09	3.04E-09	3.1E-09	3.15E-09
45.045	147.786	0.8762	2.47E-09	2.49E-09	2.5E-09	2.53E-09	2.57E-09	2.6E-09	2.63E-09	2.66E-09	2.7E-09	2.68E-09	2.72E-09	2.76E-09	2.8E-09	2.84E-09	2.88E-09	2.92E-09	2.94E-09	2.98E-09	3.03E-09	3.08E-09
45.931	150.693	0.8962	2.43E-09	2.45E-09	2.46E-09	2.49E-09	2.52E-09	2.56E-09	2.59E-09	2.62E-09	2.65E-09	2.64E-09	2.68E-09	2.72E-09	2.76E-09	2.8E-09	2.84E-09	2.87E-09	2.89E-09	2.93E-09	2.98E-09	3.03E-09
46.838	153.666	0.9162	2.41E-09	2.43E-09	2.44E-09	2.47E-09	2.5E-09	2.53E-09	2.56E-09	2.59E-09	2.63E-09	2.61E-09	2.65E-09	2.69E-09	2.73E-09	2.77E-09	2.81E-09	2.84E-09	2.86E-09	2.9E-09	2.95E-09	3E-09
47.616	156.221	0.64134	2.4E-09	2.42E-09	2.43E-09	2.46E-09	2.49E-09	2.52E-09	2.55E-09	2.58E-09	2.62E-09	2.6E-09	2.64E-09	2.68E-09	2.72E-09	2.76E-09	2.8E-09	2.83E-09	2.85E-09	2.89E-09	2.94E-09	2.99E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)									
			Time (years)									
			138	141	144	147	150	153	156	159	162	165
0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0
0.002	0.007	0.002	0	0	0	0	0	0	0	0	0	0
0.007	0.023	0.008	0	0	0	0	0	0	0	0	0	0
0.019	0.062	0.016	0	0	0	0	0	0	0	0	0	0
0.043	0.141	0.032	0	0	0	0	0	0	0	0	0	0
0.091	0.299	0.064	0	0	0	0	0	0	0	0	0	0
0.181	0.593	0.1152	0	0	0	0	0	0	0	0	0	0
0.298	0.979	0.1202	0	0	0	0	0	0	0	0	0	0
0.421	1.381	0.1252	0	0	0	0	0	0	0	0	0	0
0.549	1.800	0.1302	0	0	0	0	0	0	0	0	0	0
0.681	2.236	0.1352	0	0	0	0	0	0	0	0	0	0
0.819	2.687	0.1402	0	0	0	0	0	0	0	0	0	0
0.962	3.156	0.1452	0	0	0	0	0	0	0	0	0	0
1.110	3.640	0.1502	0	0	0	0	0	0	0	0	0	0
1.262	4.141	0.1552	0	0	0	0	0	0	0	0	0	0
1.420	4.658	0.1602	0	0	0	0	0	0	0	0	0	0
1.583	5.192	0.1652	0	0	0	0	0	0	0	0	0	0
1.750	5.742	0.1702	0	0	0	0	0	0	0	0	0	0
1.923	6.309	0.1752	0	0	0	0	0	0	0	0	0	0
2.101	6.892	0.1802	0	0	0	0	0	0	0	0	0	0
2.283	7.491	0.1852	0	0	0	0	0	0	0	0	0	0
2.471	8.107	0.1902	0	0	0	0	0	0	0	0	0	0
2.664	8.740	0.1952	0	0	0	0	0	0	0	0	0	0
2.862	9.388	0.2002	0	0	0	0	0	0	0	0	0	0
3.064	10.053	0.2052	0	0	0	0	0	0	0	0	0	0
3.272	10.735	0.2102	0	0	0	0	0	0	0	0	0	0
3.485	11.432	0.2152	0	0	0	0	0	0	0	0	0	0
3.702	12.147	0.2202	0	0	0	0	0	0	0	0	0	0
3.925	12.877	0.2252	0	0	0	0	0	0	0	0	0	0
4.153	13.624	0.2302	0	0	0	0	0	0	0	0	0	0
4.385	14.388	0.2352	0	0	0	0	0	0	0	0	0	0
4.623	15.168	0.2402	0	0	0	0	0	0	0	0	0	0
4.866	15.964	0.2452	0	0	0	0	0	0	0	0	0	0
5.114	16.777	0.2502	0	0	0	0	0	0	0	0	0	0
5.366	17.606	0.2552	0	0	0	0	0	0	0	0	0	0
5.624	18.451	0.2602	0	0	0	0	0	0	0	0	0	0
5.887	19.313	0.2652	0	0	0	0	0	0	0	0	0	0
6.154	20.191	0.2702	0	0	0	0	0	0	0	0	0	0
6.427	21.086	0.2752	0	0	0	0	0	0	0	0	0	0
6.705	21.997	0.2802	0	0	0	0	0	0	0	0	0	0
6.987	22.925	0.2852	0	0	0	0	0	0	0	0	0	0
7.275	23.868	0.2902	0	0	0	0	0	0	0	0	0	0
7.568	24.829	0.2952	0	0	0	0	0	0	0	0	0	0
7.866	25.805	0.3002	0	0	0	0	0	0	0	0	0	0
8.168	26.799	0.3052	0	0	0	0	0	0	0	0	0	0
8.476	27.808	0.3102	0	0	0	0	0	0	0	0	0	0
8.789	28.834	0.3152	0	0	0	0	0	0	0	0	0	0
9.106	29.876	0.3202	0	0	0	0	0	0	0	0	0	0

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)									
			Time (years)									
			138	141	144	147	150	153	156	159	162	165
9.429	30.935	0.3252	0	0	0	0	0	0	0	0	0	0
9.757	32.010	0.3302	0	0	0	0	0	0	0	0	0	0
10.089	33.102	0.3352	0	0	0	0	0	0	0	0	0	0
10.427	34.210	0.3402	0	0	0	0	0	0	0	0	0	0
10.770	35.334	0.3452	0	0	0	0	0	0	0	0	0	0
11.118	36.475	0.3502	0	0	0	0	0	0	0	0	0	0
11.470	37.632	0.3552	3.63E-08	0	0	0	0	0	0	0	0	0
11.828	38.805	0.3602	3.52E-08	3.57E-08	0	0	0	0	0	0	0	0
12.191	39.995	0.3652	3.41E-08	3.46E-08	3.5E-08	3.48E-08	0	0	0	0	0	0
12.558	41.202	0.3702	3.3E-08	3.35E-08	3.39E-08	3.37E-08	3.45E-08	0	0	0	0	0
12.931	42.425	0.3752	3.2E-08	3.24E-08	3.29E-08	3.26E-08	3.34E-08	3.38E-08	3.42E-08	0	0	0
13.309	43.664	0.3802	3.09E-08	3.14E-08	3.18E-08	3.16E-08	3.23E-08	3.28E-08	3.31E-08	3.36E-08	0	0
13.691	44.919	0.3852	2.99E-08	3.04E-08	3.08E-08	3.05E-08	3.12E-08	3.17E-08	3.2E-08	3.25E-08	3.3E-08	0
14.079	46.191	0.3902	2.9E-08	2.94E-08	2.98E-08	2.95E-08	3.02E-08	3.06E-08	3.1E-08	3.15E-08	3.19E-08	3.24E-08
14.472	47.480	0.3952	2.8E-08	2.84E-08	2.88E-08	2.85E-08	2.92E-08	2.96E-08	2.99E-08	3.04E-08	3.09E-08	3.13E-08
14.870	48.784	0.4002	2.7E-08	2.74E-08	2.78E-08	2.76E-08	2.82E-08	2.86E-08	2.89E-08	2.94E-08	2.98E-08	3.02E-08
15.272	50.106	0.4052	2.61E-08	2.65E-08	2.68E-08	2.66E-08	2.72E-08	2.76E-08	2.79E-08	2.84E-08	2.88E-08	2.92E-08
15.680	51.443	0.4102	2.52E-08	2.56E-08	2.59E-08	2.57E-08	2.63E-08	2.67E-08	2.7E-08	2.74E-08	2.78E-08	2.82E-08
16.093	52.797	0.4152	2.43E-08	2.47E-08	2.5E-08	2.48E-08	2.54E-08	2.57E-08	2.6E-08	2.65E-08	2.68E-08	2.72E-08
16.510	54.168	0.4202	2.35E-08	2.38E-08	2.41E-08	2.39E-08	2.44E-08	2.48E-08	2.51E-08	2.55E-08	2.59E-08	2.62E-08
16.933	55.554	0.4252	2.26E-08	2.29E-08	2.32E-08	2.31E-08	2.36E-08	2.39E-08	2.42E-08	2.46E-08	2.5E-08	2.53E-08
17.361	56.958	0.4302	2.18E-08	2.21E-08	2.24E-08	2.22E-08	2.27E-08	2.3E-08	2.34E-08	2.37E-08	2.41E-08	2.44E-08
17.793	58.377	0.4352	2.1E-08	2.13E-08	2.16E-08	2.14E-08	2.19E-08	2.22E-08	2.25E-08	2.29E-08	2.32E-08	2.35E-08
18.231	59.813	0.4402	2.02E-08	2.05E-08	2.08E-08	2.06E-08	2.11E-08	2.14E-08	2.17E-08	2.2E-08	2.23E-08	2.26E-08
18.674	61.266	0.4452	1.95E-08	1.97E-08	2E-08	1.99E-08	2.03E-08	2.06E-08	2.09E-08	2.12E-08	2.15E-08	2.18E-08
19.122	62.735	0.4502	1.87E-08	1.9E-08	1.92E-08	1.91E-08	1.95E-08	1.98E-08	2.01E-08	2.04E-08	2.07E-08	2.09E-08
19.574	64.220	0.4552	1.8E-08	1.83E-08	1.85E-08	1.84E-08	1.88E-08	1.9E-08	1.93E-08	1.96E-08	1.99E-08	2.01E-08
20.032	65.721	0.4602	1.73E-08	1.76E-08	1.78E-08	1.77E-08	1.8E-08	1.83E-08	1.86E-08	1.89E-08	1.91E-08	1.94E-08
20.495	67.240	0.4652	1.67E-08	1.69E-08	1.71E-08	1.7E-08	1.73E-08	1.76E-08	1.79E-08	1.81E-08	1.84E-08	1.86E-08
20.962	68.774	0.4702	1.6E-08	1.62E-08	1.64E-08	1.63E-08	1.66E-08	1.69E-08	1.72E-08	1.74E-08	1.77E-08	1.79E-08
21.435	70.325	0.4752	1.54E-08	1.56E-08	1.58E-08	1.57E-08	1.6E-08	1.62E-08	1.65E-08	1.67E-08	1.7E-08	1.72E-08
21.913	71.892	0.4802	1.48E-08	1.5E-08	1.52E-08	1.5E-08	1.53E-08	1.56E-08	1.58E-08	1.61E-08	1.63E-08	1.65E-08
22.395	73.476	0.4852	1.42E-08	1.44E-08	1.45E-08	1.44E-08	1.47E-08	1.5E-08	1.52E-08	1.54E-08	1.56E-08	1.58E-08
22.883	75.076	0.4902	1.36E-08	1.38E-08	1.4E-08	1.38E-08	1.41E-08	1.44E-08	1.46E-08	1.48E-08	1.5E-08	1.52E-08
23.376	76.692	0.4952	1.3E-08	1.32E-08	1.34E-08	1.33E-08	1.35E-08	1.38E-08	1.4E-08	1.42E-08	1.44E-08	1.46E-08
23.875	78.328	0.5022	1.25E-08	1.27E-08	1.28E-08	1.27E-08	1.3E-08	1.32E-08	1.34E-08	1.36E-08	1.38E-08	1.4E-08
24.380	79.988	0.5092	1.2E-08	1.21E-08	1.23E-08	1.22E-08	1.24E-08	1.26E-08	1.28E-08	1.3E-08	1.32E-08	1.34E-08
24.893	81.670	0.5162	1.15E-08	1.16E-08	1.18E-08	1.17E-08	1.19E-08	1.21E-08	1.23E-08	1.25E-08	1.27E-08	1.28E-08
25.413	83.375	0.5232	1.1E-08	1.11E-08	1.13E-08	1.12E-08	1.14E-08	1.16E-08	1.18E-08	1.2E-08	1.21E-08	1.23E-08
25.939	85.103	0.5302	1.05E-08	1.07E-08	1.08E-08	1.07E-08	1.09E-08	1.11E-08	1.13E-08	1.14E-08	1.16E-08	1.17E-08
26.473	86.854	0.5372	1.01E-08	1.02E-08	1.03E-08	1.02E-08	1.04E-08	1.06E-08	1.08E-08	1.09E-08	1.11E-08	1.12E-08
27.014	88.628	0.5442	9.61E-09	9.75E-09	9.87E-09	9.79E-09	9.98E-09	1.02E-08	1.03E-08	1.05E-08	1.06E-08	1.07E-08
27.561	90.425	0.5512	9.19E-09	9.32E-09	9.44E-09	9.36E-09	9.53E-09	9.7E-09	9.86E-09	1E-08	1.01E-08	1.03E-08
28.116	92.244	0.5582	8.78E-09	8.9E-09	9.02E-09	8.94E-09	9.11E-09	9.27E-09	9.42E-09	9.56E-09	9.69E-09	9.81E-09
28.678	94.087	0.5652	8.39E-09	8.5E-09	8.62E-09	8.54E-09	8.7E-09	8.86E-09	9E-09	9.13E-09	9.26E-09	9.38E-09
29.247	95.953	0.5722	8.01E-09	8.12E-09	8.23E-09	8.16E-09	8.31E-09	8.46E-09	8.59E-09	8.72E-09	8.84E-09	8.95E-09
29.822	97.842	0.5792	7.65E-09	7.76E-09	7.86E-09	7.79E-09	7.93E-09	8.08E-09	8.21E-09	8.33E-09	8.44E-09	8.55E-09
30.405	99.754	0.5862	7.3E-09	7.41E-09	7.51E-09	7.44E-09	7.57E-09	7.71E-09	7.83E-09	7.95E-09	8.06E-09	8.16E-09
30.995	101.688	0.5932	6.97E-09	7.07E-09	7.17E-09	7.1E-09	7.23E-09	7.36E-09	7.48E-09	7.59E-09	7.69E-09	7.79E-09
31.591	103.646	0.6002	6.66E-09	6.75E-09	6.84E-09	6.78E-09	6.9E-09	7.03E-09	7.14E-09	7.25E-09	7.34E-09	7.44E-09
32.195	105.627	0.6072	6.35E-09	6.44E-09	6.53E-09	6.47E-09	6.58E-09	6.71E-09	6.81E-09	6.92E-09	7.01E-09	7.1E-09

Coarse Tailings Oxygen Consur

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)									
			Time (years)									
			138	141	144	147	150	153	156	159	162	165
32.806	107.630	0.6142	6.07E-09	6.15E-09	6.24E-09	6.17E-09	6.28E-09	6.4E-09	6.51E-09	6.6E-09	6.69E-09	6.78E-09
33.423	109.657	0.6212	5.79E-09	5.87E-09	5.95E-09	5.9E-09	6E-09	6.11E-09	6.21E-09	6.3E-09	6.39E-09	6.48E-09
34.048	111.706	0.6282	5.53E-09	5.61E-09	5.69E-09	5.63E-09	5.73E-09	5.84E-09	5.93E-09	6.02E-09	6.1E-09	6.19E-09
34.680	113.779	0.6352	5.29E-09	5.36E-09	5.44E-09	5.38E-09	5.47E-09	5.58E-09	5.67E-09	5.75E-09	5.83E-09	5.91E-09
35.319	115.874	0.6422	5.05E-09	5.13E-09	5.2E-09	5.14E-09	5.23E-09	5.33E-09	5.42E-09	5.5E-09	5.58E-09	5.65E-09
35.964	117.993	0.6492	4.84E-09	4.9E-09	4.97E-09	4.92E-09	5.01E-09	5.1E-09	5.18E-09	5.26E-09	5.33E-09	5.41E-09
36.617	120.134	0.6562	4.63E-09	4.69E-09	4.76E-09	4.71E-09	4.79E-09	4.88E-09	4.96E-09	5.04E-09	5.11E-09	5.18E-09
37.283	122.320	0.6762	4.43E-09	4.5E-09	4.56E-09	4.51E-09	4.59E-09	4.68E-09	4.75E-09	4.83E-09	4.89E-09	4.96E-09
37.969	124.571	0.6962	4.25E-09	4.31E-09	4.37E-09	4.32E-09	4.4E-09	4.48E-09	4.55E-09	4.62E-09	4.69E-09	4.75E-09
38.676	126.888	0.7162	4.07E-09	4.13E-09	4.19E-09	4.14E-09	4.21E-09	4.29E-09	4.37E-09	4.43E-09	4.5E-09	4.56E-09
39.402	129.271	0.7362	3.91E-09	3.97E-09	4.02E-09	3.98E-09	4.04E-09	4.12E-09	4.19E-09	4.25E-09	4.31E-09	4.38E-09
40.148	131.719	0.7562	3.76E-09	3.81E-09	3.87E-09	3.82E-09	3.89E-09	3.96E-09	4.03E-09	4.09E-09	4.15E-09	4.21E-09
40.914	134.233	0.7762	3.62E-09	3.67E-09	3.72E-09	3.68E-09	3.74E-09	3.81E-09	3.88E-09	3.94E-09	3.99E-09	4.05E-09
41.700	136.812	0.7962	3.49E-09	3.54E-09	3.59E-09	3.55E-09	3.61E-09	3.68E-09	3.74E-09	3.8E-09	3.85E-09	3.91E-09
42.507	139.457	0.8162	3.38E-09	3.43E-09	3.48E-09	3.44E-09	3.49E-09	3.56E-09	3.62E-09	3.68E-09	3.73E-09	3.78E-09
43.333	142.168	0.8362	3.28E-09	3.33E-09	3.38E-09	3.34E-09	3.39E-09	3.46E-09	3.51E-09	3.57E-09	3.62E-09	3.67E-09
44.179	144.944	0.8562	3.2E-09	3.24E-09	3.29E-09	3.25E-09	3.31E-09	3.37E-09	3.43E-09	3.48E-09	3.53E-09	3.58E-09
45.045	147.786	0.8762	3.13E-09	3.18E-09	3.22E-09	3.18E-09	3.24E-09	3.3E-09	3.35E-09	3.41E-09	3.46E-09	3.5E-09
45.931	150.693	0.8962	3.08E-09	3.13E-09	3.17E-09	3.13E-09	3.18E-09	3.24E-09	3.3E-09	3.35E-09	3.4E-09	3.45E-09
46.838	153.666	0.9162	3.05E-09	3.09E-09	3.14E-09	3.1E-09	3.15E-09	3.21E-09	3.26E-09	3.32E-09	3.36E-09	3.41E-09
47.616	156.221	0.64134	3.04E-09	3.08E-09	3.12E-09	3.09E-09	3.14E-09	3.2E-09	3.25E-09	3.3E-09	3.35E-09	3.4E-09

Integrated Coarse Tailings Sulphate generation Rates

	Coarse Tailings Beaches		Embankments	
	Cell 1E	Cell 2E	Cell 1E	Cell 2E
	SO4	SO4	SO4	SO4
Year	mol/m2/year	mol/m2/year	mol/m2/year	mol/m2/year
0	0.000	1.319	0.000	0.000
1	0.000	1.319	0.000	1.319
2	0.000	1.319	0.000	0.639
3	0.000	1.323	0.000	1.493
4	0.000	1.341	0.000	2.500
5	0.000	1.395	0.000	3.640
6	0.000	1.530	0.000	3.688
7	0.000	1.849	0.000	3.710
8	0.000	2.639	0.000	3.722
9	1.319	4.225	1.319	3.730
10	1.583	7.819	0.639	3.734
11	2.757	11.062	1.493	3.737
12	6.069	11.832	2.500	3.739
13	9.152	12.113	3.640	3.741
14	9.871	12.108	3.688	3.741
15	10.217	11.850	3.710	3.742
16	10.411	11.262	3.722	3.743
17	10.529	10.360	3.730	3.743
18	9.915	8.956	3.734	3.743
19	8.993	6.817	3.737	3.743
20	7.575	6.833	3.739	3.743
21	5.425	6.845	3.741	3.744
22	5.433	6.804	3.741	3.744
24	5.438	6.871	3.742	3.744
27	5.442	6.950	3.743	3.744
30	5.445	7.052	3.743	3.744
33	5.447	7.189	3.743	3.744
36	5.449	7.134	3.743	3.744
39	5.450	7.711	3.743	3.744
42	5.451	8.108	3.744	3.744
45	5.451	8.828	3.744	3.744
48	5.846	9.872	3.744	3.744
51	6.564	11.392	3.744	3.744
54	7.607	11.393	3.744	3.744
57	9.127	11.393	3.744	3.744
60	9.128	11.394	3.744	3.744
63	9.128	11.394	3.744	3.746
66	9.128	11.394	3.744	3.749
69	9.129	11.394	3.744	3.418
72	9.129	11.395	3.744	2.813
75	9.129	11.395	3.744	2.151
78	9.129	11.397	3.744	1.281
81	9.129	11.401	3.744	0.821
84	9.129	11.408	3.744	0.337
87	9.129	11.421	3.746	0.000
90	9.130	11.443	3.749	0.000
93	9.133	11.478	3.418	0.000
96	9.142	11.190	2.813	0.000
99	9.161	10.640	2.151	0.000
102	8.854	10.044	1.281	0.000
105	8.283	9.246	0.821	0.000
108	7.664	8.865	0.337	0.000
111	6.840	8.467	0.000	0.000
114	6.431	8.222	0.000	0.000
117	6.005	8.318	0.000	0.000
120	5.732	8.223	0.000	0.000
123	5.801	8.124	0.000	0.000
126	5.679	7.634	0.000	0.000
129	5.554	7.348	0.000	0.000
132	5.035	6.892	0.000	0.000
135	4.718	6.972	0.000	0.000
138	4.229	6.721	0.000	0.000
141	4.272	6.473	0.000	0.000
144	3.987	6.397	0.000	0.000
147	3.704	6.320	0.000	0.000
150	3.590	6.404	0.000	0.000
153	3.474	6.494	0.000	0.000
156	3.518	6.377	0.000	0.000
159	3.566	6.261	0.000	0.000

Fine Tailings Oxygen Consumption Rates

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
0.001	0.002	0.001	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07
0.002	0.007	0.002	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07	1.46E-07
0.007	0.023	0.008	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07	1.44E-07
0.019	0.062	0.016	1.4E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07	1.41E-07
0.043	0.141	0.032	1.32E-07	1.33E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07
0.091	0.299	0.064	1.17E-07	1.2E-07	1.21E-07	1.21E-07	1.21E-07	1.21E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07
0.181	0.593	0.1152	9.12E-08	9.78E-08	9.97E-08	1E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07
0.298	0.979	0.1202	6.47E-08	7.46E-08	7.75E-08	7.86E-08	7.9E-08	7.93E-08	7.94E-08	7.94E-08	7.94E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08
0.421	1.381	0.1252	4.35E-08	5.55E-08	5.92E-08	6.07E-08	6.13E-08	6.16E-08	6.18E-08	6.19E-08	6.19E-08	6.19E-08	6.19E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08
0.549	1.800	0.1302	2.75E-08	4.02E-08	4.45E-08	4.63E-08	4.7E-08	4.74E-08	4.76E-08	4.77E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08
0.681	2.236	0.1352	1.62E-08	2.82E-08	3.28E-08	3.47E-08	3.56E-08	3.61E-08	3.63E-08	3.64E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08
0.819	2.687	0.1402	8.85E-09	1.9E-08	2.36E-08	2.57E-08	2.66E-08	2.71E-08	2.73E-08	2.75E-08	2.75E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08
0.962	3.156	0.1452	4.43E-09	1.24E-08	1.66E-08	1.86E-08	1.96E-08	2.01E-08	2.04E-08	2.05E-08	2.06E-08	2.06E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08
1.110	3.640	0.1502	2.03E-09	7.66E-09	1.13E-08	1.32E-08	1.42E-08	1.47E-08	1.5E-08	1.52E-08	1.52E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08
1.262	4.141	0.1552	8.42E-10	4.51E-09	7.48E-09	9.2E-09	1.01E-08	1.06E-08	1.09E-08	1.11E-08	1.11E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.12E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08
1.420	4.658	0.1602	3.17E-10	2.52E-09	4.77E-09	6.24E-09	7.09E-09	7.57E-09	7.84E-09	7.98E-09	8.07E-09	8.11E-09	8.14E-09	8.15E-09	8.16E-09	8.17E-09	8.17E-09	8.17E-09	8.17E-09	8.17E-09	8.17E-09	8.17E-09
1.583	5.192	0.1652	1.08E-10	1.32E-09	2.93E-09	4.12E-09	4.86E-09	5.3E-09	5.55E-09	5.69E-09	5.77E-09	5.82E-09	5.84E-09	5.86E-09	5.87E-09	5.87E-09	5.87E-09	5.88E-09	5.88E-09	5.88E-09	5.88E-09	5.88E-09
1.750	5.742	0.1702	3.3E-11	6.52E-10	1.73E-09	2.64E-09	3.26E-09	3.64E-09	3.87E-09	4E-09	4.08E-09	4.12E-09	4.15E-09	4.17E-09	4.17E-09	4.18E-09	4.18E-09	4.18E-09	4.18E-09	4.19E-09	4.19E-09	4.19E-09
1.923	6.309	0.1752	9.14E-12	3.01E-10	9.73E-10	1.64E-09	2.13E-09	2.46E-09	2.66E-09	2.78E-09	2.85E-09	2.89E-09	2.92E-09	2.93E-09	2.94E-09	2.94E-09	2.95E-09	2.95E-09	2.95E-09	2.95E-09	2.95E-09	2.95E-09
2.101	6.892	0.1802	2.29E-12	1.29E-10	5.22E-10	9.83E-10	1.36E-09	1.62E-09	1.79E-09	1.9E-09	1.96E-09	2E-09	2.03E-09	2.04E-09	2.05E-09	2.05E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09
2.283	7.491	0.1852	5.17E-13	5.18E-11	2.66E-10	5.67E-10	8.4E-10	1.05E-09	1.19E-09	1.28E-09	1.33E-09	1.37E-09	1.39E-09	1.4E-09	1.41E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09
2.471	8.107	0.1902	1.06E-13	1.92E-11	1.28E-10	3.14E-10	5.04E-10	6.58E-10	7.7E-10	8.44E-10	8.93E-10	9.24E-10	9.43E-10	9.55E-10	9.63E-10	9.67E-10	9.69E-10	9.71E-10	9.72E-10	9.73E-10	9.73E-10	9.73E-10
2.664	8.740	0.1952	1.96E-14	6.61E-12	5.85E-11	1.66E-10	2.92E-10	4.03E-10	4.89E-10	5.48E-10	5.89E-10	6.15E-10	6.32E-10	6.43E-10	6.49E-10	6.53E-10	6.55E-10	6.57E-10	6.58E-10	6.59E-10	6.59E-10	6.59E-10
2.862	9.388	0.2002	3.32E-15	2.11E-12	2.51E-11	8.41E-11	1.63E-10	2.4E-10	3.03E-10	3.49E-10	3.82E-10	4.04E-10	4.18E-10	4.27E-10	4.33E-10	4.36E-10	4.38E-10	4.4E-10	4.41E-10	4.41E-10	4.42E-10	4.42E-10
3.064	10.053	0.2052	5.13E-16	6.2E-13	1.01E-11	4.06E-11	8.77E-11	1.38E-10	1.83E-10	2.18E-10	2.43E-10	2.61E-10	2.72E-10	2.8E-10	2.85E-10	2.88E-10	2.9E-10	2.91E-10	2.92E-10	2.93E-10	2.93E-10	2.93E-10
3.272	10.735	0.2102	7.34E-17	1.69E-13	3.84E-12	1.86E-11	4.52E-11	7.72E-11	1.08E-10	1.32E-10	1.52E-10	1.66E-10	1.75E-10	1.81E-10	1.86E-10	1.88E-10	1.9E-10	1.91E-10	1.92E-10	1.92E-10	1.93E-10	1.93E-10
3.485	11.432	0.2152	1.07E-17	4.25E-14	1.36E-12	8.08E-12	2.24E-11	4.15E-11	6.14E-11	7.87E-11	9.27E-11	1.03E-10	1.11E-10	1.16E-10	1.19E-10	1.22E-10	1.23E-10	1.24E-10	1.24E-10	1.25E-10	1.25E-10	1.25E-10
3.702	12.147	0.2202	2.58E-18	9.89E-15	4.54E-13	3.33E-12	1.06E-11	2.15E-11	3.39E-11	4.55E-11	5.54E-11	6.31E-11	6.88E-11	7.28E-11	7.56E-11	7.75E-11	7.85E-11	7.94E-11	7.99E-11	8.03E-11	8.05E-11	8.07E-11
3.925	12.877	0.2252	1.68E-18	2.13E-15	1.41E-13	1.3E-12	4.76E-12	1.07E-11	1.81E-11	2.56E-11	3.23E-11	3.78E-11	4.2E-11	4.51E-11	4.73E-11	4.87E-11	4.96E-11	5.03E-11	5.08E-11	5.11E-11	5.13E-11	5.14E-11
4.153	13.624	0.2302	1.65E-18	4.26E-16	4.11E-14	4.77E-13	2.05E-12	5.13E-12	9.37E-12	1.4E-11	1.84E-11	2.22E-11	2.52E-11	2.74E-11	2.91E-11	3.02E-11	3.09E-11	3.15E-11	3.19E-11	3.22E-11	3.23E-11	3.24E-11
4.385	14.388	0.2352	1.65E-18	7.98E-17	1.12E-14	1.65E-13	8.36E-13	2.35E-12	4.67E-12	7.39E-12	1.02E-11	1.27E-11	1.48E-11	1.64E-11	1.76E-11	1.85E-11	1.9E-11	1.95E-11	1.98E-11	2E-11	2.01E-11	2.02E-11
4.623	15.168	0.2402	1.65E-18	1.47E-17	2.84E-15	5.41E-14	3.24E-13	1.03E-12	2.23E-12	3.78E-12	5.47E-12	7.07E-12	8.47E-12	9.61E-12	1.05E-11	1.11E-11	1.15E-11	1.19E-11	1.21E-11	1.23E-11	1.24E-11	1.25E-11
4.866	15.964	0.2452	1.65E-18	3.48E-18	6.76E-16	1.66E-14	1.19E-13	4.31E-13	1.03E-12	1.87E-12	2.85E-12	3.84E-12	4.75E-12	5.51E-12	6.13E-12	6.6E-12	6.89E-12	7.16E-12	7.35E-12	7.48E-12	7.57E-12	7.63E-12
5.114	16.777	0.2502	1.65E-18	1.77E-18	1.51E-16	4.82E-15	4.17E-14	1.72E-13	4.54E-13	8.9E-13	1.44E-12	2.03E-12	2.59E-12	3.1E-12	3.51E-12	3.84E-12	4.05E-12	4.25E-12	4.39E-12	4.49E-12	4.56E-12	4.61E-12
5.366	17.606	0.2552	1.65E-18	1.65E-18	3.22E-17	1.32E-15	1.38E-14	6.55E-14	1.92E-13	4.09E-13	7.02E-13	1.04E-12	1.38E-12	1.7E-12	1.97E-12	2.2E-12	2.34E-12	2.48E-12	2.59E-12	2.66E-12	2.72E-12	2.75E-12
5.624	18.451	0.2602	1.65E-18	1.65E-18	7.21E-18	3.38E-16	4.31E-15	2.37E-14	7.76E-14	1.81E-13	3.31E-13	5.16E-13	7.15E-13	9.09E-13	1.08E-12	1.23E-12	1.33E-12	1.43E-12	1.5E-12	1.56E-12	1.6E-12	1.62E-12
5.888	19.317	0.2677	1.65E-18	1.65E-18	2.39E-18	8.17E-17	1.27E-15	8.12E-15	2.98E-14	7.63E-14	1.5E-13	2.47E-13	3.58E-13	4.72E-13	5.79E-13	6.73E-13	7.37E-13	8.03E-13	8.55E-13	8.94E-13	9.23E-13	9.44E-13
6.159	20.208	0.2752	1.65E-18	1.65E-18	1.65E-18	1.9E-17	3.48E-16	2.61E-15	1.09E-14	3.07E-14	6.49E-14	1.14E-13	1.73E-13	2.37E-13	3E-13	3.58E-13	3.99E-13	4.42E-13	4.76E-13	5.03E-13	5.24E-13	5.39E-13
6.438	21.123	0.2827	1.65E-18	1.65E-18	1.65E-18	4.83E-18	9E-17	7.91E-16	3.73E-15	1.17E-14	2.68E-14	5.01E-14	8.03E-14	1.15E-13	1.51E-13	1.85E-13	2.1E-13	2.37E-13	2.59E-13	2.77E-13	2.91E-13	3.02E-13
6.725	22.063	0.2902	1.65E-18	1.65E-18	1.65E-18	1.99E-18	2.23E-17	2.25E-16	1.21E-15	4.26E-15	1.06E-14	2.11E-14	3.58E-14	5.36E-14	7.31E-14	9.25E-14	1.07E-13	1.24E-13	1.38E-13	1.49E-13	1.59E-13	1.66E-13
7.019	23.027	0.2977	1.65E-18	1.65E-18	1.65E-18	1.65E-18	5.79E-18	6.05E-17	3.7E-16	1.47E-15	3.96E-15	8.5E-15	1.53E-14	2.41E-14	3.42E-14	4.48E-14	5.31E-14	6.28E-14	7.13E-14	7.85E-14	8.44E-14	8.91E-14
7.320	24.016	0.3052	1.65E-18	1.65E-18	1.65E-18	1.65E-18	2.18E-18	1.57E-17	1.07E-16	4.81E-16	1.41E-15	3.27E-15	6.26E-15	1.04E-14	1.54E-14	2.1E-14	2.55E-14	3.09E-14	3.59E-14	4.03E-14	4.39E-14	4.69E-14
7.629	25.030	0.3127	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	4.46E-18	2.95E-17	1.5E-16	4.8E-16	1.2E-15	2.45E-15	4.3E-15	6.69E-15	9.46E-15	1.18E-14	1.48E-14	1.76E-14	2.01E-14	2.23E-14	2.41E-14
7.946	26.068	0.3202	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.94E-18	8.15E-18	4.43E-17	1.55E-16	4.17E-16	9.14E-16	1.7E-15	2.78E-15	4.11E-15	5.31E-15	6.84E-15	8.35E-15	9.77E-15	1.1E-14	1.21E-14
8.269	27.131	0.3277	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	2.76E-18	1.28E-17	4.76E-17	1.39E-16	3.26E-16	6.45E-16	1.11E-15	1.72E-15	2.3E-15	3.06E-15	3.85E-15	4.61E-15	5.31E-15	5.93E-15
8.601	28.218	0.3352	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.66E-18	4.05E-18	1.43E-17	4.41E-17	1.11E-16	2.34E-16	4.27E-16	6.93E-16	9.59E-16	1.32E-15	1.72E-15	2.11E-15	2.49E-15	2.83E-15
8.950	29.364	0.3632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.84E-18	4.35E-18	1.31E-17	3.48E-17	7.82E-17	1.51E-16	2.58E-16	3.73E-16	5.35E-16	7.17E-16	9.09E-16	1.1E-15	1.28E-15
9.327	30.601	0.3912	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.86E-18	3.92E-18	1.01E-17	2.36E-17	4.84E-17	8.73E-17	1.32E-16	1.98E-16	2.75E-16	3.6E-16	4.49E-16	5.36E-16
9.733	31.931	0.4192	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.75E-18	3.1E-18	6.73E-18	1.42E-17	2.68E-17	4.25E-17	6.66E-17	9.66E-17	1.31E-16	1.69E-16	2.07E-16
10.166	33.352	0.4472	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	2.27E-18	4.12E-18	7.7E-18	1.26E-17	2.05E-17	3.1E-17	4.38E-17	5.84E-17	7.4E-17
10.627	34.865	0.4752	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.73E-18	2.48E-18	3.76E-18	6.01E-18	9.27E-18	1.35E-17	1.86E-17	2.44E-17
11.116	36.470	0.5032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.67E-18	2.08E-18	2.91E-18	4.09E-18	5.64E-18	7.52E-18
11.633	38.167	0.5312	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.69E-18	2E-18	2.5E-18
12.179	39.956	0.5592	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
12.752	41.836	0.5872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
13.353	43.809	0.6152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
13.982	45.873	0.6432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
14.639	48.029	0.6712	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
15.325	50.277	0.6992	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.038	52.617	0.7272	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.779	55.049	0.7552	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
17.548	57.573	0.7832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
18.345	60.188	0.8112	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consumption Rates

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20
19.171	62.895	0.8392	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.024	65.695	0.8672	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.905	68.586	0.8952	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
21.814	71.569	0.9232	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
22.751	74.643	0.9512	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
23.717	77.810	0.9792	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
24.710	81.069	1.0072	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
25.731	84.419	1.0352	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
26.780	87.861	1.0632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
27.857	91.395	1.0912	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
28.963	95.021	1.1192	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
30.096	98.739	1.1472	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
31.257	102.549	1.1752	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
32.446	106.450	1.2032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
33.663	110.444	1.2312	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
34.909	114.529	1.2592	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
36.182	118.706	1.2872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
37.483	122.975	1.3152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
38.812	127.336	1.3432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
40.160	131.760	1.3532	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
41.519	136.216	1.3632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
42.887	140.704	1.3732	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
44.265	145.226	1.3832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
45.653	149.781	1.3932	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.051	154.368	1.4032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.758	156.686	0.01	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			21	22	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
0.001	0.002	0.001	1.46E-07	1.46E-07	1.46E-07	1.46E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.002	0.007	0.002	1.46E-07	1.46E-07	1.46E-07	1.46E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.007	0.023	0.008	1.44E-07	1.44E-07	1.44E-07	1.44E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.019	0.062	0.016	1.41E-07	1.41E-07	1.41E-07	1.41E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.043	0.141	0.032	1.34E-07	1.34E-07	1.34E-07	1.34E-07	1.34E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.091	0.299	0.064	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	1.22E-07	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.181	0.593	0.1152	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.01E-07	1.02E-07	1.03E-07	1.04E-07	1.03E-07	0	0	0	0	0	0	0	0	0	0	0
0.298	0.979	0.1202	7.95E-08	7.95E-08	7.95E-08	7.95E-08	7.95E-08	8E-08	8.13E-08	8.16E-08	8.12E-08	8.61E-08	8.69E-08	8.69E-08	8.69E-08	0	0	0	0	0	0	0
0.421	1.381	0.1252	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.2E-08	6.23E-08	6.32E-08	6.36E-08	6.35E-08	6.67E-08	6.77E-08	6.77E-08	6.78E-08	7.37E-08	7.42E-08	7.53E-08	7.43E-08	0	0	0
0.549	1.800	0.1302	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.78E-08	4.81E-08	4.86E-08	4.91E-08	4.91E-08	5.12E-08	5.22E-08	5.23E-08	5.23E-08	5.66E-08	5.73E-08	5.78E-08	5.74E-08	6.39E-08	6.44E-08	6.44E-08
0.681	2.236	0.1352	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.65E-08	3.67E-08	3.71E-08	3.75E-08	3.75E-08	3.88E-08	3.98E-08	3.99E-08	3.99E-08	4.3E-08	4.37E-08	4.39E-08	4.38E-08	4.86E-08	4.92E-08	4.92E-08
0.819	2.687	0.1402	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.76E-08	2.77E-08	2.8E-08	2.83E-08	2.83E-08	2.91E-08	3.01E-08	3.02E-08	3.02E-08	3.24E-08	3.3E-08	3.32E-08	3.32E-08	3.66E-08	3.71E-08	3.72E-08
0.962	3.156	0.1452	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.07E-08	2.08E-08	2.09E-08	2.12E-08	2.12E-08	2.16E-08	2.25E-08	2.26E-08	2.26E-08	2.41E-08	2.47E-08	2.48E-08	2.48E-08	2.73E-08	2.78E-08	2.79E-08
1.110	3.640	0.1502	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.53E-08	1.54E-08	1.55E-08	1.57E-08	1.57E-08	1.59E-08	1.66E-08	1.67E-08	1.68E-08	1.77E-08	1.83E-08	1.84E-08	1.84E-08	2.01E-08	2.06E-08	2.07E-08
1.262	4.141	0.1552	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.13E-08	1.15E-08	1.15E-08	1.16E-08	1.22E-08	1.23E-08	1.23E-08	1.29E-08	1.34E-08	1.35E-08	1.35E-08	1.46E-08	1.51E-08	1.51E-08
1.420	4.658	0.1602	8.17E-09	8.17E-09	8.17E-09	8.17E-09	8.17E-09	8.19E-09	8.22E-09	8.35E-09	8.33E-09	8.42E-09	8.82E-09	8.92E-09	8.94E-09	9.27E-09	9.7E-09	9.78E-09	9.82E-09	1.05E-08	1.09E-08	1.1E-08
1.583	5.192	0.1652	5.88E-09	5.88E-09	5.88E-09	5.88E-09	5.88E-09	5.89E-09	5.91E-09	6E-09	5.98E-09	6.04E-09	6.32E-09	6.41E-09	6.43E-09	6.61E-09	6.96E-09	7.03E-09	7.06E-09	7.51E-09	7.84E-09	7.91E-09
1.750	5.742	0.1702	4.19E-09	4.19E-09	4.19E-09	4.19E-09	4.19E-09	4.19E-09	4.21E-09	4.27E-09	4.25E-09	4.29E-09	4.48E-09	4.56E-09	4.57E-09	4.67E-09	4.93E-09	5E-09	5.03E-09	5.3E-09	5.56E-09	5.63E-09
1.923	6.309	0.1752	2.95E-09	2.95E-09	2.95E-09	2.95E-09	2.95E-09	2.95E-09	2.96E-09	3E-09	2.99E-09	3.02E-09	3.15E-09	3.21E-09	3.22E-09	3.28E-09	3.46E-09	3.51E-09	3.54E-09	3.7E-09	3.91E-09	3.96E-09
2.101	6.892	0.1802	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.06E-09	2.07E-09	2.09E-09	2.09E-09	2.11E-09	2.19E-09	2.24E-09	2.25E-09	2.27E-09	2.4E-09	2.44E-09	2.47E-09	2.56E-09	2.71E-09	2.76E-09
2.283	7.491	0.1852	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.42E-09	1.43E-09	1.44E-09	1.44E-09	1.45E-09	1.5E-09	1.54E-09	1.55E-09	1.57E-09	1.65E-09	1.68E-09	1.71E-09	1.75E-09	1.87E-09	1.91E-09
2.471	8.107	0.1902	9.73E-10	9.74E-10	9.74E-10	9.74E-10	9.74E-10	9.74E-10	9.77E-10	9.85E-10	9.83E-10	9.94E-10	1.02E-09	1.05E-09	1.06E-09	1.07E-09	1.12E-09	1.15E-09	1.17E-09	1.19E-09	1.27E-09	1.3E-09
2.664	8.740	0.1952	6.59E-10	6.59E-10	6.59E-10	6.59E-10	6.59E-10	6.6E-10	6.61E-10	6.66E-10	6.65E-10	6.72E-10	6.89E-10	7.11E-10	7.19E-10	7.22E-10	7.55E-10	7.72E-10	7.88E-10	8.02E-10	8.53E-10	8.79E-10
2.862	9.388	0.2002	4.42E-10	4.42E-10	4.42E-10	4.42E-10	4.42E-10	4.42E-10	4.43E-10	4.46E-10	4.45E-10	4.5E-10	4.6E-10	4.75E-10	4.81E-10	4.84E-10	5.03E-10	5.15E-10	5.27E-10	5.35E-10	5.68E-10	5.88E-10
3.064	10.053	0.2052	2.93E-10	2.93E-10	2.94E-10	2.94E-10	2.94E-10	2.94E-10	2.94E-10	2.96E-10	2.95E-10	2.98E-10	3.04E-10	3.14E-10	3.19E-10	3.21E-10	3.32E-10	3.4E-10	3.49E-10	3.54E-10	3.74E-10	3.89E-10
3.272	10.735	0.2102	1.93E-10	1.93E-10	1.93E-10	1.93E-10	1.93E-10	1.93E-10	1.93E-10	1.94E-10	1.94E-10	1.96E-10	1.99E-10	2.06E-10	2.09E-10	2.11E-10	2.17E-10	2.22E-10	2.29E-10	2.32E-10	2.44E-10	2.54E-10
3.485	11.432	0.2152	1.25E-10	1.25E-10	1.26E-10	1.26E-10	1.26E-10	1.26E-10	1.26E-10	1.26E-10	1.26E-10	1.27E-10	1.29E-10	1.33E-10	1.36E-10	1.37E-10	1.4E-10	1.44E-10	1.48E-10	1.51E-10	1.57E-10	1.65E-10
3.702	12.147	0.2202	8.08E-11	8.08E-11	8.09E-11	8.09E-11	8.09E-11	8.09E-11	8.1E-11	8.13E-11	8.12E-11	8.19E-11	8.29E-11	8.55E-11	8.74E-11	8.82E-11	8.99E-11	9.22E-11	9.53E-11	9.69E-11	1.01E-10	1.06E-10
3.925	12.877	0.2252	5.15E-11	5.15E-11	5.16E-11	5.16E-11	5.16E-11	5.16E-11	5.17E-11	5.18E-11	5.18E-11	5.22E-11	5.28E-11	5.43E-11	5.56E-11	5.62E-11	5.71E-11	5.85E-11	6.05E-11	6.17E-11	6.37E-11	6.69E-11
4.153	13.624	0.2302	3.25E-11	3.25E-11	3.26E-11	3.26E-11	3.26E-11	3.26E-11	3.26E-11	3.27E-11	3.27E-11	3.29E-11	3.33E-11	3.41E-11	3.5E-11	3.55E-11	3.59E-11	3.68E-11	3.81E-11	3.89E-11	4E-11	4.2E-11
4.385	14.388	0.2352	2.03E-11	2.03E-11	2.04E-11	2.04E-11	2.04E-11	2.04E-11	2.04E-11	2.05E-11	2.05E-11	2.06E-11	2.08E-11	2.12E-11	2.18E-11	2.22E-11	2.24E-11	2.29E-11	2.37E-11	2.42E-11	2.48E-11	2.61E-11
4.623	15.168	0.2402	1.25E-11	1.26E-11	1.26E-11	1.26E-11	1.26E-11	1.26E-11	1.26E-11	1.27E-11	1.27E-11	1.27E-11	1.28E-11	1.31E-11	1.35E-11	1.37E-11	1.38E-11	1.41E-11	1.46E-11	1.5E-11	1.53E-11	1.6E-11
4.866	15.964	0.2452	7.67E-12	7.69E-12	7.74E-12	7.75E-12	7.75E-12	7.75E-12	7.75E-12	7.76E-12	7.76E-12	7.79E-12	7.86E-12	8E-12	8.22E-12	8.38E-12	8.47E-12	8.62E-12	8.9E-12	9.15E-12	9.34E-12	9.75E-12
5.114	16.777	0.2502	4.64E-12	4.66E-12	4.69E-12	4.7E-12	4.71E-12	4.71E-12	4.71E-12	4.71E-12	4.71E-12	4.73E-12	4.77E-12	4.84E-12	4.97E-12	5.07E-12	5.13E-12	5.22E-12	5.37E-12	5.53E-12	5.65E-12	5.87E-12
5.366	17.606	0.2552	2.78E-12	2.79E-12	2.82E-12	2.83E-12	2.83E-12	2.83E-12	2.83E-12	2.83E-12	2.83E-12	2.84E-12	2.86E-12	2.9E-12	2.98E-12	3.04E-12	3.08E-12	3.12E-12	3.21E-12	3.31E-12	3.38E-12	3.51E-12
5.624	18.451	0.2602	1.64E-12	1.65E-12	1.68E-12	1.68E-12	1.69E-12	1.69E-12	1.69E-12	1.69E-12	1.69E-12	1.69E-12	1.7E-12	1.72E-12	1.76E-12	1.81E-12	1.83E-12	1.85E-12	1.9E-12	1.96E-12	2.01E-12	2.07E-12
5.888	19.317	0.2677	9.59E-13	9.66E-13	9.84E-13	9.89E-13	9.91E-13	9.91E-13	9.91E-13	9.92E-13	9.92E-13	9.94E-13	9.99E-13	1.01E-12	1.03E-12	1.06E-12	1.07E-12	1.08E-12	1.11E-12	1.15E-12	1.17E-12	1.21E-12
6.159	20.208	0.2752	5.49E-13	5.55E-13	5.68E-13	5.73E-13	5.74E-13	5.74E-13	5.74E-13	5.74E-13	5.74E-13	5.75E-13	5.78E-13	5.84E-13	5.95E-13	6.1E-13	6.2E-13	6.26E-13	6.42E-13	6.61E-13	6.78E-13	6.96E-13
6.438	21.123	0.2827	3.09E-13	3.13E-13	3.23E-13	3.26E-13	3.27E-13	3.28E-13	3.28E-13	3.28E-13	3.28E-13	3.28E-13	3.3E-13	3.33E-13	3.38E-13	3.47E-13	3.53E-13	3.56E-13	3.64E-13	3.75E-13	3.85E-13	3.95E-13
6.725	22.063	0.2902	1.71E-13	1.74E-13	1.81E-13	1.83E-13	1.84E-13	1.84E-13	1.84E-13	1.84E-13	1.84E-13	1.85E-13	1.85E-13	1.87E-13	1.9E-13	1.94E-13	1.98E-13	1.99E-13	2.04E-13	2.1E-13	2.16E-13	2.21E-13
7.019	23.027	0.2977	9.27E-14	9.45E-14	9.96E-14	1.01E-13	1.02E-13	1.02E-13	1.02E-13	1.02E-13	1.02E-13	1.02E-13	1.03E-13	1.03E-13	1.05E-13	1.07E-13	1.09E-13	1.1E-13	1.13E-13	1.16E-13	1.19E-13	1.22E-13
7.320	24.016	0.3052	4.92E-14	5.05E-14	5.39E-14	5.52E-14	5.57E-14	5.58E-14	5.58E-14	5.59E-14	5.59E-14	5.59E-14	5.6E-14	5.64E-14	5.7E-14	5.82E-14	5.95E-14	5.99E-14	6.12E-14	6.28E-14	6.46E-14	6.62E-14
7.629	25.030	0.3127	2.56E-14	2.64E-14	2.87E-14	2.96E-14	2.99E-14	3E-14	3.01E-14	3.01E-14	3.01E-14	3.01E-14	3.02E-14	3.03E-14	3.06E-14	3.12E-14	3.19E-14	3.21E-14	3.28E-14	3.36E-14	3.46E-14	3.55E-14
7.946	26.068	0.3202	1.3E-14	1.35E-14	1.5E-14	1.56E-14	1.59E-14	1.59E-14	1.6E-14	1.6E-14	1.6E-14	1.6E-14	1.6E-14	1.61E-14	1.62E-14	1.65E-14	1.69E-14	1.7E-14	1.73E-14	1.77E-14	1.83E-14	1.87E-14
8.269	27.131	0.3277	6.47E-15	6.77E-15	7.7E-15	8.11E-15	8.27E-15	8.33E-15	8.35E-15	8.35E-15	8.35E-15	8.35E-15	8.37E-15	8.4E-15	8.46E-15	8.59E-15	8.78E-15	8.83E-15	9.02E-15	9.23E-15	9.49E-15	9.75E-15
8.601	28.218	0.3352	3.14E-15	3.31E-15	3.88E-15	4.15E-15	4.26E-15	4.29E-15	4.31E-15	4.31E-15	4.31E-15	4.31E-15	4.32E-15	4.33E-15	4.36E-15	4.42E-15	4.51E-15	4.54E-15	4.64E-15	4.74E-15	4.87E-15	5E-15
8.950	29.364	0.3632	1.44E-15	1.54E-15	1.87E-15	2.03E-15	2.1E-15	2.13E-15	2.14E-15	2.14E-15	2.14E-15	2.14E-15	2.14E-15	2.15E-15	2.16E-15	2.19E-15	2.23E-15	2.24E-15	2.29E-15	2.34E-15	2.4E-15	2.47E-15
9.327	30.601	0.3912	6.18E-16	6.68E-16	8.44E-16	9.39E-16	9.82E-16	9.99E-16	1E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.01E-15	1.02E-15	1.03E-15	1.04E-15	1.05E-15	1.07E-15	1.1E-15	1.12E-15	1.15E-15
9.733	31.931	0.4192	2.45E-16	2.69E-16	3.57E-16	4.09E-16	4.33E-16	4.44E-16	4.48E-16	4.49E-16	4.49E-16	4.49E-16	4.5E-16	4.51E-16	4.52E-16	4.56E-16	4.63E-16	4.67E-16	4.76E-16	4.86E-16	4.98E-16	5.11E-16
10.166	33.352	0.4472	8.99E-17	1E-16	1.41E-16	1.67E-16	1.81E-16	1.87E-16	1.89E-16	1.9E-16	1.9E-16	1.9E-16	1.9E-16	1.91E-16	1.91E-16	1.93E-16	1.95E-16	1.97E-16	2E-16	2.05E-16	2.09E-16	2.15E-16
10.627	34.865	0.4752	3.05E-17	3.48E-17	5.21E-17	6.44E-17	7.12E-17	7.44E-17	7.58E-17	7.63E-17	7.61E-17	7.64E-17	7.65E-17	7.66E-17	7.68E-17	7.72E-17	7.81E-17	7.87E-17	8.01E-17	8.17E-17	8.35E-17	8.57E-17
11.116	36.470	0.5032	9.65E-18	1.12E-17	1.8E-17	2.32E-17	2.64E-17	2.81E-17	2.88E-17	2.91E-17	2.9E-17	2.92E-17	2.92E-17	2.92E-17	2.93E-17	2.94E-17	2.97E-17	2.99E-17	3.04E-17	3.1E-17	3.17E-17	3.25E-17
11.633	38.167	0.5312	3.11E-18	3.58E-18	5.87E-18	7.94E-18	9.32E-18	1.01E-17	1.04E-17	1.06E-17	1.05E-17	1.06E-17	1.06E-17	1.07E-17	1.07E-17	1.07E-17	1.08E-17	1.09E-17	1.1E-17	1.12E-17	1.15E-17	1.17E-17
12.179	39.956	0.5592	1.65E-18	1.65E-18	2.12E-18	2.79E-18	3.28E-18	3.57E-18	3.71E-18	3.77E-18	3.73E-18	3.78E-18	3.8E-18	3.8E-18	3.81E-18	3.82E-18	3.84E-18	3.84E-18	3.9E-18	3.96E-18	4.04E-18	4.13E-18
12.752	41.836	0.5872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.66E-18	1.69E-18
13.353	43.809	0.6152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
13.982	45.873	0.6432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
14.639	48.029	0.6712	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
15.325	50.277	0.6992	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.038	52.617	0.7272	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.779	55.049	0.7552	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
17.548	57.573	0.7832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
18.345	60.188	0.8112	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			21	22	24	27	30	33	36	39	42	45	48	51	54	57	60	63	66	69	72	75
19.171	62.895	0.8392	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.024	65.695	0.8672	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.905	68.586	0.8952	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
21.814	71.569	0.9232	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
22.751	74.643	0.9512	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
23.717	77.810	0.9792	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
24.710	81.069	1.0072	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
25.731	84.419	1.0352	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
26.780	87.861	1.0632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
27.857	91.395	1.0912	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
28.963	95.021	1.1192	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
30.096	98.739	1.1472	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
31.257	102.549	1.1752	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
32.446	106.450	1.2032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
33.663	110.444	1.2312	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
34.909	114.529	1.2592	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
36.182	118.706	1.2872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
37.483	122.975	1.3152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
38.812	127.336	1.3432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
40.160	131.760	1.3532	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
41.519	136.216	1.3632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
42.887	140.704	1.3732	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
44.265	145.226	1.3832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
45.653	149.781	1.3932	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.051	154.368	1.4032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.758	156.686	0.01	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135
0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.002	0.007	0.002	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.007	0.023	0.008	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.019	0.062	0.016	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.043	0.141	0.032	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.091	0.299	0.064	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.181	0.593	0.1152	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.298	0.979	0.1202	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.421	1.381	0.1252	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.549	1.800	0.1302	6.44E-08	6.44E-08	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
0.681	2.236	0.1352	4.92E-08	4.92E-08	4.95E-08	5.58E-08	5.65E-08	5.66E-08	5.66E-08	5.66E-08	5.66E-08	0	0	0	0	0	0	0	0	0	0	0
0.819	2.687	0.1402	3.72E-08	3.72E-08	3.73E-08	4.2E-08	4.27E-08	4.28E-08	4.28E-08	4.28E-08	4.28E-08	5.03E-08	5.01E-08	5.02E-08	5.02E-08	5.02E-08	5.02E-08	5.02E-08	0	0	0	0
0.962	3.156	0.1452	2.79E-08	2.79E-08	2.79E-08	3.13E-08	3.19E-08	3.2E-08	3.2E-08	3.2E-08	3.2E-08	3.68E-08	3.75E-08	3.75E-08	3.76E-08	3.76E-08	3.76E-08	3.76E-08	3.77E-08	4.34E-08	4.45E-08	4.48E-08
1.110	3.640	0.1502	2.07E-08	2.07E-08	2.07E-08	2.3E-08	2.36E-08	2.37E-08	2.37E-08	2.37E-08	2.38E-08	2.68E-08	2.78E-08	2.78E-08	2.78E-08	2.78E-08	2.78E-08	2.78E-08	2.79E-08	3.2E-08	3.29E-08	3.32E-08
1.262	4.141	0.1552	1.52E-08	1.52E-08	1.52E-08	1.68E-08	1.73E-08	1.74E-08	1.74E-08	1.74E-08	1.74E-08	1.93E-08	2.03E-08	2.04E-08	2.04E-08	2.04E-08	2.04E-08	2.04E-08	2.04E-08	2.32E-08	2.41E-08	2.43E-08
1.420	4.658	0.1602	1.1E-08	1.1E-08	1.1E-08	1.21E-08	1.25E-08	1.26E-08	1.27E-08	1.27E-08	1.27E-08	1.38E-08	1.47E-08	1.48E-08	1.48E-08	1.48E-08	1.48E-08	1.48E-08	1.48E-08	1.67E-08	1.75E-08	1.77E-08
1.583	5.192	0.1652	7.92E-09	7.92E-09	7.93E-09	8.59E-09	8.99E-09	9.08E-09	9.1E-09	9.11E-09	9.11E-09	9.79E-09	1.06E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.07E-08	1.19E-08	1.25E-08	1.27E-08
1.750	5.742	0.1702	5.64E-09	5.64E-09	5.64E-09	6.05E-09	6.38E-09	6.46E-09	6.48E-09	6.48E-09	6.48E-09	6.89E-09	7.49E-09	7.58E-09	7.6E-09	7.6E-09	7.6E-09	7.6E-09	7.6E-09	8.37E-09	8.88E-09	9.03E-09
1.923	6.309	0.1752	3.97E-09	3.98E-09	3.98E-09	4.22E-09	4.48E-09	4.55E-09	4.57E-09	4.57E-09	4.57E-09	4.81E-09	5.26E-09	5.34E-09	5.36E-09	5.36E-09	5.36E-09	5.36E-09	5.36E-09	5.83E-09	6.23E-09	6.35E-09
2.101	6.892	0.1802	2.77E-09	2.78E-09	2.77E-09	2.91E-09	3.11E-09	3.17E-09	3.19E-09	3.19E-09	3.19E-09	3.33E-09	3.64E-09	3.72E-09	3.74E-09	3.74E-09	3.74E-09	3.74E-09	3.74E-09	4.01E-09	4.32E-09	4.43E-09
2.283	7.491	0.1852	1.92E-09	1.92E-09	1.92E-09	1.99E-09	2.14E-09	2.19E-09	2.2E-09	2.2E-09	2.2E-09	2.28E-09	2.5E-09	2.57E-09	2.58E-09	2.58E-09	2.58E-09	2.58E-09	2.58E-09	2.74E-09	2.96E-09	3.05E-09
2.471	8.107	0.1902	1.31E-09	1.31E-09	1.31E-09	1.35E-09	1.45E-09	1.49E-09	1.5E-09	1.51E-09	1.51E-09	1.55E-09	1.69E-09	1.75E-09	1.76E-09	1.77E-09	1.77E-09	1.77E-09	1.77E-09	1.85E-09	2.01E-09	2.08E-09
2.664	8.740	0.1952	8.86E-10	8.88E-10	8.87E-10	9.08E-10	9.75E-10	1.01E-09	1.02E-09	1.02E-09	1.02E-09	1.05E-09	1.13E-09	1.18E-09	1.19E-09	1.2E-09	1.2E-09	1.2E-09	1.2E-09	1.24E-09	1.35E-09	1.4E-09
2.862	9.388	0.2002	5.94E-10	5.96E-10	5.95E-10	6.05E-10	6.48E-10	6.74E-10	6.82E-10	6.84E-10	6.85E-10	6.98E-10	7.52E-10	7.9E-10	8E-10	8.02E-10	8.03E-10	8.03E-10	8.02E-10	8.24E-10	8.97E-10	9.38E-10
3.064	10.053	0.2052	3.94E-10	3.95E-10	3.94E-10	3.99E-10	4.27E-10	4.46E-10	4.52E-10	4.54E-10	4.55E-10	4.61E-10	4.93E-10	5.22E-10	5.3E-10	5.33E-10	5.33E-10	5.33E-10	5.33E-10	5.43E-10	5.89E-10	6.2E-10
3.272	10.735	0.2102	2.59E-10	2.6E-10	2.59E-10	2.62E-10	2.78E-10	2.91E-10	2.97E-10	2.98E-10	2.99E-10	3.02E-10	3.21E-10	3.41E-10	3.48E-10	3.5E-10	3.5E-10	3.5E-10	3.5E-10	3.55E-10	3.83E-10	4.05E-10
3.485	11.432	0.2152	1.68E-10	1.69E-10	1.68E-10	1.7E-10	1.79E-10	1.89E-10	1.93E-10	1.94E-10	1.94E-10	1.96E-10	2.06E-10	2.2E-10	2.26E-10	2.28E-10	2.28E-10	2.28E-10	2.28E-10	2.3E-10	2.46E-10	2.62E-10
3.702	12.147	0.2202	1.08E-10	1.09E-10	1.08E-10	1.09E-10	1.14E-10	1.21E-10	1.24E-10	1.25E-10	1.25E-10	1.26E-10	1.32E-10	1.41E-10	1.45E-10	1.47E-10	1.47E-10	1.47E-10	1.47E-10	1.48E-10	1.57E-10	1.68E-10
3.925	12.877	0.2252	6.87E-11	6.94E-11	6.88E-11	6.95E-11	7.23E-11	7.65E-11	7.88E-11	7.97E-11	7.99E-11	8.03E-11	8.32E-11	8.91E-11	9.23E-11	9.34E-11	9.37E-11	9.38E-11	9.36E-11	9.4E-11	9.9E-11	1.06E-10
4.153	13.624	0.2302	4.33E-11	4.38E-11	4.33E-11	4.38E-11	4.53E-11	4.8E-11	4.96E-11	5.03E-11	5.05E-11	5.06E-11	5.22E-11	5.58E-11	5.81E-11	5.89E-11	5.92E-11	5.92E-11	5.91E-11	5.93E-11	6.19E-11	6.63E-11
4.385	14.388	0.2352	2.7E-11	2.73E-11	2.7E-11	2.74E-11	2.81E-11	2.97E-11	3.09E-11	3.14E-11	3.15E-11	3.16E-11	3.24E-11	3.45E-11	3.61E-11	3.68E-11	3.7E-11	3.7E-11	3.69E-11	3.7E-11	3.84E-11	4.11E-11
4.623	15.168	0.2402	1.66E-11	1.69E-11	1.66E-11	1.69E-11	1.73E-11	1.83E-11	1.9E-11	1.94E-11	1.95E-11	1.95E-11	2E-11	2.12E-11	2.22E-11	2.27E-11	2.29E-11	2.29E-11	2.28E-11	2.29E-11	2.36E-11	2.52E-11
4.866	15.964	0.2452	1.01E-11	1.03E-11	1.02E-11	1.04E-11	1.06E-11	1.11E-11	1.16E-11	1.19E-11	1.2E-11	1.2E-11	1.22E-11	1.28E-11	1.35E-11	1.39E-11	1.4E-11	1.41E-11	1.4E-11	1.4E-11	1.43E-11	1.53E-11
5.114	16.777	0.2502	6.12E-12	6.26E-12	6.13E-12	6.27E-12	6.38E-12	6.68E-12	7E-12	7.18E-12	7.26E-12	7.25E-12	7.36E-12	7.72E-12	8.16E-12	8.41E-12	8.51E-12	8.54E-12	8.47E-12	8.52E-12	8.66E-12	9.17E-12
5.366	17.606	0.2552	3.66E-12	3.75E-12	3.66E-12	3.76E-12	3.82E-12	3.98E-12	4.18E-12	4.3E-12	4.36E-12	4.35E-12	4.41E-12	4.6E-12	4.87E-12	5.04E-12	5.11E-12	5.13E-12	5.08E-12	5.12E-12	5.18E-12	5.46E-12
5.624	18.451	0.2602	2.16E-12	2.23E-12	2.17E-12	2.23E-12	2.27E-12	2.35E-12	2.47E-12	2.55E-12	2.59E-12	2.58E-12	2.62E-12	2.71E-12	2.87E-12	2.98E-12	3.04E-12	3.05E-12	3.02E-12	3.05E-12	3.08E-12	3.22E-12
5.888	19.317	0.2677	1.26E-12	1.3E-12	1.27E-12	1.31E-12	1.33E-12	1.37E-12	1.44E-12	1.49E-12	1.52E-12	1.51E-12	1.54E-12	1.58E-12	1.67E-12	1.74E-12	1.78E-12	1.79E-12	1.77E-12	1.79E-12	1.8E-12	1.87E-12
6.159	20.208	0.2752	7.26E-13	7.51E-13	7.29E-13	7.52E-13	7.67E-13	7.89E-13	8.27E-13	8.6E-13	8.78E-13	8.72E-13	8.87E-13	9.1E-13	9.58E-13	1E-12	1.03E-12	1.04E-12	1.02E-12	1.03E-12	1.04E-12	1.08E-12
6.438	21.123	0.2827	4.11E-13	4.26E-13	4.13E-13	4.27E-13	4.36E-13	4.47E-13	4.68E-13	4.88E-13	4.99E-13	4.96E-13	5.05E-13	5.16E-13	5.42E-13	5.69E-13	5.85E-13	5.92E-13	5.79E-13	5.89E-13	5.94E-13	6.09E-13
6.725	22.063	0.2902	2.29E-13	2.38E-13	2.31E-13	2.39E-13	2.45E-13	2.5E-13	2.61E-13	2.72E-13	2.8E-13	2.77E-13	2.83E-13	2.89E-13	3.02E-13	3.17E-13	3.27E-13	3.32E-13	3.24E-13	3.3E-13	3.34E-13	3.4E-13
7.019	23.027	0.2977	1.26E-13	1.31E-13	1.27E-13	1.32E-13	1.35E-13	1.38E-13	1.43E-13	1.5E-13	1.54E-13	1.53E-13	1.56E-13	1.59E-13	1.66E-13	1.74E-13	1.8E-13	1.84E-13	1.78E-13	1.83E-13	1.85E-13	1.88E-13
7.320	24.016	0.3052	6.84E-14	7.11E-14	6.89E-14	7.14E-14	7.34E-14	7.5E-14	7.76E-14	8.11E-14	8.39E-14	8.3E-14	8.5E-14	8.66E-14	8.97E-14	9.42E-14	9.8E-14	1E-13	9.68E-14	9.93E-14	1.01E-13	1.02E-13
7.629	25.030	0.3127	3.66E-14	3.8E-14	3.69E-14	3.82E-14	3.93E-14	4.02E-14	4.14E-14	4.33E-14	4.49E-14	4.44E-14	4.56E-14	4.65E-14	4.79E-14	5.02E-14	5.24E-14	5.37E-14	5.17E-14	5.32E-14	5.41E-14	5.47E-14
7.946	26.068	0.3202	1.93E-14	2E-14	1.94E-14	2.01E-14	2.07E-14	2.12E-14	2.18E-14	2.28E-14	2.36E-14	2.34E-14	2.41E-14	2.46E-14	2.52E-14	2.64E-14	2.76E-14	2.84E-14	2.72E-14	2.81E-14	2.86E-14	2.9E-14
8.269	27.131	0.3277	1E-14	1.04E-14	1.01E-14	1.04E-14	1.08E-14	1.1E-14	1.13E-14	1.18E-14	1.23E-14	1.22E-14	1.25E-14	1.28E-14	1.31E-14	1.37E-14	1.43E-14	1.48E-14	1.41E-14	1.46E-14	1.49E-14	1.51E-14
8.601	28.218	0.3352	5.14E-15	5.31E-15	5.17E-15	5.35E-15	5.53E-15	5.68E-15	5.82E-15	6.04E-15	6.29E-15	6.23E-15	6.42E-15	6.57E-15	6.72E-15	6.98E-15	7.31E-15	7.57E-15	7.24E-15	7.49E-15	7.67E-15	7.78E-15
8.950	29.364	0.3632	2.53E-15	2.62E-15	2.55E-15	2.63E-15	2.72E-15	2.8E-15	2.87E-15	2.97E-15	3.09E-15	3.07E-15	3.17E-15	3.25E-15	3.32E-15	3.43E-15	3.59E-15	3.73E-15	3.56E-15	3.69E-15	3.79E-15	3.85E-15
9.327	30.601	0.3912	1.18E-15	1.22E-15	1.19E-15	1.23E-15	1.27E-15	1.31E-15	1.34E-15	1.38E-15	1.44E-15	1.43E-15	1.48E-15	1.52E-15	1.55E-15	1.6E-15	1.67E-15	1.74E-15	1.66E-15	1.72E-15	1.77E-15	1.8E-15
9.733	31.931	0.4192	5.25E-16	5.4E-16	5.27E-16	5.44E-16	5.62E-16	5.8E-16	5.95E-16	6.12E-16	6.36E-16	6.33E-16	6.54E-16	6.73E-16	6.89E-16	7.08E-16	7.37E-16	7.69E-16	7.35E-16	7.62E-16	7.86E-16	8.02E-16
10.166	33.352	0.4472	2.21E-16	2.27E-16	2.21E-16	2.28E-16	2.36E-16	2.43E-16	2.5E-16	2.57E-16	2.66E-16	2.65E-16	2.74E-16	2.83E-16	2.9E-16	2.97E-16	3.08E-16	3.22E-16	3.08E-16	3.19E-16	3.3E-16	3.38E-16
10.627	34.865	0.4752	8.8E-17	9.04E-17	8.82E-17	9.08E-17	9.38E-17	9.7E-17	9.97E-17	1.02E-16	1.06E-16	1.06E-16	1.09E-16	1.13E-16	1.16E-16	1.18E-16	1.22E-16	1.28E-16	1.23E-16	1.27E-16	1.31E-16	1.35E-16
11.116	36.470	0.5032	3.33E-17	3.42E-17	3.34E-17	3.44E-17	3.55E-17	3.67E-17	3.78E-17	3.88E-17	4E-17	4E-17	4.13E-17	4.26E-17	4.38E-17	4.49E-17	4.63E-17	4.81E-17	4.64E-17	4.79E-17	4.96E-17	5.11E-17
11.633	38.167	0.5312	1.2E-17	1.23E-17	1.2E-17	1.24E-17	1.28E-17	1.32E-17	1.36E-17	1.4E-17	1.44E-17	1.44E-17	1.48E-17	1.53E-17	1.58E-17	1.62E-17	1.66E-17	1.73E-17	1.67E-17	1.72E-17	1.78E-17	1.84E-17
12.179	39.956	0.5592	4.23E-18	4.33E-18	4.2E-18	4.34E-18	4.47E-18	4.61E-18	4.76E-18	4.89E-18	5.02E-18	4.98E-18	5.17E-18	5.34E-18	5.5E-18	5.64E-18	5.78E-18	5.98E-18	5.77E-18	5.97E-18	6.18E-18	6.38E-18
12.752	41.836	0.5872	1.72E-18	1.75E-18	1.65E-18	1.75E-18	1.79E-18	1.83E-18	1.87E-18	1.91E-18	1.95E-18	1.85E-18	1.99E-18	2.05E-18	2.1E-18	2.14E-18	2.18E-18	2.23E-18	2.09E-18	2.23E-18	2.29E-18	2.36E-18
13.353	43.809	0.6152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
13.982	45.873	0.6432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
14.639	48.029	0.6712	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
15.325	50.277	0.6992	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.038	52.617	0.7272	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.779	55.049	0.7552	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
17.548	57.573	0.7832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
18.345	60.188	0.8112	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)																			
			TIME (YEAR)																			
			78	81	84	87	90	93	96	99	102	105	108	111	114	117	120	123	126	129	132	135
19.171	62.895	0.8392	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.024	65.695	0.8672	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.905	68.586	0.8952	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
21.814	71.569	0.9232	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
22.751	74.643	0.9512	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
23.717	77.810	0.9792	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
24.710	81.069	1.0072	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
25.731	84.419	1.0352	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
26.780	87.861	1.0632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
27.857	91.395	1.0912	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
28.963	95.021	1.1192	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
30.096	98.739	1.1472	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
31.257	102.549	1.1752	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
32.446	106.450	1.2032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
33.663	110.444	1.2312	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
34.909	114.529	1.2592	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
36.182	118.706	1.2872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
37.483	122.975	1.3152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
38.812	127.336	1.3432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
40.160	131.760	1.3532	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
41.519	136.216	1.3632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
42.887	140.704	1.3732	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
44.265	145.226	1.3832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
45.653	149.781	1.3932	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.051	154.368	1.4032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.758	156.686	0.01	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)									
			Time (years)									
			138	141	144	147	150	153	156	159	162	165
0.001	0.002	0.001	0	0	0	0	0	0	0	0	0	0
0.002	0.007	0.002	0	0	0	0	0	0	0	0	0	0
0.007	0.023	0.008	0	0	0	0	0	0	0	0	0	0
0.019	0.062	0.016	0	0	0	0	0	0	0	0	0	0
0.043	0.141	0.032	0	0	0	0	0	0	0	0	0	0
0.091	0.299	0.064	0	0	0	0	0	0	0	0	0	0
0.181	0.593	0.1152	0	0	0	0	0	0	0	0	0	0
0.298	0.979	0.1202	0	0	0	0	0	0	0	0	0	0
0.421	1.381	0.1252	0	0	0	0	0	0	0	0	0	0
0.549	1.800	0.1302	0	0	0	0	0	0	0	0	0	0
0.681	2.236	0.1352	0	0	0	0	0	0	0	0	0	0
0.819	2.687	0.1402	0	0	0	0	0	0	0	0	0	0
0.962	3.156	0.1452	4.48E-08	4.49E-08	4.49E-08	4.52E-08	0	0	0	0	0	0
1.110	3.640	0.1502	3.32E-08	3.32E-08	3.33E-08	3.34E-08	3.62E-08	3.92E-08	4.01E-08	4.03E-08	4.04E-08	4.04E-08
1.262	4.141	0.1552	2.44E-08	2.44E-08	2.44E-08	2.45E-08	2.61E-08	2.86E-08	2.93E-08	2.96E-08	2.96E-08	2.96E-08
1.420	4.658	0.1602	1.77E-08	1.77E-08	1.77E-08	1.78E-08	1.86E-08	2.07E-08	2.13E-08	2.15E-08	2.15E-08	2.15E-08
1.583	5.192	0.1652	1.27E-08	1.27E-08	1.27E-08	1.28E-08	1.32E-08	1.47E-08	1.53E-08	1.54E-08	1.55E-08	1.55E-08
1.750	5.742	0.1702	9.07E-09	9.08E-09	9.08E-09	9.08E-09	9.28E-09	1.04E-08	1.08E-08	1.1E-08	1.1E-08	1.1E-08
1.923	6.309	0.1752	6.39E-09	6.4E-09	6.4E-09	6.4E-09	6.48E-09	7.26E-09	7.61E-09	7.72E-09	7.76E-09	7.77E-09
2.101	6.892	0.1802	4.46E-09	4.46E-09	4.47E-09	4.47E-09	4.5E-09	5.01E-09	5.29E-09	5.38E-09	5.41E-09	5.42E-09
2.283	7.491	0.1852	3.08E-09	3.08E-09	3.09E-09	3.09E-09	3.1E-09	3.42E-09	3.64E-09	3.71E-09	3.74E-09	3.75E-09
2.471	8.107	0.1902	2.1E-09	2.11E-09	2.11E-09	2.11E-09	2.12E-09	2.31E-09	2.47E-09	2.53E-09	2.56E-09	2.56E-09
2.664	8.740	0.1952	1.42E-09	1.43E-09	1.43E-09	1.43E-09	1.43E-09	1.55E-09	1.66E-09	1.71E-09	1.73E-09	1.73E-09
2.862	9.388	0.2002	9.53E-10	9.57E-10	9.59E-10	9.59E-10	9.61E-10	1.02E-09	1.11E-09	1.14E-09	1.16E-09	1.16E-09
3.064	10.053	0.2052	6.32E-10	6.35E-10	6.36E-10	6.37E-10	6.38E-10	6.71E-10	7.28E-10	7.57E-10	7.68E-10	7.72E-10
3.272	10.735	0.2102	4.14E-10	4.17E-10	4.18E-10	4.18E-10	4.19E-10	4.36E-10	4.74E-10	4.95E-10	5.04E-10	5.07E-10
3.485	11.432	0.2152	2.69E-10	2.71E-10	2.72E-10	2.72E-10	2.73E-10	2.81E-10	3.05E-10	3.21E-10	3.27E-10	3.3E-10
3.702	12.147	0.2202	1.73E-10	1.75E-10	1.75E-10	1.75E-10	1.76E-10	1.8E-10	1.94E-10	2.05E-10	2.1E-10	2.12E-10
3.925	12.877	0.2252	1.1E-10	1.11E-10	1.12E-10	1.12E-10	1.12E-10	1.14E-10	1.23E-10	1.3E-10	1.34E-10	1.35E-10
4.153	13.624	0.2302	6.91E-11	7.02E-11	7.06E-11	7.06E-11	7.07E-11	7.15E-11	7.65E-11	8.16E-11	8.43E-11	8.54E-11
4.385	14.388	0.2352	4.3E-11	4.38E-11	4.41E-11	4.41E-11	4.42E-11	4.46E-11	4.73E-11	5.06E-11	5.25E-11	5.33E-11
4.623	15.168	0.2402	2.64E-11	2.71E-11	2.73E-11	2.73E-11	2.74E-11	2.75E-11	2.9E-11	3.1E-11	3.23E-11	3.29E-11
4.866	15.964	0.2452	1.61E-11	1.65E-11	1.67E-11	1.67E-11	1.68E-11	1.69E-11	1.76E-11	1.88E-11	1.97E-11	2.02E-11
5.114	16.777	0.2502	9.7E-12	1E-11	1.01E-11	1.01E-11	1.02E-11	1.02E-11	1.06E-11	1.13E-11	1.19E-11	1.22E-11
5.366	17.606	0.2552	5.78E-12	5.99E-12	6.09E-12	6.07E-12	6.12E-12	6.14E-12	6.3E-12	6.72E-12	7.1E-12	7.31E-12
5.624	18.451	0.2602	3.41E-12	3.55E-12	3.62E-12	3.6E-12	3.64E-12	3.65E-12	3.73E-12	3.96E-12	4.19E-12	4.33E-12
5.888	19.317	0.2677	1.99E-12	2.07E-12	2.12E-12	2.11E-12	2.14E-12	2.15E-12	2.18E-12	2.3E-12	2.44E-12	2.53E-12
6.159	20.208	0.2752	1.14E-12	1.19E-12	1.22E-12	1.22E-12	1.24E-12	1.24E-12	1.26E-12	1.32E-12	1.4E-12	1.46E-12
6.438	21.123	0.2827	6.43E-13	6.76E-13	6.96E-13	6.92E-13	7.04E-13	7.09E-13	7.15E-13	7.44E-13	7.91E-13	8.28E-13
6.725	22.063	0.2902	3.58E-13	3.77E-13	3.9E-13	3.87E-13	3.95E-13	3.98E-13	4.01E-13	4.15E-13	4.4E-13	4.62E-13
7.019	23.027	0.2977	1.96E-13	2.07E-13	2.15E-13	2.13E-13	2.18E-13	2.2E-13	2.22E-13	2.28E-13	2.41E-13	2.54E-13
7.320	24.016	0.3052	1.06E-13	1.12E-13	1.17E-13	1.15E-13	1.19E-13	1.2E-13	1.21E-13	1.24E-13	1.3E-13	1.37E-13
7.629	25.030	0.3127	5.66E-14	5.96E-14	6.23E-14	6.17E-14	6.36E-14	6.46E-14	6.51E-14	6.62E-14	6.93E-14	7.32E-14
7.946	26.068	0.3202	2.98E-14	3.13E-14	3.28E-14	3.25E-14	3.35E-14	3.42E-14	3.45E-14	3.5E-14	3.64E-14	3.84E-14
8.269	27.131	0.3277	1.55E-14	1.62E-14	1.7E-14	1.68E-14	1.74E-14	1.78E-14	1.8E-14	1.82E-14	1.88E-14	1.99E-14
8.601	28.218	0.3352	7.93E-15	8.27E-15	8.68E-15	8.62E-15	8.94E-15	9.16E-15	9.28E-15	9.37E-15	9.64E-15	1.01E-14
8.950	29.364	0.3632	3.92E-15	4.06E-15	4.26E-15	4.24E-15	4.4E-15	4.53E-15	4.6E-15	4.64E-15	4.75E-15	4.97E-15
9.327	30.601	0.3912	1.83E-15	1.89E-15	1.98E-15	1.97E-15	2.05E-15	2.12E-15	2.16E-15	2.18E-15	2.22E-15	2.31E-15
9.733	31.931	0.4192	8.14E-16	8.37E-16	8.74E-16	8.72E-16	9.07E-16	9.37E-16	9.57E-16	9.69E-16	9.84E-16	1.02E-15
10.166	33.352	0.4472	3.43E-16	3.51E-16	3.65E-16	3.66E-16	3.8E-16	3.93E-16	4.03E-16	4.09E-16	4.15E-16	4.27E-16
10.627	34.865	0.4752	1.37E-16	1.4E-16	1.45E-16	1.45E-16	1.51E-16	1.56E-16	1.61E-16	1.64E-16	1.66E-16	1.7E-16
11.116	36.470	0.5032	5.21E-17	5.31E-17	5.47E-17	5.5E-17	5.69E-17	5.91E-17	6.09E-17	6.22E-17	6.3E-17	6.43E-17
11.633	38.167	0.5312	1.88E-17	1.92E-17	1.97E-17	1.98E-17	2.04E-17	2.12E-17	2.19E-17	2.25E-17	2.28E-17	2.32E-17
12.179	39.956	0.5592	6.54E-18	6.66E-18	6.81E-18	6.82E-18	7.06E-18	7.31E-18	7.57E-18	7.77E-18	7.9E-18	8.03E-18
12.752	41.836	0.5872	2.41E-18	2.45E-18	2.49E-18	2.42E-18	2.55E-18	2.63E-18	2.71E-18	2.77E-18	2.82E-18	2.86E-18
13.353	43.809	0.6152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
13.982	45.873	0.6432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
14.639	48.029	0.6712	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
15.325	50.277	0.6992	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.038	52.617	0.7272	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
16.779	55.049	0.7552	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
17.548	57.573	0.7832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
18.345	60.188	0.8112	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Fine Tailings Oxygen Consump

DEPTH (m)	Depth (ft)	Cell Sizes (m)	Oxygen Consumption (mol/m3/s)									
			Time (years)									
			138	141	144	147	150	153	156	159	162	165
19.171	62.895	0.8392	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.024	65.695	0.8672	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
20.905	68.586	0.8952	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
21.814	71.569	0.9232	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
22.751	74.643	0.9512	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
23.717	77.810	0.9792	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
24.710	81.069	1.0072	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
25.731	84.419	1.0352	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
26.780	87.861	1.0632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
27.857	91.395	1.0912	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
28.963	95.021	1.1192	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
30.096	98.739	1.1472	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
31.257	102.549	1.1752	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
32.446	106.450	1.2032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
33.663	110.444	1.2312	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
34.909	114.529	1.2592	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
36.182	118.706	1.2872	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
37.483	122.975	1.3152	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
38.812	127.336	1.3432	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
40.160	131.760	1.3532	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
41.519	136.216	1.3632	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
42.887	140.704	1.3732	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
44.265	145.226	1.3832	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
45.653	149.781	1.3932	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.051	154.368	1.4032	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18
47.758	156.686	0.01	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18	1.65E-18

Integrated Fine Tailings Sulphate generation Rates

	FIne Tailings Beaches	
	Cell 1E	Cell 2E
	SO4	SO4
Year	mol/m2/year	mol/m2/year
1	0.000	0.136
2	0.000	0.170
3	0.000	0.186
4	0.000	0.130
5	0.000	0.136
6	0.000	0.170
7	0.000	0.186
8	0.000	0.130
9	0.239	0.136
10	0.005	0.170
11	0.003	0.186
12	0.005	0.130
13	0.005	0.136
14	0.005	0.170
15	0.005	0.186
16	0.239	0.130
17	0.005	0.136
18	0.003	0.170
19	0.005	0.186
20	0.005	0.130
21	0.005	0.136
22	0.005	0.170
25	0.239	0.186
28	0.005	0.130
31	0.003	0.000
34	0.005	0.000
37	0.005	0.000
40	0.005	0.000
43	0.005	0.000
46	0.239	0.000
49	0.005	0.239
52	0.003	0.005
55	0.005	0.003
58	0.187	0.005
61	0.846	0.005
64	0.859	0.005
67	0.861	0.005
70	0.862	0.239
73	0.862	0.005
76	0.862	0.003
79	0.862	0.005
82	0.862	0.005
85	0.862	0.005
88	0.812	0.005
91	0.761	0.239
94	0.666	0.005
97	0.669	0.003
100	0.676	0.005
103	0.540	0.005
106	0.543	0.005
109	0.546	0.005
112	0.566	0.239
115	0.442	0.005
118	0.445	0.003
121	0.452	0.005
124	0.480	0.187
127	0.360	0.846
130	0.361	0.859
133	0.361	0.861
136	0.361	0.862
139	0.272	0.862
142	0.298	0.862
145	0.302	0.862
148	0.302	0.862
151	0.302	0.862
154	0.303	0.812
157	0.312	0.761
160	0.249	0.666

Appendix D.3

Tailings Source Pore Water Concentrations

CELL 2E EMBANKMENT SOURCE CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	823	0.047	0.132	0.075	0.280	0.613	0.018	155	86	68	94	0.003	0.272	0.009	0.002	0.006	0.010	0.0030
2	667	0.039	0.109	0.059	0.217	0.482	0.014	142	71	64	73	0.003	0.262	0.007	0.002	0.006	0.008	0.0028
3	741	0.043	0.120	0.067	0.247	0.544	0.016	148	78	66	83	0.003	0.267	0.008	0.002	0.006	0.009	0.0029
4	894	0.050	0.143	0.082	0.309	0.673	0.019	160	93	70	103	0.003	0.277	0.010	0.003	0.006	0.011	0.0031
5	1090	0.060	0.173	0.102	0.388	0.837	0.024	175	111	75	129	0.004	0.290	0.012	0.003	0.007	0.014	0.0033
6	1214	0.067	0.192	0.115	0.438	0.941	0.027	185	123	79	146	0.005	0.299	0.014	0.004	0.007	0.015	0.0035
7	1273	0.070	0.201	0.121	0.462	0.990	0.029	189	129	80	154	0.005	0.303	0.015	0.004	0.008	0.016	0.0036
8	1360	0.074	0.214	0.130	0.498	1.063	0.031	196	137	83	165	0.005	0.309	0.016	0.004	0.008	0.017	0.0037
9	1549	0.084	0.243	0.149	0.574	1.222	0.035	211	155	88	190	0.006	0.321	0.019	0.004	0.009	0.020	0.0040
10	1755	0.095	0.274	0.170	0.658	1.394	0.040	226	175	93	218	0.006	0.335	0.021	0.005	0.009	0.023	0.0042
11	1780	0.096	0.278	0.172	0.668	1.416	0.041	228	177	94	221	0.006	0.337	0.022	0.005	0.009	0.023	0.0043
12	1791	0.096	0.280	0.173	0.672	1.425	0.041	229	178	94	223	0.006	0.337	0.022	0.005	0.009	0.023	0.0043
13	1841	0.099	0.287	0.179	0.693	1.467	0.042	233	183	95	229	0.007	0.341	0.023	0.005	0.010	0.024	0.0044
14	1786	0.096	0.279	0.173	0.670	1.421	0.041	229	178	94	222	0.006	0.337	0.022	0.005	0.009	0.023	0.0043
15	1809	0.097	0.282	0.175	0.679	1.440	0.041	231	180	94	225	0.007	0.339	0.022	0.005	0.009	0.023	0.0043
16	1854	0.100	0.289	0.180	0.698	1.478	0.043	234	184	96	231	0.007	0.342	0.023	0.005	0.010	0.024	0.0044
17	1862	0.100	0.291	0.181	0.701	1.484	0.043	235	185	96	232	0.007	0.342	0.023	0.005	0.010	0.024	0.0044
18	1903	0.102	0.297	0.185	0.718	1.519	0.044	238	189	97	238	0.007	0.345	0.023	0.005	0.010	0.025	0.0044
19	1922	0.103	0.300	0.187	0.726	1.535	0.044	239	191	97	240	0.007	0.346	0.024	0.005	0.010	0.025	0.0045
20	1943	0.104	0.303	0.189	0.734	1.552	0.045	241	193	98	243	0.007	0.348	0.024	0.006	0.010	0.025	0.0045
21	1965	0.105	0.306	0.191	0.743	1.571	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
22	1967	0.105	0.307	0.191	0.743	1.572	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
24	1967	0.105	0.307	0.191	0.744	1.573	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
27	1968	0.105	0.307	0.192	0.744	1.573	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
30	1968	0.105	0.307	0.192	0.744	1.573	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
33	1968	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
36	1968	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
39	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
42	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
45	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
48	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
51	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
54	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
57	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
60	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
63	1969	0.105	0.307	0.192	0.744	1.574	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
66	1769	0.091	0.270	0.180	0.717	1.484	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
69	1756	0.090	0.268	0.179	0.712	1.473	0.042	136	168	46	234	0.006	0.118	0.024	0.005	0.006	0.024	0.0024
72	1719	0.088	0.262	0.175	0.697	1.442	0.042	133	164	45	229	0.006	0.116	0.023	0.005	0.006	0.023	0.0023
75	1654	0.085	0.252	0.168	0.671	1.387	0.040	128	158	44	220	0.006	0.111	0.022	0.004	0.006	0.022	0.0022
78	1552	0.080	0.236	0.158	0.629	1.302	0.038	120	148	41	207	0.005	0.104	0.021	0.004	0.005	0.021	0.0021
81	1429	0.073	0.218	0.145	0.580	1.199	0.035	110	137	38	190	0.005	0.096	0.019	0.004	0.005	0.019	0.0019
84	1282	0.066	0.195	0.130	0.520	1.075	0.031	99	123	34	171	0.004	0.086	0.017	0.003	0.004	0.017	0.0017
87	1108	0.057	0.169	0.113	0.449	0.930	0.027	86	106	29	148	0.004	0.074	0.015	0.003	0.004	0.015	0.0015
90	930	0.048	0.142	0.095	0.377	0.780	0.023	72	89	25	124	0.003	0.063	0.013	0.003	0.003	0.013	0.0013
93	767	0.039	0.117	0.078	0.311	0.643	0.019	59	73	20	102	0.003	0.052	0.010	0.002	0.003	0.010	0.0010
96	628	0.032	0.096	0.064	0.255	0.527	0.015	48	60	17	84	0.002	0.042	0.008	0.002	0.002	0.008	0.0008
99	515	0.026	0.078	0.052	0.209	0.432	0.012	40	49	14	69	0.002	0.035	0.007	0.001	0.002	0.007	0.0007
102	423	0.022	0.065	0.043	0.172	0.355	0.010	33	40	11	56	0.001	0.028	0.006	0.001	0.001	0.006	0.0006
105	356	0.018	0.054	0.036	0.144	0.298	0.009	27	34	9	47	0.001	0.024	0.005	0.001	0.001	0.005	0.0005
108	290	0.015	0.044	0.030	0.118	0.243	0.007	22	28	8	39	0.001	0.020	0.004	0.001	0.001	0.004	0.0004
111	241	0.012	0.037	0.024	0.098	0.202	0.006	19	23	6	32	0.001	0.016	0.003	0.001	0.001	0.003	0.0003
114	187	0.010	0.029	0.019	0.076	0.157	0.005	14	18	5	25	0.001	0.013	0.003	0.001	0.001	0.003	0.0003
117	125	0.006	0.019	0.013	0.051	0.105	0.003	10	12	3	17	0.000	0.008	0.002	0.000	0.000	0.002	0.0002
120	92	0.005	0.014	0.009	0.037	0.077	0.002	7	9	2	12	0.000	0.006	0.001	0.000	0.000	0.001	0.0001
123	56	0.003	0.009	0.006	0.023	0.047	0.001	4	5	1	8	0.000	0.004	0.001	0.000	0.000	0.001	0.0001
126	24	0.001	0.004	0.002	0.010	0.020	0.001	2	2	1	3	0.000	0.002	0.000	0.000	0.000	0.000	0.0000
129	16	0.001	0.002	0.002	0.006	0.013	0.000	1	1	0	2	0.000	0.001	0.000	0.000	0.000	0.000	0.0000
132	6	0.000	0.001	0.001	0.003	0.005	0.000	0	1	0	1	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
135	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
138	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
141	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
144	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
147	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
150	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000

CELL 2E COARSE BEACH SOURCE CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	332	0.022	0.057	0.025	0.081	0.201	0.006	117	39	55	28	0.002	0.239	0.002	0.001	0.004	0.004	0.0023
2	332	0.022	0.057	0.025	0.081	0.201	0.006	117	39	55	28	0.002	0.239	0.002	0.001	0.004	0.004	0.0023
3	332	0.022	0.057	0.025	0.081	0.201	0.006	117	39	55	28	0.002	0.239	0.002	0.001	0.004	0.004	0.0023
4	332	0.022	0.058	0.025	0.081	0.201	0.006	117	39	55	28	0.002	0.239	0.002	0.001	0.004	0.004	0.0023
5	334	0.022	0.058	0.025	0.082	0.203	0.006	117	39	56	29	0.002	0.240	0.002	0.001	0.004	0.004	0.0023
6	340	0.022	0.059	0.026	0.084	0.208	0.006	117	40	56	29	0.002	0.240	0.002	0.001	0.004	0.004	0.0023
7	353	0.023	0.061	0.027	0.089	0.219	0.006	118	41	56	31	0.002	0.241	0.003	0.001	0.005	0.004	0.0024
8	385	0.024	0.066	0.030	0.102	0.246	0.007	121	44	57	35	0.002	0.243	0.003	0.001	0.005	0.004	0.0024
9	725	0.042	0.117	0.065	0.240	0.531	0.015	147	77	66	81	0.003	0.266	0.008	0.002	0.006	0.009	0.0029
10	1,040	0.058	0.165	0.097	0.368	0.795	0.023	171	107	74	123	0.004	0.287	0.012	0.003	0.007	0.013	0.0033
11	1,755	0.095	0.274	0.170	0.658	1.395	0.040	227	175	93	218	0.006	0.335	0.021	0.005	0.009	0.023	0.0042
12	2,401	0.128	0.373	0.236	0.919	1.936	0.056	276	237	110	304	0.009	0.378	0.030	0.007	0.011	0.031	0.0051
13	2,554	0.135	0.396	0.251	0.982	2.065	0.060	288	251	114	324	0.009	0.389	0.032	0.007	0.012	0.033	0.0053
14	2,610	0.138	0.404	0.257	1.004	2.111	0.061	292	257	116	332	0.009	0.393	0.033	0.007	0.012	0.034	0.0054
15	2,609	0.138	0.404	0.257	1.004	2.111	0.061	292	257	116	332	0.009	0.392	0.033	0.007	0.012	0.034	0.0054
16	2,557	0.136	0.397	0.251	0.983	2.068	0.060	288	252	114	325	0.009	0.389	0.032	0.007	0.012	0.034	0.0053
17	2,440	0.130	0.379	0.240	0.936	1.970	0.057	279	241	111	309	0.009	0.381	0.031	0.007	0.012	0.032	0.0052
18	2,261	0.120	0.351	0.221	0.863	1.819	0.052	266	223	106	285	0.008	0.369	0.028	0.006	0.011	0.030	0.0049
19	1,982	0.106	0.309	0.193	0.750	1.585	0.046	244	197	99	248	0.007	0.350	0.024	0.006	0.010	0.026	0.0045
20	1,556	0.084	0.244	0.150	0.577	1.228	0.035	211	156	88	191	0.006	0.322	0.019	0.004	0.009	0.020	0.0040
21	1,559	0.085	0.244	0.150	0.578	1.231	0.035	211	156	88	192	0.006	0.322	0.019	0.004	0.009	0.020	0.0040
22	3,434	0.181	0.530	0.341	1.339	2.803	0.081	356	336	137	442	0.012	0.448	0.044	0.010	0.015	0.045	0.0065
24	3,414	0.180	0.527	0.339	1.331	2.787	0.080	355	334	137	439	0.012	0.447	0.044	0.009	0.015	0.045	0.0065
27	3,446	0.181	0.532	0.342	1.343	2.813	0.081	357	337	138	443	0.012	0.449	0.044	0.010	0.015	0.045	0.0065
30	3,483	0.183	0.538	0.346	1.359	2.844	0.082	360	340	139	448	0.012	0.451	0.045	0.010	0.015	0.046	0.0066
33	3,532	0.186	0.545	0.351	1.378	2.885	0.083	364	345	140	455	0.012	0.454	0.045	0.010	0.015	0.047	0.0066
36	3,596	0.189	0.555	0.357	1.404	2.939	0.085	369	351	142	463	0.013	0.459	0.046	0.010	0.015	0.047	0.0067
39	3,571	0.188	0.551	0.355	1.394	2.917	0.084	367	349	141	460	0.012	0.457	0.046	0.010	0.015	0.047	0.0067
42	3,843	0.202	0.592	0.382	1.504	3.146	0.091	388	375	148	496	0.013	0.475	0.050	0.011	0.016	0.051	0.0070
45	4,031	0.211	0.621	0.401	1.580	3.303	0.095	402	393	153	521	0.014	0.488	0.052	0.011	0.017	0.053	0.0073
48	4,371	0.229	0.673	0.436	1.718	3.588	0.103	428	425	162	566	0.015	0.511	0.057	0.012	0.018	0.058	0.0078
51	4,864	0.254	0.748	0.486	1.918	4.002	0.115	467	472	175	632	0.017	0.544	0.063	0.013	0.020	0.065	0.0084
54	5,582	0.291	0.857	0.559	2.210	4.605	0.133	522	541	194	728	0.019	0.592	0.073	0.015	0.022	0.074	0.0094
57	5,582	0.291	0.857	0.559	2.210	4.605	0.133	522	541	194	728	0.019	0.592	0.073	0.015	0.022	0.074	0.0094
60	5,583	0.291	0.857	0.559	2.210	4.605	0.133	522	541	194	728	0.019	0.592	0.073	0.015	0.022	0.074	0.0094
63	5,583	0.291	0.857	0.559	2.210	4.605	0.133	522	541	194	728	0.019	0.592	0.073	0.015	0.022	0.074	0.0094
66	5,383	0.276	0.820	0.548	2.183	4.515	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
69	5,383	0.276	0.820	0.548	2.183	4.515	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
72	5,383	0.276	0.820	0.548	2.183	4.515	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
75	5,383	0.276	0.820	0.548	2.183	4.515	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
78	5,384	0.276	0.820	0.548	2.183	4.515	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
81	5,385	0.276	0.820	0.548	2.183	4.516	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
84	5,386	0.276	0.821	0.548	2.184	4.518	0.130	416	515	142	717	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
87	5,390	0.276	0.821	0.548	2.186	4.520	0.130	416	516	142	718	0.018	0.362	0.072	0.014	0.018	0.072	0.0072
90	5,396	0.276	0.822	0.549	2.188	4.526	0.131	417	516	142	719	0.018	0.363	0.073	0.015	0.018	0.073	0.0073
93	5,406	0.277	0.824	0.550	2.192	4.534	0.131	417	517	143	720	0.018	0.363	0.073	0.015	0.018	0.073	0.0073
96	5,423	0.278	0.826	0.552	2.199	4.548	0.131	419	519	143	722	0.018	0.364	0.073	0.015	0.018	0.073	0.0073
99	5,287	0.271	0.805	0.538	2.144	4.434	0.128	408	506	139	704	0.018	0.355	0.071	0.014	0.018	0.071	0.0071
102	5,027	0.258	0.766	0.511	2.038	4.216	0.122	388	481	133	670	0.017	0.338	0.068	0.014	0.017	0.068	0.0068
105	4,745	0.243	0.723	0.483	1.924	3.980	0.115	366	454	125	632	0.016	0.319	0.064	0.013	0.016	0.064	0.0064
108	4,368	0.224	0.665	0.444	1.771	3.663	0.106	337	418	115	582	0.015	0.294	0.059	0.012	0.015	0.059	0.0059
111	4,188	0.215	0.638	0.426	1.698	3.513	0.101	323	401	110	558	0.014	0.281	0.056	0.011	0.014	0.056	0.0056
114	4,000	0.205	0.609	0.407	1.622	3.355	0.097	309	383	106	533	0.013	0.269	0.054	0.011	0.014	0.054	0.0054
117	3,885	0.199	0.592	0.395	1.575	3.258	0.094	300	372	102	517	0.013	0.261	0.052	0.010	0.013	0.052	0.0052
120	3,930	0.201	0.599	0.400	1.594	3.296	0.095	303	376	104	523	0.013	0.264	0.053	0.011	0.013	0.053	0.0053
123	3,885	0.199	0.592	0.395	1.575	3.258	0.094	300	372	103	517	0.013	0.261	0.052	0.010	0.013	0.052	0.0052
126	3,838	0.197	0.585	0.391	1.556	3.219	0.093	296	367	101	511	0.013	0.258	0.052	0.010	0.013	0.052	0.0052
129	3,607	0.185	0.549	0.367	1.462	3.025	0.087	278	345	95	480	0.012	0.242	0.048	0.010	0.012	0.048	0.0048
132	3,471	0.178	0.529	0.353	1.408	2.912	0.084	268	332	92	462	0.012	0.233	0.047	0.009	0.012	0.047	0.0047
135	3,256	0.167	0.496	0.331	1.320	2.731	0.079	251	311	86	434	0.011	0.219	0.044	0.009	0.011	0.044	0.0044
138	3,294	0.169	0.502	0.335	1.336	2.762	0.080	254	315	87	439	0.011	0.221	0.044	0.009	0.011	0.044	0.0044
141	3,175	0.163	0.484	0.323	1.288	2.663	0.077	245	304	84	423	0.011	0.213	0.043	0.009	0.011	0.043	0.0043
144	3,058	0.157	0.466	0.311	1.240	2.565	0.074	236	293	81	407	0.010	0.206	0.041	0.008	0.010	0.041	0.0041
147	3,022	0.155	0.460	0.308	1.225	2.535	0.073	233	289	80	403	0.010	0.203	0.041	0.008	0.010	0.041	0.0041
150	2,986	0.153	0.455	0.304	1.211	2.504	0.072	231	286	79	398	0.010	0.201	0.040	0.008	0.010	0.040	0.0040

CELL 2E FINES BEACH SOURCE CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	230	0.016	0.047	0.014	0.028	0.104	0.003	107	30	54	14	0.001	0.233	0.001	0.001	0.004	0.002	0.0022
2	238	0.017	0.050	0.015	0.029	0.107	0.003	107	31	54	15	0.001	0.234	0.001	0.001	0.004	0.002	0.0022
3	241	0.017	0.051	0.015	0.029	0.108	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
4	229	0.016	0.047	0.014	0.028	0.103	0.003	107	30	54	14	0.001	0.233	0.001	0.001	0.004	0.002	0.0022
5	230	0.016	0.047	0.014	0.028	0.104	0.003	107	30	54	14	0.001	0.233	0.001	0.001	0.004	0.002	0.0022
6	238	0.017	0.050	0.015	0.029	0.107	0.003	107	31	54	15	0.001	0.234	0.001	0.001	0.004	0.002	0.0022
7	241	0.017	0.051	0.015	0.029	0.108	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
8	229	0.016	0.047	0.014	0.028	0.103	0.003	107	30	54	14	0.001	0.233	0.001	0.001	0.004	0.002	0.0022
9	245	0.017	0.052	0.016	0.029	0.110	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
10	256	0.018	0.056	0.017	0.029	0.115	0.003	107	33	55	17	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
11	262	0.018	0.057	0.017	0.030	0.117	0.003	107	33	55	18	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
12	243	0.017	0.051	0.016	0.029	0.109	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
13	245	0.017	0.052	0.016	0.029	0.110	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
14	256	0.018	0.056	0.017	0.029	0.115	0.003	107	33	55	17	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
15	262	0.018	0.057	0.017	0.030	0.117	0.003	107	33	55	18	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
16	243	0.017	0.051	0.016	0.029	0.109	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
17	245	0.017	0.052	0.016	0.029	0.110	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
18	256	0.018	0.056	0.017	0.029	0.115	0.003	107	33	55	17	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
19	262	0.018	0.057	0.017	0.030	0.117	0.003	107	33	55	18	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
20	243	0.017	0.051	0.016	0.029	0.109	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
21	245	0.017	0.052	0.016	0.029	0.110	0.003	107	31	54	16	0.001	0.235	0.001	0.001	0.004	0.002	0.0022
22	280	0.019	0.063	0.019	0.030	0.125	0.003	108	35	56	20	0.001	0.238	0.002	0.001	0.004	0.003	0.0022
24	288	0.019	0.066	0.020	0.031	0.129	0.003	108	36	57	21	0.001	0.239	0.002	0.001	0.004	0.003	0.0023
27	262	0.018	0.057	0.017	0.030	0.117	0.003	107	33	55	18	0.001	0.236	0.001	0.001	0.004	0.003	0.0022
30	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
33	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
36	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
39	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
42	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
45	200	0.015	0.037	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
48	313	0.021	0.074	0.022	0.032	0.140	0.003	108	39	58	24	0.002	0.241	0.002	0.001	0.004	0.003	0.0023
51	202	0.015	0.038	0.012	0.027	0.092	0.003	106	27	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
54	201	0.015	0.038	0.012	0.027	0.091	0.003	106	26	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
57	202	0.015	0.038	0.012	0.027	0.092	0.003	106	27	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
60	202	0.015	0.038	0.012	0.027	0.092	0.003	106	27	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
63	202	0.015	0.038	0.012	0.027	0.092	0.003	106	27	52	11	0.001	0.231	0.001	0.001	0.004	0.002	0.0022
66	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.00002	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
69	113	0.0058	0.0368	0.0105	0.0045	0.0491	0.0009	2	13	6	13	0.000	0.011	0.001	0.000	0.000	0.001	0.0001
72	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
75	1	0.00006	0.00040	0.00011	0.00005	0.00053	0.00001	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
78	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
81	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
84	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
87	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
90	113	0.0058	0.0368	0.0105	0.0045	0.0491	0.0009	2	13	6	13	0.000	0.011	0.001	0.000	0.000	0.001	0.0001
93	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
96	1	0.0001	0.0004	0.0001	0.0000	0.0005	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
99	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
102	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
105	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
108	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
111	113	0.0058	0.0368	0.0105	0.0045	0.0491	0.0009	2	13	6	13	0.000	0.011	0.001	0.000	0.000	0.001	0.0001
114	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
117	1	0.0001	0.0004	0.0001	0.0000	0.0005	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
120	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
123	88	0.0045	0.0287	0.0082	0.0035	0.0383	0.0007	2	10	5	10	0.000	0.008	0.001	0.000	0.000	0.001	0.0001
126	399	0.0205	0.1299	0.0372	0.0158	0.1734	0.0031	7	45	22	46	0.001	0.038	0.005	0.001	0.001	0.005	0.0005
129	406	0.0208	0.1320	0.0378	0.0161	0.1762	0.0032	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
132	407	0.0208	0.1323	0.0379	0.0161	0.1766	0.0032	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
135	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
138	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
141	407	0.021	0.132	0.038	0.016	0.177	0.003	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
144	407	0.021	0.132	0.038	0.016	0.177	0.003	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
147	407	0.021	0.132	0.038	0.016	0.177	0.003	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005
150	407	0.021	0.132	0.038	0.016	0.177	0.003	7	46	22	47	0.001	0.039	0.005	0.001	0.001	0.005	0.0005

CELL 1E EMBANKMENT SOURCE CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9	823	0.047	0.132	0.075	0.280	0.613	0.018	155	86	68	94	0.003	0.272	0.009	0.002	0.006	0.010	0.0030
10	502	0.030	0.083	0.042	0.150	0.344	0.010	130	55	60	51	0.002	0.251	0.005	0.002	0.005	0.006	0.0026
11	906	0.051	0.145	0.083	0.313	0.682	0.020	161	94	71	105	0.004	0.278	0.010	0.003	0.006	0.011	0.0031
12	1136	0.063	0.180	0.107	0.407	0.876	0.025	179	116	77	136	0.004	0.294	0.013	0.003	0.007	0.014	0.0034
13	1298	0.071	0.205	0.123	0.472	1.012	0.029	191	131	81	157	0.005	0.304	0.015	0.004	0.008	0.017	0.0036
14	1488	0.081	0.234	0.143	0.549	1.171	0.034	206	149	86	182	0.005	0.317	0.018	0.004	0.008	0.019	0.0039
15	1421	0.077	0.223	0.136	0.522	1.114	0.032	201	143	84	173	0.005	0.313	0.017	0.004	0.008	0.018	0.0038
16	1481	0.080	0.232	0.142	0.546	1.165	0.034	205	149	86	181	0.005	0.317	0.018	0.004	0.008	0.019	0.0039
17	1618	0.088	0.253	0.156	0.602	1.280	0.037	216	162	89	200	0.006	0.326	0.020	0.005	0.009	0.021	0.0041
18	1744	0.094	0.273	0.169	0.653	1.385	0.040	226	174	93	216	0.006	0.334	0.021	0.005	0.009	0.023	0.0042
19	1903	0.102	0.297	0.185	0.718	1.519	0.044	238	189	97	238	0.007	0.345	0.023	0.005	0.010	0.025	0.0044
20	1924	0.103	0.300	0.187	0.726	1.537	0.044	240	191	97	240	0.007	0.346	0.024	0.005	0.010	0.025	0.0045
21	1943	0.104	0.303	0.189	0.734	1.553	0.045	241	193	98	243	0.007	0.348	0.024	0.006	0.010	0.025	0.0045
22	1963	0.105	0.306	0.191	0.742	1.569	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
24	1965	0.105	0.306	0.191	0.743	1.571	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
27	1966	0.105	0.306	0.191	0.743	1.572	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
30	1967	0.105	0.307	0.191	0.744	1.573	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
33	1968	0.105	0.307	0.191	0.744	1.573	0.045	243	195	99	246	0.007	0.349	0.024	0.006	0.010	0.026	0.0045
36	1768	0.091	0.269	0.180	0.717	1.483	0.043	136	169	47	235	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
39	1768	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
42	1768	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
45	1768	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
48	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
51	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
54	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
57	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
60	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
63	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
66	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
69	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
72	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
75	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
78	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
81	1769	0.091	0.269	0.180	0.717	1.483	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
84	1769	0.091	0.269	0.180	0.717	1.484	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
87	1769	0.091	0.270	0.180	0.717	1.484	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
90	1770	0.091	0.270	0.180	0.718	1.484	0.043	137	169	47	236	0.006	0.119	0.024	0.005	0.006	0.024	0.0024
93	1712	0.088	0.261	0.174	0.694	1.436	0.041	132	164	45	228	0.006	0.115	0.023	0.005	0.006	0.023	0.0023
96	1606	0.082	0.245	0.163	0.651	1.347	0.039	124	154	42	214	0.005	0.108	0.022	0.004	0.005	0.022	0.0022
99	1491	0.076	0.227	0.152	0.605	1.251	0.036	115	143	39	199	0.005	0.100	0.020	0.004	0.005	0.020	0.0020
102	1294	0.066	0.197	0.132	0.525	1.086	0.031	100	124	34	172	0.004	0.087	0.017	0.003	0.004	0.017	0.0017
105	1132	0.058	0.172	0.115	0.459	0.949	0.027	87	108	30	151	0.004	0.076	0.015	0.003	0.004	0.015	0.0015
108	957	0.049	0.146	0.097	0.388	0.803	0.023	74	92	25	128	0.003	0.064	0.013	0.003	0.003	0.013	0.0013
111	732	0.037	0.111	0.074	0.297	0.614	0.018	56	70	19	97	0.002	0.049	0.010	0.002	0.002	0.010	0.0010
114	580	0.030	0.088	0.059	0.235	0.487	0.014	45	55	15	77	0.002	0.039	0.008	0.002	0.002	0.008	0.0008
117	417	0.021	0.064	0.042	0.169	0.350	0.010	32	40	11	56	0.001	0.028	0.006	0.001	0.001	0.006	0.0006
120	239	0.012	0.036	0.024	0.097	0.200	0.006	18	23	6	32	0.001	0.016	0.003	0.001	0.001	0.003	0.0003
123	163	0.008	0.025	0.017	0.066	0.136	0.004	13	16	4	22	0.001	0.011	0.002	0.000	0.001	0.002	0.0002
126	82	0.004	0.012	0.008	0.033	0.068	0.002	6	8	2	11	0.000	0.005	0.001	0.000	0.000	0.001	0.0001
129	19	0.001	0.003	0.002	0.008	0.016	0.000	1	2	1	3	0.000	0.001	0.000	0.000	0.000	0.000	0.0000
132	12	0.001	0.002	0.001	0.005	0.010	0.000	1	1	0	2	0.000	0.001	0.000	0.000	0.000	0.000	0.0000
135	5	0.000	0.001	0.001	0.002	0.004	0.000	0	0	0	1	0.000	0.000	0.000	0.000	0.000	0.000	0.0000
138	0	0.000	0.000	0.000	0.000	0.000	0.000	0	0	0	0	0.000	0.000	0.000	0.000	0.000	0.000	0.0000

CELL 1E Coarse Beach CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9	462	0.0283	0.0774	0.0383	0.1336	0.3106	0.0089	127	51	59	46	0.0020	0.2482	0.0041	0.0015	0.0049	0.0054	0.0025
10	515	0.0310	0.0854	0.0437	0.1548	0.3546	0.0102	131	56	60	53	0.0022	0.2517	0.0048	0.0017	0.0050	0.0061	0.0026
11	749	0.0430	0.1210	0.0674	0.2496	0.5505	0.0158	149	79	66	84	0.0030	0.2674	0.0079	0.0023	0.0058	0.0092	0.0029
12	1407	0.0767	0.2213	0.1345	0.5167	1.1030	0.0318	200	142	84	172	0.0052	0.3117	0.0168	0.0041	0.0081	0.0181	0.0038
13	2020	0.1081	0.3147	0.1969	0.7654	1.6174	0.0466	247	200	100	253	0.0073	0.3529	0.0250	0.0057	0.0101	0.0263	0.0046
14	2164	0.1155	0.3365	0.2114	0.8234	1.7374	0.0501	258	214	104	272	0.0078	0.3625	0.0269	0.0061	0.0106	0.0282	0.0048
15	2232	0.1190	0.3470	0.2184	0.8513	1.7951	0.0517	263	221	106	282	0.0080	0.3672	0.0279	0.0063	0.0108	0.0291	0.0049
16	2271	0.1210	0.3529	0.2224	0.8669	1.8274	0.0527	266	224	107	287	0.0081	0.3698	0.0284	0.0064	0.0110	0.0297	0.0049
17	2295	0.1222	0.3565	0.2248	0.8765	1.8472	0.0532	268	227	107	290	0.0082	0.3713	0.0287	0.0064	0.0111	0.0300	0.0050
18	2172	0.1159	0.3379	0.2123	0.8269	1.7447	0.0503	259	215	104	274	0.0078	0.3631	0.0270	0.0061	0.0106	0.0283	0.0048
19	1989	0.1065	0.3099	0.1937	0.7526	1.5910	0.0458	245	197	99	249	0.0072	0.3508	0.0246	0.0056	0.0100	0.0259	0.0046
20	1707	0.0921	0.2669	0.1649	0.6381	1.3542	0.0390	223	170	92	212	0.0062	0.3318	0.0208	0.0049	0.0091	0.0221	0.0042
21	1279	0.0701	0.2018	0.1214	0.4647	0.9956	0.0287	190	130	80	155	0.0048	0.3031	0.0150	0.0037	0.0076	0.0163	0.0036
22	2767	0.1464	0.4284	0.2728	1.0679	2.2431	0.0647	305	272	120	353	0.0098	0.4031	0.0350	0.0077	0.0126	0.0363	0.0056
24	2769	0.1465	0.4288	0.2731	1.0690	2.2453	0.0647	305	272	120	353	0.0098	0.4032	0.0351	0.0077	0.0127	0.0364	0.0056
27	2771	0.1466	0.4291	0.2733	1.0697	2.2469	0.0648	305	272	120	353	0.0098	0.4034	0.0351	0.0077	0.0127	0.0364	0.0056
30	2772	0.1467	0.4293	0.2734	1.0703	2.2481	0.0648	305	272	120	353	0.0098	0.4035	0.0351	0.0077	0.0127	0.0364	0.0056
33	2773	0.1467	0.4295	0.2735	1.0707	2.2489	0.0648	305	272	120	354	0.0098	0.4035	0.0351	0.0077	0.0127	0.0364	0.0056
36	2574	0.1319	0.3922	0.2619	1.0438	2.1590	0.0623	199	246	68	343	0.0087	0.1730	0.0346	0.0069	0.0087	0.0346	0.0035
39	2575	0.1319	0.3923	0.2620	1.0441	2.1595	0.0623	199	246	68	343	0.0087	0.1731	0.0346	0.0069	0.0087	0.0346	0.0035
42	2575	0.1319	0.3923	0.2620	1.0442	2.1599	0.0623	199	246	68	343	0.0087	0.1731	0.0346	0.0069	0.0087	0.0346	0.0035
45	2576	0.1320	0.3924	0.2621	1.0444	2.1601	0.0623	199	246	68	343	0.0087	0.1731	0.0346	0.0069	0.0087	0.0346	0.0035
48	2762	0.1415	0.4208	0.2810	1.1200	2.3165	0.0668	213	264	73	368	0.0093	0.1856	0.0371	0.0074	0.0093	0.0371	0.0037
51	3101	0.1589	0.4725	0.3156	1.2576	2.6011	0.0750	239	297	82	413	0.0104	0.2084	0.0417	0.0083	0.0105	0.0417	0.0042
54	3594	0.1842	0.5475	0.3657	1.4574	3.0143	0.0870	277	344	95	479	0.0121	0.2416	0.0483	0.0097	0.0121	0.0483	0.0048
57	4312	0.2209	0.6569	0.4388	1.7485	3.6166	0.1043	333	412	114	574	0.0145	0.2898	0.0580	0.0116	0.0146	0.0580	0.0058
60	4312	0.2210	0.6570	0.4388	1.7486	3.6168	0.1043	333	413	114	574	0.0145	0.2898	0.0580	0.0116	0.0146	0.0580	0.0058
63	4313	0.2210	0.6570	0.4388	1.7487	3.6170	0.1043	333	413	114	574	0.0145	0.2898	0.0580	0.0116	0.0146	0.0580	0.0058
66	4313	0.2210	0.6570	0.4388	1.7488	3.6171	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
69	4313	0.2210	0.6570	0.4389	1.7488	3.6171	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
72	4313	0.2210	0.6570	0.4389	1.7488	3.6172	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
75	4313	0.2210	0.6570	0.4389	1.7488	3.6172	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
78	4313	0.2210	0.6570	0.4389	1.7488	3.6172	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
81	4313	0.2210	0.6570	0.4389	1.7488	3.6172	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
84	4313	0.2210	0.6570	0.4389	1.7488	3.6172	0.1043	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
87	4313	0.2210	0.6571	0.4389	1.7489	3.6173	0.1044	333	413	114	574	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
90	4313	0.2210	0.6571	0.4389	1.7490	3.6176	0.1044	333	413	114	575	0.0145	0.2899	0.0580	0.0116	0.0146	0.0580	0.0058
93	4315	0.2211	0.6574	0.4391	1.7497	3.6190	0.1044	333	413	114	575	0.0145	0.2900	0.0580	0.0116	0.0146	0.0580	0.0058
96	4319	0.2213	0.6580	0.4395	1.7515	3.6226	0.1045	333	413	114	575	0.0145	0.2903	0.0581	0.0116	0.0146	0.0581	0.0058
99	4328	0.2218	0.6593	0.4404	1.7549	3.6298	0.1047	334	414	114	576	0.0145	0.2909	0.0582	0.0116	0.0146	0.0582	0.0058
102	4183	0.2143	0.6373	0.4257	1.6963	3.5085	0.1012	323	400	110	557	0.0141	0.2811	0.0562	0.0112	0.0141	0.0562	0.0056
105	3913	0.2005	0.5962	0.3982	1.5868	3.2820	0.0947	302	374	103	521	0.0132	0.2630	0.0526	0.0105	0.0132	0.0526	0.0053
108	3621	0.1855	0.5516	0.3684	1.4681	3.0366	0.0876	280	346	96	482	0.0122	0.2433	0.0487	0.0097	0.0122	0.0487	0.0049
111	3231	0.1656	0.4923	0.3288	1.3103	2.7102	0.0782	249	309	85	430	0.0109	0.2172	0.0434	0.0087	0.0109	0.0434	0.0043
114	3038	0.1557	0.4629	0.3092	1.2320	2.5482	0.0735	235	291	80	405	0.0102	0.2042	0.0408	0.0082	0.0103	0.0408	0.0041
117	2837	0.1454	0.4322	0.2887	1.1504	2.3794	0.0686	219	271	75	378	0.0095	0.1907	0.0381	0.0076	0.0096	0.0381	0.0038
120	2708	0.1387	0.4125	0.2755	1.0980	2.2711	0.0655	209	259	71	361	0.0091	0.1820	0.0364	0.0073	0.0091	0.0364	0.0036
123	2740	0.1404	0.4175	0.2789	1.1112	2.2985	0.0663	212	262	72	365	0.0092	0.1842	0.0368	0.0074	0.0093	0.0368	0.0037
126	2683	0.1375	0.4087	0.2730	1.0879	2.2501	0.0649	207	257	71	357	0.0090	0.1803	0.0361	0.0072	0.0091	0.0361	0.0036
129	2624	0.1344	0.3997	0.2670	1.0639	2.2006	0.0635	203	251	69	349	0.0088	0.1763	0.0353	0.0071	0.0089	0.0353	0.0035
132	2379	0.1219	0.3624	0.2421	0.9646	1.9951	0.0576	184	228	63	317	0.0080	0.1599	0.0320	0.0064	0.0080	0.0320	0.0032
135	2229	0.1142	0.3396	0.2268	0.9039	1.8696	0.0539	172	213	59	297	0.0075	0.1498	0.0300	0.0060	0.0075	0.0300	0.0030
138	1998	0.1024	0.3044	0.2033	0.8102	1.6758	0.0483	154	191	53	266	0.0067	0.1343	0.0269	0.0054	0.0067	0.0269	0.0027

CELL 1E FINEBeach CONCENTRATIONS

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9	279	0.0189	0.0632	0.0190	0.0303	0.1250	0.0032	107.793	35.282	56.382	19.920	0.0014	0.2381	0.0015	0.0010	0.0042	0.0028	0.0022
10	202	0.0149	0.0379	0.0118	0.0272	0.0912	0.0026	106.467	26.490	52.096	11.008	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
11	201	0.0149	0.0377	0.0117	0.0272	0.0909	0.0026	106.452	26.393	52.049	10.910	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
12	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
13	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
14	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
15	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
16	279	0.0189	0.0632	0.0190	0.0303	0.1250	0.0032	107.793	35.282	56.382	19.920	0.0014	0.2381	0.0015	0.0010	0.0042	0.0028	0.0022
17	202	0.0149	0.0379	0.0118	0.0272	0.0912	0.0026	106.467	26.490	52.096	11.008	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
18	201	0.0149	0.0377	0.0117	0.0272	0.0909	0.0026	106.452	26.393	52.049	10.910	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
19	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
20	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
21	202	0.0149	0.0380	0.0118	0.0272	0.0913	0.0026	106.467	26.492	52.097	11.010	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
22	202	0.0150	0.0382	0.0118	0.0273	0.0916	0.0026	106.480	26.574	52.137	11.094	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
24	313	0.0207	0.0742	0.0221	0.0317	0.1396	0.0034	108.370	39.101	58.244	23.791	0.0015	0.2414	0.0019	0.0011	0.0043	0.0032	0.0023
27	202	0.0150	0.0382	0.0118	0.0273	0.0916	0.0026	106.479	26.572	52.136	11.092	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
30	201	0.0149	0.0378	0.0117	0.0272	0.0910	0.0026	106.458	26.435	52.069	10.952	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
33	202	0.0150	0.0382	0.0118	0.0273	0.0916	0.0026	106.480	26.574	52.137	11.094	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
36	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0.042	0.277	0.135	0.281	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
39	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0.042	0.277	0.135	0.281	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
42	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0.042	0.277	0.135	0.281	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
45	113	0.0058	0.0368	0.0105	0.0045	0.0491	0.0009	1.932	12.804	6.242	12.978	0.0003	0.0108	0.0014	0.0003	0.0004	0.0014	0.0001
48	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.0000	0.042	0.275	0.134	0.279	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
51	1	0.0001	0.0004	0.0001	0.00005	0.0005	0.00001	0.021	0.138	0.067	0.139	0.0000	0.0001	0.0000	0.0000	0.0000	0.0000	0.0000
54	2	0.0001	0.0008	0.0002	0.0001	0.0011	0.00002	0.042	0.277	0.135	0.281	0.0000	0.0002	0.0000	0.0000	0.0000	0.0000	0.0000
57	88	0.0045	0.0287	0.0082	0.0035	0.0383	0.0007	1.506	9.983	4.866	10.119	0.0003	0.0084	0.0011	0.0002	0.0003	0.0011	0.0001
60	399	0.0205	0.1299	0.0372	0.0158	0.1734	0.0031	6.822	45.212	22.040	45.827	0.0012	0.0381	0.0049	0.0010	0.0012	0.0049	0.0005
63	406	0.0208	0.1320	0.0378	0.0161	0.1762	0.0032	6.931	45.935	22.393	46.560	0.0013	0.0387	0.0050	0.0010	0.0013	0.0050	0.0005
66	407	0.0208	0.1323	0.0379	0.0161	0.1766	0.0032	6.949	46.050	22.449	46.677	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
69	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.952	46.071	22.459	46.699	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
72	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.952	46.076	22.461	46.703	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
75	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.953	46.077	22.462	46.704	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
78	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.953	46.077	22.462	46.705	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
81	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.953	46.078	22.462	46.705	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
84	407	0.0209	0.1324	0.0379	0.0161	0.1767	0.0032	6.954	46.084	22.465	46.712	0.0013	0.0388	0.0050	0.0010	0.0013	0.0050	0.0005
87	384	0.0197	0.1248	0.0357	0.0152	0.1666	0.0030	6.553	43.429	21.171	44.020	0.0012	0.0366	0.0047	0.0009	0.0012	0.0047	0.0005
90	360	0.0184	0.1169	0.0335	0.0143	0.1561	0.0028	6.140	40.691	19.836	41.245	0.0011	0.0343	0.0044	0.0009	0.0011	0.0044	0.0004
93	315	0.0161	0.1023	0.0293	0.0125	0.1366	0.0025	5.375	35.625	17.367	36.110	0.0010	0.0300	0.0039	0.0008	0.0010	0.0039	0.0004
96	316	0.0162	0.1027	0.0294	0.0125	0.1371	0.0025	5.395	35.755	17.430	36.242	0.0010	0.0301	0.0039	0.0008	0.0010	0.0039	0.0004
99	319	0.0164	0.1039	0.0297	0.0127	0.1386	0.0025	5.455	36.152	17.623	36.644	0.0010	0.0305	0.0039	0.0008	0.0010	0.0039	0.0004
102	255	0.0131	0.0829	0.0237	0.0101	0.1107	0.0020	4.354	28.854	14.066	29.247	0.0008	0.0243	0.0031	0.0006	0.0008	0.0031	0.0003
105	257	0.0131	0.0834	0.0239	0.0102	0.1114	0.0020	4.382	29.044	14.158	29.439	0.0008	0.0245	0.0032	0.0006	0.0008	0.0032	0.0003
108	258	0.0132	0.0839	0.0240	0.0102	0.1120	0.0020	4.406	29.200	14.234	29.597	0.0008	0.0246	0.0032	0.0006	0.0008	0.0032	0.0003
111	267	0.0137	0.0870	0.0249	0.0106	0.1161	0.0021	4.567	30.270	14.756	30.682	0.0008	0.0255	0.0033	0.0007	0.0008	0.0033	0.0003
114	209	0.0107	0.0680	0.0194	0.0083	0.0907	0.0016	3.569	23.654	11.531	23.976	0.0006	0.0199	0.0026	0.0005	0.0007	0.0026	0.0003
117	210	0.0108	0.0684	0.0196	0.0083	0.0913	0.0016	3.593	23.811	11.607	24.135	0.0006	0.0201	0.0026	0.0005	0.0007	0.0026	0.0003
120	213	0.0109	0.0694	0.0199	0.0085	0.0926	0.0017	3.643	24.145	11.770	24.473	0.0007	0.0203	0.0026	0.0005	0.0007	0.0026	0.0003
123	227	0.0116	0.0737	0.0211	0.0090	0.0983	0.0018	3.869	25.644	12.501	25.993	0.0007	0.0216	0.0028	0.0006	0.0007	0.0028	0.0003
126	170	0.0087	0.0553	0.0158	0.0067	0.0738	0.0013	2.905	19.254	9.386	19.516	0.0005	0.0162	0.0021	0.0004	0.0005	0.0021	0.0002
129	170	0.0087	0.0554	0.0159	0.0068	0.0740	0.0013	2.910	19.283	9.400	19.545	0.0005	0.0163	0.0021	0.0004	0.0005	0.0021	0.0002
132	170	0.0087	0.0554	0.0159	0.0068	0.0740	0.0013	2.910	19.288	9.403	19.551	0.0005	0.0163	0.0021	0.0004	0.0005	0.0021	0.0002
135	171	0.0087	0.0555	0.0159	0.0068	0.0741	0.0013	2.915	19.316	9.416	19.579	0.0005	0.0163	0.0021	0.0004	0.0005	0.0021	0.0002
138	128	0.0066	0.0417	0.0119	0.0051	0.0557	0.0010	2.191	14.520	7.078	14.718	0.0004	0.0122	0.0016	0.0003	0.0004	0.0016	0.0002

Appendix D.4

Seepage Water Quality Results

Cell 2E Seepage Concentrations in Collection Drains

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
2	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
3	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
4	196	0.0046	0.0069	0.0043	0.0089	0.0266	0.0017	73	77	94	16	0.0011	0.2336	0.0004	0.0003	0.0069	0.0021	0.0020
5	205	0.0058	0.0104	0.0058	0.0139	0.0387	0.0020	76	75	91	17	0.0011	0.2340	0.0005	0.0003	0.0067	0.0022	0.0020
6	211	0.0065	0.0126	0.0067	0.0170	0.0463	0.0021	78	73	89	17	0.0011	0.2342	0.0006	0.0004	0.0066	0.0023	0.0021
7	215	0.0071	0.0142	0.0073	0.0192	0.0517	0.0023	79	72	88	18	0.0011	0.2344	0.0007	0.0004	0.0065	0.0023	0.0021
8	258	0.0165	0.0422	0.0148	0.0400	0.1171	0.0033	109	29	53	15	0.0013	0.2327	0.0010	0.0009	0.0041	0.0023	0.0022
9	260	0.0166	0.0427	0.0151	0.0411	0.1195	0.0034	109	30	53	15	0.0013	0.2329	0.0010	0.0009	0.0041	0.0023	0.0022
10	262	0.0168	0.0432	0.0155	0.0425	0.1222	0.0035	109	30	53	16	0.0013	0.2331	0.0010	0.0009	0.0041	0.0023	0.0022
11	267	0.0171	0.0440	0.0160	0.0444	0.1263	0.0036	110	30	53	17	0.0013	0.2335	0.0011	0.0009	0.0041	0.0024	0.0022
12	312	0.0196	0.0510	0.0197	0.0578	0.1565	0.0045	120	35	58	21	0.0015	0.2519	0.0015	0.0011	0.0045	0.0029	0.0024
13	295	0.0186	0.0482	0.0180	0.0513	0.1426	0.0041	117	33	56	19	0.0014	0.2475	0.0013	0.0010	0.0044	0.0027	0.0023
14	278	0.0176	0.0454	0.0164	0.0450	0.1291	0.0037	114	31	55	17	0.0013	0.2424	0.0011	0.0010	0.0043	0.0025	0.0023
15	269	0.0170	0.0439	0.0154	0.0415	0.1215	0.0034	112	30	54	16	0.0013	0.2396	0.0010	0.0009	0.0042	0.0023	0.0023
16	262	0.0167	0.0428	0.0148	0.0391	0.1163	0.0033	111	30	54	15	0.0013	0.2374	0.0009	0.0009	0.0042	0.0023	0.0022
17	260	0.0165	0.0424	0.0145	0.0379	0.1139	0.0032	111	29	54	15	0.0013	0.2370	0.0009	0.0009	0.0042	0.0022	0.0022
18	258	0.0164	0.0421	0.0143	0.0372	0.1124	0.0032	110	29	54	14	0.0013	0.2363	0.0009	0.0009	0.0041	0.0022	0.0022
19	257	0.0163	0.0419	0.0142	0.0368	0.1115	0.0032	110	29	54	14	0.0013	0.2360	0.0009	0.0009	0.0041	0.0022	0.0022
20	257	0.0163	0.0419	0.0142	0.0366	0.1111	0.0031	110	29	53	14	0.0012	0.2358	0.0009	0.0009	0.0041	0.0022	0.0022
21	257	0.0163	0.0419	0.0142	0.0366	0.1112	0.0031	110	29	53	14	0.0012	0.2357	0.0009	0.0009	0.0041	0.0022	0.0022
22	257	0.0163	0.0419	0.0142	0.0367	0.1113	0.0031	110	29	53	14	0.0012	0.2356	0.0009	0.0009	0.0041	0.0022	0.0022
23	257	0.0163	0.0419	0.0142	0.0368	0.1115	0.0032	110	29	53	14	0.0013	0.2355	0.0009	0.0009	0.0041	0.0022	0.0022
24	258	0.0164	0.0421	0.0143	0.0371	0.1122	0.0032	110	29	54	14	0.0013	0.2360	0.0009	0.0009	0.0041	0.0022	0.0022
25	256	0.0162	0.0417	0.0141	0.0361	0.1101	0.0031	110	29	53	14	0.0012	0.2358	0.0008	0.0009	0.0041	0.0022	0.0022
26	253	0.0161	0.0412	0.0138	0.0349	0.1076	0.0030	109	29	53	14	0.0012	0.2353	0.0008	0.0009	0.0041	0.0021	0.0022
27	251	0.0160	0.0409	0.0136	0.0341	0.1060	0.0030	109	28	53	13	0.0012	0.2350	0.0008	0.0009	0.0041	0.0021	0.0022
28	250	0.0159	0.0406	0.0134	0.0336	0.1047	0.0030	109	28	53	13	0.0012	0.2347	0.0008	0.0009	0.0041	0.0021	0.0022
29	249	0.0158	0.0404	0.0133	0.0331	0.1037	0.0029	109	28	53	13	0.0012	0.2345	0.0007	0.0009	0.0041	0.0021	0.0022
30	248	0.0158	0.0403	0.0132	0.0327	0.1029	0.0029	109	28	53	13	0.0012	0.2343	0.0007	0.0009	0.0041	0.0020	0.0022
31	247	0.0157	0.0401	0.0131	0.0324	0.1022	0.0029	109	28	53	13	0.0012	0.2341	0.0007	0.0009	0.0041	0.0020	0.0022
32	246	0.0157	0.0400	0.0130	0.0321	0.1016	0.0029	108	28	53	13	0.0012	0.2340	0.0007	0.0009	0.0041	0.0020	0.0022
33	246	0.0156	0.0398	0.0130	0.0318	0.1010	0.0029	108	28	53	12	0.0012	0.2338	0.0007	0.0009	0.0041	0.0020	0.0022
34	245	0.0156	0.0397	0.0129	0.0316	0.1005	0.0028	108	28	53	12	0.0012	0.2337	0.0007	0.0009	0.0041	0.0020	0.0022
35	245	0.0156	0.0396	0.0128	0.0314	0.1000	0.0028	108	28	53	12	0.0012	0.2335	0.0007	0.0009	0.0041	0.0020	0.0022
36	244	0.0155	0.0395	0.0128	0.0312	0.0996	0.0028	108	28	53	12	0.0012	0.2334	0.0007	0.0009	0.0041	0.0020	0.0022
37	244	0.0155	0.0394	0.0127	0.0311	0.0992	0.0028	108	27	53	12	0.0012	0.2332	0.0007	0.0008	0.0041	0.0020	0.0022
38	243	0.0155	0.0393	0.0127	0.0309	0.0989	0.0028	108	27	53	12	0.0012	0.2331	0.0007	0.0008	0.0041	0.0020	0.0022
39	243	0.0154	0.0393	0.0126	0.0308	0.0986	0.0028	108	27	53	12	0.0012	0.2330	0.0007	0.0008	0.0040	0.0020	0.0022
40	243	0.0154	0.0392	0.0126	0.0306	0.0983	0.0028	108	27	53	12	0.0012	0.2329	0.0007	0.0008	0.0040	0.0020	0.0022
41	242	0.0154	0.0391	0.0126	0.0305	0.0980	0.0028	108	27	53	12	0.0012	0.2328	0.0007	0.0008	0.0040	0.0020	0.0022
42	242	0.0154	0.0391	0.0125	0.0304	0.0978	0.0028	108	27	53	12	0.0012	0.2328	0.0007	0.0008	0.0040	0.0020	0.0022
43	242	0.0154	0.0391	0.0125	0.0303	0.0976	0.0028	108	27	53	12	0.0012	0.2327	0.0006	0.0008	0.0040	0.0019	0.0022
44	242	0.0154	0.0390	0.0125	0.0302	0.0974	0.0028	108	27	53	12	0.0012	0.2326	0.0006	0.0008	0.0040	0.0019	0.0022
45	241	0.0153	0.0390	0.0125	0.0301	0.0972	0.0027	108	27	53	12	0.0012	0.2326	0.0006	0.0008	0.0040	0.0019	0.0022
46	241	0.0153	0.0390	0.0125	0.0301	0.0972	0.0027	108	27	53	12	0.0012	0.2325	0.0006	0.0008	0.0040	0.0019	0.0022
47	242	0.0154	0.0390	0.0125	0.0302	0.0974	0.0028	108	27	53	12	0.0012	0.2325	0.0006	0.0008	0.0040	0.0019	0.0022
48	242	0.0154	0.0391	0.0126	0.0304	0.0978	0.0028	108	27	53	12	0.0012	0.2325	0.0007	0.0008	0.0040	0.0020	0.0022
49	243	0.0154	0.0393	0.0127	0.0308	0.0986	0.0028	108	27	53	12	0.0012	0.2326	0.0007	0.0008	0.0040	0.0020	0.0022
50	244	0.0155	0.0395	0.0128	0.0312	0.0995	0.0028	108	28	53	12	0.0012	0.2327	0.0007	0.0008	0.0040	0.0020	0.0022

Cell 2E Seepage Concentrations in Collection Drains (cont.)

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
51	245	0.0156	0.0397	0.0129	0.0317	0.1007	0.0028	108	28	53	12	0.0012	0.2328	0.0007	0.0009	0.0040	0.0020	0.0022
52	247	0.0157	0.0400	0.0131	0.0324	0.1020	0.0029	108	28	53	13	0.0012	0.2329	0.0007	0.0009	0.0041	0.0020	0.0022
53	249	0.0157	0.0403	0.0133	0.0331	0.1036	0.0029	108	28	53	13	0.0012	0.2330	0.0007	0.0009	0.0041	0.0020	0.0022
54	251	0.0159	0.0406	0.0135	0.0340	0.1053	0.0030	108	28	53	13	0.0012	0.2333	0.0008	0.0009	0.0041	0.0021	0.0022
55	253	0.0159	0.0409	0.0136	0.0345	0.1066	0.0030	109	28	53	13	0.0012	0.2334	0.0008	0.0009	0.0041	0.0021	0.0022
56	254	0.0160	0.0411	0.0138	0.0352	0.1080	0.0031	109	29	53	14	0.0012	0.2336	0.0008	0.0009	0.0041	0.0021	0.0022
57	256	0.0161	0.0414	0.0140	0.0359	0.1095	0.0031	109	29	53	14	0.0012	0.2338	0.0008	0.0009	0.0041	0.0021	0.0022
58	258	0.0162	0.0417	0.0142	0.0367	0.1111	0.0031	109	29	53	14	0.0012	0.2339	0.0009	0.0009	0.0041	0.0022	0.0022
59	260	0.0163	0.0420	0.0144	0.0376	0.1129	0.0032	109	29	53	14	0.0013	0.2341	0.0009	0.0009	0.0041	0.0022	0.0022
60	262	0.0164	0.0423	0.0146	0.0385	0.1147	0.0032	109	29	53	15	0.0013	0.2343	0.0009	0.0009	0.0041	0.0022	0.0022
61	265	0.0166	0.0426	0.0148	0.0394	0.1166	0.0033	110	29	53	15	0.0013	0.2344	0.0010	0.0009	0.0041	0.0023	0.0022
62	267	0.0167	0.0429	0.0151	0.0404	0.1185	0.0034	110	30	53	15	0.0013	0.2346	0.0010	0.0009	0.0041	0.0023	0.0022
63	269	0.0168	0.0432	0.0153	0.0413	0.1204	0.0034	110	30	53	16	0.0013	0.2347	0.0010	0.0009	0.0041	0.0023	0.0022
64	271	0.0169	0.0435	0.0155	0.0422	0.1222	0.0035	110	30	53	16	0.0013	0.2348	0.0010	0.0009	0.0041	0.0023	0.0022
65	273	0.0170	0.0438	0.0157	0.0430	0.1239	0.0035	110	30	53	16	0.0013	0.2349	0.0011	0.0009	0.0041	0.0024	0.0022
66	275	0.0171	0.0441	0.0159	0.0438	0.1254	0.0036	110	30	53	16	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
67	276	0.0171	0.0443	0.0160	0.0444	0.1266	0.0036	110	31	53	17	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
68	278	0.0172	0.0444	0.0161	0.0449	0.1276	0.0036	110	31	54	17	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
69	278	0.0172	0.0445	0.0162	0.0452	0.1282	0.0036	111	31	54	17	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
70	279	0.0172	0.0445	0.0162	0.0453	0.1284	0.0037	111	31	54	17	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
71	278	0.0172	0.0445	0.0162	0.0453	0.1283	0.0036	110	31	54	17	0.0013	0.2350	0.0011	0.0009	0.0042	0.0024	0.0022
72	278	0.0172	0.0444	0.0162	0.0450	0.1277	0.0036	110	31	53	17	0.0013	0.2349	0.0011	0.0009	0.0042	0.0024	0.0022
73	277	0.0171	0.0442	0.0160	0.0446	0.1268	0.0036	110	31	53	17	0.0013	0.2348	0.0011	0.0009	0.0042	0.0024	0.0022
74	275	0.0171	0.0439	0.0159	0.0440	0.1255	0.0036	110	30	53	16	0.0013	0.2346	0.0011	0.0009	0.0041	0.0024	0.0022
75	273	0.0170	0.0436	0.0157	0.0432	0.1240	0.0035	110	30	53	16	0.0013	0.2345	0.0011	0.0009	0.0041	0.0024	0.0022
76	271	0.0168	0.0433	0.0155	0.0424	0.1222	0.0035	110	30	53	16	0.0013	0.2343	0.0010	0.0009	0.0041	0.0023	0.0022
77	269	0.0167	0.0429	0.0152	0.0414	0.1203	0.0034	110	30	53	16	0.0013	0.2341	0.0010	0.0009	0.0041	0.0023	0.0022
78	266	0.0166	0.0426	0.0150	0.0405	0.1182	0.0034	109	30	53	15	0.0013	0.2339	0.0010	0.0009	0.0041	0.0023	0.0022
79	264	0.0165	0.0422	0.0147	0.0394	0.1161	0.0033	109	29	53	15	0.0013	0.2336	0.0009	0.0009	0.0041	0.0022	0.0022
80	262	0.0163	0.0418	0.0145	0.0384	0.1140	0.0032	109	29	53	15	0.0013	0.2334	0.0009	0.0009	0.0041	0.0022	0.0022
81	259	0.0162	0.0414	0.0142	0.0375	0.1120	0.0032	109	29	53	14	0.0012	0.2332	0.0009	0.0009	0.0041	0.0022	0.0022
82	257	0.0161	0.0411	0.0140	0.0365	0.1101	0.0031	109	29	53	14	0.0012	0.2330	0.0008	0.0009	0.0041	0.0021	0.0022
83	255	0.0160	0.0407	0.0138	0.0357	0.1082	0.0031	108	28	53	14	0.0012	0.2328	0.0008	0.0009	0.0041	0.0021	0.0022
84	253	0.0159	0.0404	0.0136	0.0348	0.1065	0.0030	108	28	53	13	0.0012	0.2326	0.0008	0.0009	0.0041	0.0021	0.0022
85	251	0.0158	0.0401	0.0134	0.0341	0.1050	0.0030	108	28	53	13	0.0012	0.2325	0.0008	0.0009	0.0041	0.0021	0.0022
86	249	0.0157	0.0399	0.0132	0.0334	0.1035	0.0029	108	28	53	13	0.0012	0.2323	0.0007	0.0009	0.0040	0.0020	0.0022
87	248	0.0156	0.0396	0.0131	0.0328	0.1023	0.0029	108	28	53	13	0.0012	0.2322	0.0007	0.0009	0.0040	0.0020	0.0022
88	246	0.0155	0.0394	0.0129	0.0322	0.1011	0.0029	108	28	52	12	0.0012	0.2321	0.0007	0.0009	0.0040	0.0020	0.0022
89	245	0.0155	0.0392	0.0128	0.0317	0.1001	0.0028	108	27	52	12	0.0012	0.2320	0.0007	0.0008	0.0040	0.0020	0.0022
90	244	0.0154	0.0391	0.0127	0.0313	0.0992	0.0028	107	27	52	12	0.0012	0.2319	0.0007	0.0008	0.0040	0.0020	0.0022
91	243	0.0154	0.0389	0.0126	0.0309	0.0984	0.0028	107	27	52	12	0.0012	0.2318	0.0007	0.0008	0.0040	0.0020	0.0022
92	242	0.0153	0.0388	0.0125	0.0306	0.0977	0.0028	107	27	52	12	0.0012	0.2317	0.0006	0.0008	0.0040	0.0019	0.0022
93	242	0.0153	0.0387	0.0124	0.0303	0.0971	0.0027	107	27	52	12	0.0012	0.2316	0.0006	0.0008	0.0040	0.0019	0.0022
94	241	0.0153	0.0386	0.0124	0.0301	0.0966	0.0027	107	27	52	12	0.0012	0.2316	0.0006	0.0008	0.0040	0.0019	0.0022
95	240	0.0152	0.0385	0.0123	0.0298	0.0962	0.0027	107	27	52	12	0.0012	0.2315	0.0006	0.0008	0.0040	0.0019	0.0022
96	240	0.0152	0.0384	0.0123	0.0297	0.0958	0.0027	107	27	52	12	0.0012	0.2315	0.0006	0.0008	0.0040	0.0019	0.0022
97	240	0.0152	0.0384	0.0122	0.0295	0.0954	0.0027	107	27	52	12	0.0012	0.2315	0.0006	0.0008	0.0040	0.0019	0.0022
98	239	0.0152	0.0383	0.0122	0.0294	0.0952	0.0027	107	27	52	12	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022
99	239	0.0151	0.0383	0.0122	0.0292	0.0949	0.0027	107	27	52	12	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022
100	239	0.0151	0.0382	0.0121	0.0291	0.0947	0.0027	107	27	52	11	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022

Cell 2E Concentrations in Percolate to Groundwater

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
2	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
3	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
4	186	0.0034	0.0033	0.0029	0.0039	0.0142	0.0014	70	80	96	15	0.0010	0.2331	0.0002	0.0002	0.0070	0.0020	0.0020
5	188	0.0036	0.0040	0.0031	0.0048	0.0165	0.0014	70	79	96	15	0.0010	0.2332	0.0003	0.0002	0.0070	0.0021	0.0020
6	188	0.0037	0.0042	0.0032	0.0051	0.0173	0.0015	71	79	96	15	0.0010	0.2332	0.0003	0.0002	0.0070	0.0021	0.0020
7	189	0.0037	0.0043	0.0033	0.0053	0.0177	0.0015	71	79	96	15	0.0010	0.2333	0.0003	0.0002	0.0070	0.0021	0.0020
8	238	0.0151	0.0382	0.0122	0.0293	0.0950	0.0027	107	27	52	12	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
9	238	0.0151	0.0382	0.0122	0.0293	0.0949	0.0027	107	27	52	12	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
10	238	0.0152	0.0383	0.0122	0.0295	0.0953	0.0027	107	27	52	12	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
11	239	0.0152	0.0384	0.0123	0.0298	0.0959	0.0027	107	27	52	12	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
12	246	0.0156	0.0394	0.0128	0.0318	0.1005	0.0028	108	28	53	12	0.0012	0.2338	0.0007	0.0009	0.0041	0.0020	0.0022
13	243	0.0154	0.0390	0.0126	0.0308	0.0983	0.0028	108	27	53	12	0.0012	0.2331	0.0007	0.0008	0.0040	0.0020	0.0022
14	241	0.0153	0.0386	0.0123	0.0298	0.0963	0.0027	108	27	52	12	0.0012	0.2323	0.0006	0.0008	0.0040	0.0019	0.0022
15	239	0.0152	0.0384	0.0122	0.0293	0.0951	0.0027	107	27	52	12	0.0012	0.2319	0.0006	0.0008	0.0040	0.0019	0.0022
16	238	0.0151	0.0382	0.0121	0.0289	0.0943	0.0027	107	27	52	11	0.0012	0.2316	0.0006	0.0008	0.0040	0.0019	0.0022
17	238	0.0151	0.0381	0.0120	0.0288	0.0940	0.0027	107	27	52	11	0.0012	0.2315	0.0006	0.0008	0.0040	0.0019	0.0022
18	237	0.0151	0.0381	0.0120	0.0286	0.0937	0.0027	107	27	52	11	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022
19	237	0.0151	0.0381	0.0120	0.0286	0.0936	0.0026	107	27	52	11	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022
20	237	0.0151	0.0380	0.0120	0.0285	0.0935	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
21	237	0.0151	0.0380	0.0120	0.0285	0.0935	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
22	237	0.0151	0.0380	0.0120	0.0285	0.0935	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
23	237	0.0151	0.0380	0.0120	0.0286	0.0935	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
24	237	0.0151	0.0381	0.0120	0.0286	0.0936	0.0026	107	27	52	11	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0022
25	237	0.0151	0.0380	0.0120	0.0285	0.0933	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
26	237	0.0150	0.0379	0.0119	0.0283	0.0930	0.0026	107	27	52	11	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0022
27	236	0.0150	0.0379	0.0119	0.0282	0.0927	0.0026	107	27	52	11	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
28	236	0.0150	0.0379	0.0119	0.0281	0.0926	0.0026	107	27	52	11	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
29	236	0.0150	0.0378	0.0119	0.0280	0.0924	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
30	236	0.0150	0.0378	0.0118	0.0280	0.0923	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
31	236	0.0150	0.0378	0.0118	0.0279	0.0922	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
32	236	0.0150	0.0378	0.0118	0.0279	0.0921	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
33	236	0.0150	0.0377	0.0118	0.0278	0.0920	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
34	236	0.0150	0.0377	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
35	235	0.0150	0.0377	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0018	0.0022
36	235	0.0150	0.0377	0.0118	0.0278	0.0918	0.0026	107	26	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0018	0.0022
37	235	0.0149	0.0377	0.0118	0.0277	0.0918	0.0026	107	26	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0018	0.0022
38	235	0.0149	0.0377	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
39	235	0.0149	0.0377	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
40	235	0.0149	0.0377	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
41	235	0.0149	0.0376	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
42	235	0.0149	0.0376	0.0118	0.0276	0.0916	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
43	235	0.0149	0.0376	0.0118	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
44	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
45	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
46	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
47	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
48	235	0.0149	0.0376	0.0118	0.0276	0.0916	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
49	235	0.0149	0.0377	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022
50	235	0.0149	0.0377	0.0118	0.0277	0.0918	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0018	0.0022

Cell 2E Concentrations in Percolate to Groundwater (cont.)

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
51	236	0.0150	0.0377	0.0118	0.0278	0.0920	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
52	236	0.0150	0.0378	0.0118	0.0279	0.0922	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
53	236	0.0150	0.0378	0.0119	0.0280	0.0924	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
54	236	0.0150	0.0379	0.0119	0.0281	0.0926	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
55	237	0.0150	0.0379	0.0119	0.0282	0.0928	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
56	237	0.0150	0.0379	0.0119	0.0283	0.0930	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
57	237	0.0150	0.0380	0.0120	0.0284	0.0932	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
58	237	0.0151	0.0380	0.0120	0.0285	0.0935	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
59	238	0.0151	0.0381	0.0120	0.0287	0.0937	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
60	238	0.0151	0.0381	0.0121	0.0288	0.0940	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
61	238	0.0151	0.0381	0.0121	0.0289	0.0943	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
62	239	0.0151	0.0382	0.0121	0.0291	0.0945	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
63	239	0.0151	0.0382	0.0122	0.0292	0.0948	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
64	239	0.0151	0.0383	0.0122	0.0293	0.0951	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
65	240	0.0152	0.0383	0.0122	0.0295	0.0953	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
66	240	0.0152	0.0384	0.0122	0.0296	0.0955	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
67	240	0.0152	0.0384	0.0123	0.0297	0.0957	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
68	240	0.0152	0.0384	0.0123	0.0297	0.0959	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
69	240	0.0152	0.0384	0.0123	0.0298	0.0959	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
70	240	0.0152	0.0384	0.0123	0.0298	0.0960	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
71	240	0.0152	0.0384	0.0123	0.0298	0.0960	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
72	240	0.0152	0.0384	0.0123	0.0297	0.0959	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
73	240	0.0152	0.0384	0.0123	0.0297	0.0957	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
74	240	0.0152	0.0383	0.0122	0.0296	0.0956	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0022
75	240	0.0152	0.0383	0.0122	0.0295	0.0953	0.0027	107	27	52	12	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
76	239	0.0151	0.0382	0.0122	0.0294	0.0951	0.0027	107	27	52	12	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
77	239	0.0151	0.0382	0.0121	0.0292	0.0948	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0022
78	239	0.0151	0.0381	0.0121	0.0291	0.0945	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
79	238	0.0151	0.0381	0.0121	0.0289	0.0942	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
80	238	0.0151	0.0380	0.0120	0.0288	0.0939	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
81	238	0.0151	0.0380	0.0120	0.0287	0.0936	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0022
82	237	0.0150	0.0379	0.0120	0.0285	0.0933	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
83	237	0.0150	0.0379	0.0119	0.0284	0.0931	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
84	237	0.0150	0.0378	0.0119	0.0283	0.0928	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0022
85	236	0.0150	0.0378	0.0119	0.0282	0.0926	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
86	236	0.0150	0.0377	0.0119	0.0281	0.0924	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
87	236	0.0150	0.0377	0.0118	0.0280	0.0922	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
88	236	0.0150	0.0377	0.0118	0.0279	0.0920	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0022
89	236	0.0149	0.0377	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0018	0.0022
90	235	0.0149	0.0376	0.0118	0.0278	0.0918	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0018	0.0022
91	235	0.0149	0.0376	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
92	235	0.0149	0.0376	0.0117	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
93	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0022
94	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
95	235	0.0149	0.0376	0.0117	0.0276	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
96	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
97	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
98	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
99	235	0.0149	0.0375	0.0117	0.0275	0.0911	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
100	235	0.0149	0.0375	0.0117	0.0275	0.0911	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022

Cell 1E Underdrain Seepage Collection Concentrations

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1																		
2																		
3																		
4																		
5																		
6																		
7																		
8																		
9	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
10	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
11	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
12	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
13	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
14	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
15	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
16	238	0.0151	0.0380	0.0121	0.0289	0.0941	0.0027	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
17	269	0.0169	0.0436	0.0157	0.0436	0.1244	0.0035	110	30	53	16	0.0013	0.2333	0.0011	0.0009	0.0041	0.0024	0.0018
18	302	0.0188	0.0491	0.0194	0.0584	0.1550	0.0044	112	34	54	21	0.0014	0.2357	0.0016	0.0010	0.0042	0.0029	0.0016
19	359	0.0218	0.0580	0.0254	0.0821	0.2041	0.0058	117	39	56	29	0.0016	0.2397	0.0024	0.0012	0.0044	0.0036	0.0015
20	479	0.0280	0.0765	0.0377	0.1312	0.3057	0.0088	126	51	59	45	0.0020	0.2478	0.0040	0.0015	0.0049	0.0053	0.0014
21	646	0.0367	0.1023	0.0549	0.1998	0.4476	0.0129	139	67	63	68	0.0026	0.2592	0.0063	0.0020	0.0054	0.0075	0.0013
22	785	0.0438	0.1234	0.0691	0.2562	0.5642	0.0162	150	80	67	86	0.0031	0.2685	0.0081	0.0023	0.0059	0.0094	0.0013
23	893	0.0493	0.1399	0.0801	0.3000	0.6548	0.0188	158	91	70	100	0.0034	0.2758	0.0096	0.0026	0.0063	0.0109	0.0013
24	976	0.0536	0.1525	0.0885	0.3336	0.7244	0.0208	165	99	72	111	0.0037	0.2814	0.0107	0.0028	0.0065	0.0120	0.0013
25	1026	0.0561	0.1601	0.0936	0.3538	0.7661	0.0220	169	103	73	118	0.0039	0.2847	0.0114	0.0030	0.0067	0.0127	0.0013
26	1031	0.0564	0.1609	0.0941	0.3559	0.7704	0.0222	169	104	73	119	0.0039	0.2851	0.0114	0.0030	0.0067	0.0127	0.0013
27	1007	0.0552	0.1573	0.0915	0.3453	0.7490	0.0216	168	102	73	115	0.0038	0.2864	0.0111	0.0029	0.0067	0.0124	0.0013
28	975	0.0539	0.1526	0.0868	0.3244	0.7097	0.0204	176	99	78	109	0.0037	0.3097	0.0103	0.0029	0.0070	0.0118	0.0016
29	887	0.0496	0.1393	0.0768	0.2828	0.6266	0.0180	177	91	80	95	0.0035	0.3221	0.0089	0.0026	0.0069	0.0105	0.0018
30	677	0.0385	0.1067	0.0557	0.1995	0.4527	0.0130	156	70	72	68	0.0027	0.2966	0.0062	0.0021	0.0060	0.0077	0.0019
31	512	0.0298	0.0810	0.0391	0.1346	0.3168	0.0091	139	54	65	46	0.0022	0.2749	0.0041	0.0016	0.0053	0.0055	0.0020
32	403	0.0240	0.0638	0.0280	0.0908	0.2254	0.0064	128	43	61	32	0.0018	0.2622	0.0026	0.0013	0.0049	0.0040	0.0021
33	320	0.0195	0.0509	0.0199	0.0593	0.1588	0.0045	118	35	57	21	0.0015	0.2476	0.0016	0.0011	0.0044	0.0029	0.0021
34	262	0.0164	0.0418	0.0144	0.0380	0.1134	0.0032	110	29	53	14	0.0013	0.2349	0.0009	0.0009	0.0041	0.0022	0.0021
35	250	0.0157	0.0399	0.0132	0.0335	0.1038	0.0029	108	28	53	13	0.0012	0.2325	0.0007	0.0009	0.0041	0.0020	0.0021
36	247	0.0155	0.0394	0.0129	0.0323	0.1012	0.0029	108	28	52	12	0.0012	0.2320	0.0007	0.0009	0.0040	0.0020	0.0021
37	245	0.0154	0.0391	0.0127	0.0314	0.0994	0.0028	107	27	52	12	0.0012	0.2318	0.0007	0.0008	0.0040	0.0020	0.0021
38	243	0.0153	0.0388	0.0126	0.0308	0.0982	0.0028	107	27	52	12	0.0012	0.2316	0.0007	0.0008	0.0040	0.0019	0.0021
39	242	0.0153	0.0386	0.0124	0.0304	0.0972	0.0028	107	27	52	12	0.0012	0.2314	0.0006	0.0008	0.0040	0.0019	0.0021
40	241	0.0152	0.0385	0.0123	0.0300	0.0965	0.0027	107	27	52	12	0.0012	0.2313	0.0006	0.0008	0.0040	0.0019	0.0021
41	240	0.0152	0.0384	0.0123	0.0297	0.0959	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0021
42	240	0.0152	0.0383	0.0122	0.0295	0.0954	0.0027	107	27	52	12	0.0012	0.2312	0.0006	0.0008	0.0040	0.0019	0.0021
43	239	0.0151	0.0382	0.0122	0.0293	0.0950	0.0027	107	27	52	12	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0021
44	239	0.0151	0.0382	0.0121	0.0291	0.0946	0.0027	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0021
45	238	0.0151	0.0381	0.0121	0.0290	0.0943	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0021
46	238	0.0151	0.0380	0.0120	0.0289	0.0940	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0021
47	238	0.0151	0.0380	0.0120	0.0288	0.0938	0.0027	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0021
48	238	0.0150	0.0380	0.0120	0.0287	0.0936	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
49	237	0.0150	0.0379	0.0120	0.0286	0.0934	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
50	237	0.0150	0.0379	0.0120	0.0285	0.0932	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021

Cell 1E Underdrain Seepage Collection Concentrations (cont.)

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
51	237	0.0150	0.0379	0.0119	0.0284	0.0931	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
52	237	0.0150	0.0378	0.0119	0.0284	0.0930	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
53	237	0.0150	0.0378	0.0119	0.0283	0.0928	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
54	237	0.0150	0.0378	0.0119	0.0282	0.0927	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
55	236	0.0150	0.0378	0.0119	0.0282	0.0926	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
56	236	0.0150	0.0378	0.0119	0.0281	0.0925	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
57	236	0.0150	0.0378	0.0119	0.0281	0.0925	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
58	236	0.0150	0.0377	0.0118	0.0281	0.0924	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
59	236	0.0150	0.0377	0.0118	0.0280	0.0923	0.0026	107	27	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
60	236	0.0150	0.0377	0.0118	0.0280	0.0922	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
61	236	0.0150	0.0377	0.0118	0.0280	0.0922	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
62	236	0.0150	0.0377	0.0118	0.0279	0.0921	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0019	0.0021
63	236	0.0150	0.0377	0.0118	0.0279	0.0921	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0019	0.0021
64	236	0.0149	0.0377	0.0118	0.0279	0.0920	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
65	236	0.0149	0.0377	0.0118	0.0279	0.0920	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
66	236	0.0149	0.0377	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
67	236	0.0149	0.0376	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
68	236	0.0149	0.0376	0.0118	0.0278	0.0918	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
69	235	0.0149	0.0376	0.0118	0.0278	0.0918	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
70	235	0.0149	0.0376	0.0118	0.0278	0.0917	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
71	235	0.0149	0.0376	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
72	235	0.0149	0.0376	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
73	235	0.0149	0.0376	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
74	235	0.0149	0.0376	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
75	235	0.0149	0.0376	0.0118	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
76	235	0.0149	0.0376	0.0117	0.0277	0.0916	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
77	235	0.0149	0.0376	0.0117	0.0277	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
78	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
79	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
80	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
81	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
82	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
83	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
84	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
85	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
86	235	0.0149	0.0375	0.0117	0.0276	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
87	235	0.0149	0.0375	0.0117	0.0276	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
88	235	0.0149	0.0375	0.0117	0.0276	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
89	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
90	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
91	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
92	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
93	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
94	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
95	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
96	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
97	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
98	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
99	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021
100	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0021

Cell 1E Percolate Concentrations at Barrier Wall

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
1	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
2	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
3	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
4	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
5	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
6	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
7	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
8	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
9	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
10	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
11	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
12	183	0.0030	0.0021	0.0024	0.0022	0.0101	0.0013	69	81	97	15	0.0010	0.2330	0.0002	0.0002	0.0071	0.0020	0.0020
13	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
14	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
15	234	0.0149	0.0374	0.0116	0.0272	0.0905	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
16	235	0.0149	0.0376	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2309	0.0005	0.0008	0.0040	0.0018	0.0021
17	244	0.0154	0.0390	0.0126	0.0307	0.0981	0.0028	108	27	53	12	0.0012	0.2338	0.0006	0.0008	0.0041	0.0020	0.0021
18	252	0.0159	0.0405	0.0134	0.0339	0.1052	0.0030	110	28	53	13	0.0012	0.2362	0.0008	0.0009	0.0041	0.0021	0.0021
19	265	0.0167	0.0426	0.0147	0.0391	0.1160	0.0033	111	30	54	15	0.0013	0.2383	0.0009	0.0009	0.0042	0.0022	0.0021
20	292	0.0180	0.0466	0.0174	0.0497	0.1381	0.0039	114	32	55	18	0.0014	0.2409	0.0013	0.0010	0.0043	0.0026	0.0021
21	328	0.0199	0.0522	0.0211	0.0641	0.1681	0.0048	117	36	56	23	0.0015	0.2441	0.0017	0.0011	0.0044	0.0031	0.0020
22	357	0.0214	0.0566	0.0240	0.0759	0.1925	0.0055	119	38	57	27	0.0016	0.2462	0.0021	0.0012	0.0045	0.0035	0.0020
23	380	0.0226	0.0601	0.0263	0.0851	0.2115	0.0060	121	41	57	30	0.0017	0.2477	0.0024	0.0012	0.0046	0.0038	0.0020
24	397	0.0234	0.0627	0.0281	0.0921	0.2260	0.0065	122	42	58	32	0.0017	0.2489	0.0027	0.0013	0.0047	0.0040	0.0020
25	407	0.0240	0.0643	0.0291	0.0963	0.2347	0.0067	123	43	58	34	0.0018	0.2497	0.0028	0.0013	0.0047	0.0041	0.0020
26	408	0.0240	0.0645	0.0293	0.0968	0.2357	0.0067	123	43	58	34	0.0018	0.2498	0.0028	0.0013	0.0047	0.0042	0.0020
27	403	0.0238	0.0637	0.0287	0.0945	0.2311	0.0066	123	43	58	33	0.0017	0.2498	0.0028	0.0013	0.0047	0.0041	0.0020
28	394	0.0234	0.0623	0.0276	0.0899	0.2220	0.0063	124	42	59	32	0.0017	0.2524	0.0026	0.0013	0.0047	0.0040	0.0021
29	374	0.0223	0.0592	0.0254	0.0810	0.2039	0.0058	123	40	59	29	0.0017	0.2531	0.0023	0.0012	0.0047	0.0037	0.0021
30	329	0.0199	0.0522	0.0209	0.0634	0.1670	0.0048	118	36	57	23	0.0015	0.2465	0.0017	0.0011	0.0045	0.0031	0.0021
31	293	0.0180	0.0467	0.0174	0.0498	0.1382	0.0039	114	32	55	18	0.0014	0.2410	0.0013	0.0010	0.0043	0.0026	0.0021
32	270	0.0168	0.0430	0.0151	0.0405	0.1188	0.0034	111	30	54	15	0.0013	0.2375	0.0010	0.0009	0.0042	0.0023	0.0021
33	252	0.0158	0.0402	0.0134	0.0339	0.1049	0.0030	109	28	53	13	0.0012	0.2343	0.0008	0.0009	0.0041	0.0021	0.0021
34	240	0.0152	0.0383	0.0122	0.0295	0.0953	0.0027	107	27	52	12	0.0012	0.2316	0.0006	0.0008	0.0040	0.0019	0.0021
35	237	0.0150	0.0379	0.0120	0.0285	0.0933	0.0026	107	27	52	11	0.0012	0.2311	0.0006	0.0008	0.0040	0.0019	0.0021
36	237	0.0150	0.0378	0.0119	0.0282	0.0928	0.0026	107	27	52	11	0.0012	0.2310	0.0006	0.0008	0.0040	0.0019	0.0021
37	236	0.0150	0.0378	0.0119	0.0281	0.0924	0.0026	107	27	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
38	236	0.0150	0.0377	0.0118	0.0279	0.0921	0.0026	107	26	52	11	0.0012	0.2309	0.0006	0.0008	0.0040	0.0019	0.0021
39	236	0.0149	0.0377	0.0118	0.0278	0.0919	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0018	0.0021
40	236	0.0149	0.0376	0.0118	0.0278	0.0918	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0018	0.0021
41	235	0.0149	0.0376	0.0118	0.0277	0.0917	0.0026	107	26	52	11	0.0012	0.2308	0.0006	0.0008	0.0040	0.0018	0.0021
42	235	0.0149	0.0376	0.0117	0.0277	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
43	235	0.0149	0.0376	0.0117	0.0276	0.0915	0.0026	107	26	52	11	0.0012	0.2307	0.0006	0.0008	0.0040	0.0018	0.0021
44	235	0.0149	0.0376	0.0117	0.0276	0.0914	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0021
45	235	0.0149	0.0375	0.0117	0.0276	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
46	235	0.0149	0.0375	0.0117	0.0275	0.0913	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
47	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
48	235	0.0149	0.0375	0.0117	0.0275	0.0912	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
49	235	0.0149	0.0375	0.0117	0.0275	0.0911	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
50	235	0.0149	0.0375	0.0117	0.0274	0.0911	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022

Cell 1E Percolate Concentrations at Barrier Wall (cont.)

Year	SO4 mg/L	Sb mg/L	As mg/L	Cu mg/L	Ni mg/L	Zn mg/L	Co mg/L	Ca mg/L	Mg mg/L	Na mg/L	K mg/L	Ag mg/L	B mg/L	Be mg/L	Cd mg/L	Pb mg/L	Se mg/L	Tl mg/L
51	235	0.0149	0.0375	0.0117	0.0274	0.0911	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
52	235	0.0149	0.0375	0.0117	0.0274	0.0910	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
53	235	0.0149	0.0375	0.0117	0.0274	0.0910	0.0026	107	26	52	11	0.0012	0.2307	0.0005	0.0008	0.0040	0.0018	0.0022
54	235	0.0149	0.0375	0.0117	0.0274	0.0910	0.0026	107	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
55	235	0.0149	0.0375	0.0117	0.0274	0.0910	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
56	234	0.0149	0.0375	0.0117	0.0274	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
57	234	0.0149	0.0375	0.0117	0.0274	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
58	234	0.0149	0.0375	0.0117	0.0274	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
59	234	0.0149	0.0375	0.0117	0.0273	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
60	234	0.0149	0.0375	0.0117	0.0273	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
61	234	0.0149	0.0375	0.0117	0.0273	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
62	234	0.0149	0.0375	0.0117	0.0273	0.0909	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
63	234	0.0149	0.0375	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
64	234	0.0149	0.0375	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
65	234	0.0149	0.0375	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
66	234	0.0149	0.0375	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
67	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
68	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
69	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
70	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
71	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
72	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
73	234	0.0149	0.0374	0.0117	0.0273	0.0908	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
74	234	0.0149	0.0374	0.0117	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
75	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
76	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
77	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
78	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
79	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
80	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
81	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
82	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
83	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
84	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
85	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
86	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
87	234	0.0149	0.0374	0.0116	0.0273	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
88	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
89	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
90	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
91	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
92	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
93	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
94	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
95	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
96	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
97	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
98	234	0.0149	0.0374	0.0116	0.0272	0.0907	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
99	234	0.0149	0.0374	0.0116	0.0272	0.0906	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022
100	234	0.0149	0.0374	0.0116	0.0272	0.0906	0.0026	106	26	52	11	0.0012	0.2306	0.0005	0.0008	0.0040	0.0018	0.0022

Appendix D.5

Process Water Pond Concentrations

SRK Consulting
Project NorthMet
Number 1UP005.001
Date 7/17/2007 16:37
G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
1	Jan-01	31	1E	3.945075	0.218203	0.029773	5.156219	0.000736	0.000736	3.261290649	0.001852629	0.000205	0.000476	0.000798	8.1911E-06	0.0036	1.73119E-05	2.813844	4.13462E-05	1.9679E-05	8.97333E-05	0.002863	4.45569E-05	0.600919342
	Feb-01	28		13.63536	2.310071	0.058932	13.54723	0.005537	0.005537	9.072334377	0.008013894	0.000485	0.001162	0.001736	1.59447E-05	0.011783	3.51952E-05	6.002242	8.9267E-05	4.65768E-05	0.00020271	0.004	8.54772E-05	1.525753728
	Mar-01	31		23.24376	3.691047	0.096733	24.32412	0.010854	0.010854	15.34508124	0.01	0.000818	0.001756	0.00366	2.87035E-05	0.020543	5.14765E-05	9.350448	0.000200868	9.35517E-05	0.000408972	0.004	0.000135454	2.80828166
	Apr-01	30		28.48159	4.408889	0.128476	31.70562	0.01451	0.01451	20.94350833	0.01	0.001126	0.002282	0.005365	4.14477E-05	0.027212	6.64298E-05	12.26035	0.000297774	0.000132642	0.000626857	0.004	0.000184292	3.591592596
	May-01	31		35.72447	4.682754	0.166703	41.52043	0.017659	0.017659	25.43353477	0.01	0.001403	0.002732	0.00725	5.4173E-05	0.033262	8.03914E-05	15.20342	0.000409774	0.000178698	0.000811779	0.004	0.000232365	4.859327366
	Jun-01	30		42.62871	4.92575	0.203898	51.97791	0.02208	0.02208	30.5815172	0.01	0.001711	0.003133	0.009731	6.93183E-05	0.040385	9.10308E-05	17.89931	0.000561008	0.000234418	0.001071008	0.004	0.000279811	6.169362096
	Jul-01	31		47.8589	5.144675	0.238316	60.88993	0.026335	0.026335	35.84163719	0.01	0.002021	0.003527	0.012191	8.45068E-05	0.047406	0.000102331	20.56792	0.000710496	0.000285098	0.001343365	0.004	0.000328609	7.20958963
	Aug-01	31		57.284	5.133295	0.27777	74.11839	0.031192	0.031192	39.83408493	0.01	0.002282	0.003772	0.014996	9.90842E-05	0.054369	0.000107849	22.81179	0.000888161	0.000350569	0.001580164	0.004	0.000367056	9.057111669
	Sep-01	30		61.4488	5.123965	0.302575	80.28009	0.032957	0.032957	42.53058307	0.01	0.002457	0.004051	0.016265	0.000107642	0.057963	0.000116548	24.66791	0.000964365	0.000380573	0.001705056	0.004	0.000398508	9.859361543
	Oct-01	31		63.30855	5.248693	0.326068	84.56693	0.034613	0.034613	46.95852832	0.01	0.002707	0.004437	0.017351	0.000118187	0.061634	0.000127658	26.7572	0.00102021	0.00041174	0.001884789	0.004	0.00043771	10.26254118
	Nov-01	30		64.1564	5.29722	0.343659	87.45716	0.035697	0.035697	50.62140249	0.01	0.002913	0.004757	0.018114	0.000126719	0.064215	0.000136206	28.34643	0.001056751	0.000436479	0.002033254	0.004	0.000468672	10.49803002
	Dec-01	31		65.94049	5.376848	0.364799	90.8323	0.036493	0.036493	53.74076007	0.01	0.003098	0.005106	0.018861	0.000134423	0.067006	0.000148015	30.33809	0.001094815	0.000455883	0.002146046	0.004	0.000503442	10.83046585
2	Jan-02	31	1E	67.33521	5.450092	0.384551	94.63569	0.038214	0.038214	57.85952425	0.01	0.003336	0.005414	0.019947	0.00014446	0.070398	0.000160008	32.49285	0.001150423	0.000484324	0.002309389	0.004	0.000540431	11.14709647
	Feb-02	28		68.33157	5.526707	0.400954	98.12323	0.040509	0.040509	61.45378476	0.01	0.003547	0.005679	0.021326	0.000154259	0.074283	0.0001692	34.28849	0.001230398	0.000510212	0.002490131	0.004	0.000572742	11.41479698
	Mar-02	31		69.49525	5.60916	0.418779	101.8043	0.042781	0.042781	65.19681312	0.01	0.003762	0.005924	0.022701	0.000164144	0.078199	0.000178999	36.1722	0.001309025	0.000537262	0.002668639	0.004	0.000606639	11.71433453
	Apr-02	30		79.24993	5.487356	0.446067	113.6846	0.046614	0.046614	66.0554103	0.01	0.003858	0.005909	0.024853	0.00017181	0.082851	0.000178627	37.32414	0.001454037	0.000585409	0.002765351	0.004	0.000620525	13.54485824
	May-02	31		81.19909	5.515659	0.462119	117.3938	0.048205	0.048205	68.58121369	0.01	0.004011	0.006095	0.025882	0.000178969	0.085755	0.000186616	38.87006	0.001513684	0.000606987	0.002879729	0.004	0.000646464	13.94539648
	Jun-02	30		84.0175	5.584893	0.482601	122.1282	0.049811	0.049811	71.7789667	0.01	0.004203	0.006368	0.026902	0.000187373	0.088913	0.000196284	40.73866	0.001569444	0.000634417	0.003006118	0.004	0.000677594	14.48436482
	Jul-02	31		89.64307	5.47224	0.499441	128.9785	0.051572	0.051572	72.53643934	0.01	0.004271	0.006378	0.027917	0.000191815	0.091058	0.000196602	41.45544	0.001635265	0.000664069	0.003053151	0.004	0.000686763	15.55032447
	Aug-02	31		92.29176	5.483193	0.515021	133.1264	0.052987	0.052987	74.66293825	0.01	0.004402	0.006532	0.028797	0.000197952	0.093496	0.000202456	42.7242	0.001686138	0.000686694	0.003144996	0.004	0.000707824	16.06955001
	Sep-02	30		93.39816	5.566662	0.531919	135.6895	0.053618	0.053618	77.77804962	0.01	0.004583	0.006841	0.029331	0.000204994	0.09568	0.000213894	44.58797	0.001708241	0.000704409	0.003244909	0.004	0.000739096	16.2710788
	Oct-02	31		94.6392	5.666038	0.550748	138.6729	0.054416	0.054416	81.49203534	0.01	0.004794	0.007171	0.02992	0.000213097	0.09808	0.000225628	46.55716	0.00173129	0.000727038	0.003365203	0.004	0.000773296	16.51509353
	Nov-02	30		94.89901	5.73259	0.563322	140.5185	0.055357	0.055357	84.39863688	0.01	0.004956	0.007406	0.030547	0.000219765	0.100217	0.000233698	47.94801	0.0017614	0.000744005	0.003479942	0.004	0.000799034	16.61040091
	Dec-02	31		95.29264	5.80112	0.575901	142.292	0.056202	0.056202	86.94150272	0.01	0.005101	0.007622	0.031166	0.00022578	0.102343	0.000242464	49.3952	0.001792578	0.000757753	0.003577685	0.004	0.000824563	16.70825042
3	Jan-03	31	1E	95.22683	5.846767	0.585671	143.784	0.057298	0.057298	89.58549554	0.01	0.005254	0.007784	0.031847	0.000232051	0.104426	0.000251851	50.92002	0.001826309	0.000771855	0.003678373	0.004	0.000849462	16.73233763
	Feb-03	28		94.41573	5.853973	0.589412	144.1339	0.058161	0.058161	91.24602679	0.01	0.00535	0.007888	0.032373	0.000236306	0.105847	0.000257121	51.77896	0.001854699	0.000779355	0.003758465	0.004	0.000864378	16.63366913
	Mar-03	31		93.14757	5.831739	0.590702	143.7981	0.058739	0.058739	92.50305678	0.01	0.005419	0.007918	0.03274	0.000239287	0.106728	0.000261112	52.37638	0.001873466	0.000783538	0.00381757	0.004	0.000875346	16.46262742
	Apr-03	30		102.6669	5.597802	0.600124	152.9479	0.06075	0.06075	89.14516581	0.01	0.005279	0.007579	0.033734	0.000236778	0.107737	0.000249928	51.58867	0.001956656	0.000806432	0.003726122	0.004	0.000852648	18.16148573
	May-03	31		102.6731	5.651367	0.610334	153.9405	0.061051	0.061051	91.35254837	0.01	0.005409	0.007779	0.034059	0.00024158	0.109155	0.00026061	53.16528	0.001967555	0.000814543	0.003786474	0.004	0.00087722	18.14782484
	Jun-03	30		104.8211	5.67301	0.623637	157.1347	0.061793	0.061793	93.25889598	0.01	0.005528	0.007946	0.034558	0.000246458	0.110789	0.000268114	54.51267	0.001991982	0.000831327	0.003842566	0.004	0.000897606	18.52975651
	Jul-03	31		106.8554	5.673362	0.6353	160.0154	0.062334	0.062334	94.80721942	0.01	0.005625	0.008071	0.034938	0.000250381	0.112027	0.000274436	55.65136	0.00200964	0.000846071	0.00388186	0.004	0.000914551	18.89273292
	Aug-03	31		107.7883	5.75308	0.649703	162.3506	0.063105	0.063105	97.68466139	0.01	0.005792	0.008311	0.035483	0.000256849	0.114083	0.000285173	57.39736	0.00203298	0.000862577	0.003972485	0.004	0.000943201	19.06353863
	Sep-03	30		108.4447	5.819274	0.662003	164.129	0.063603	0.063603	100.1076677	0.01	0.005935	0.008538	0.035893	0.000262284	0.115759	0.000295387	58.99731	0.002049115	0.00087482	0.004044065	0.004	0.000968792	19.17075376
	Oct-03	31		108.1375	5.819993	0.665884	164.6424	0.064126	0.064126	101.3629188	0.01	0.006003	0.008594	0.036213	0.000265177	0.116642	0.000298524	59.54002	0.002065061	0.000882013	0.004097364	0.004	0.000979498	19.15942376
	Nov-03	30		107.7324	5.891129	0.673592	165.532	0.065093	0.065093	103.5689302	0.01	0.006125	0.008747	0.036811	0.000270369	0.118533	0.000305246	60.64885	0.002096466	0.000892485	0.004192712	0.004	0.000999961	19.12395687
	Dec-03	31		107.8557	5.957231	0.683386	166.6821	0.06563	0.06563	105.6672283	0.01	0.006246	0.008924	0.037233	0.000275096	0.120132	0.000314241	62.02976	0.002115281	0.000901473	0.00426053	0.004	0.001022646	19.14416099
4	Jan-04	31	1E	107.0147	5.979004	0.687112	166.8007	0.066192	0.066192	107.3703183	0.01	0.006343	0.009003	0.037577	0.000278823	0.121201	0.000321651	63.11132	0.002129488	0.000907072	0.004316484	0.004	0.001039321	19.00853009
	Feb-04	28		106.3411	6.011151	0.690332	167.0446	0.066903	0.066903	108.8459881	0.01	0.006432	0.009106	0.037999	0.000282554	0.122452	0.000327772	64.041	0.002151317	0.000912378	0.004379016	0.004	0.00105388	18.89939276
	Mar-04	31		105.72	6.042511	0.694274	167.3334	0.067557	0.067557	110.3910105	0.01	0.00652	0.00918	0.038396	0.000286242	0.123653	0.00033438	65.02407	0.002170787	0.000918186	0.004436871	0.004	0.001069278	18.80083769
	Apr-04	30		108.9994	6.019254	0.701493	170.9876	0.068671	0.068671	110.2936629	0.01	0.006535	0.00915	0.038994	0.000287965	0.124937	0.000335694	65.52373	0.002212009	0.000930134	0.004441317	0.004	0.001072841	19.36705605
	May-04	31		110.289	6.152512	0.718411	173.8119	0.069792	0.069792	113.503138	0.01	0.00673	0.009429	0.039764	0.000295724	0.127771	0.000351358	67.96438	0.002249072	0.000946444	0.004538297	0.004	0.001109109	19.55016473
	Jun-04	30		111.6437	6.149824	0.723681	175.7029	0.070502	0.070502	114.1234107	0.01	0.006775	0.009459	0.040162	0.000298097	0.12877	0.000354362	68.56028	0.002273298	0.000955187	0.004564556	0.004	0.001116838	19.78973961
	Jul-04	31		112.7116	6.212253	0.731609	177.8401	0.071852	0.071852	115.5793572	0.01	0.006864	0.009532	0.040922	0.000302582	0.13086	0.000359859	69.5747	0.002319461	0.00096713	0.004636345	0.004	0.001132544	19.98953821
	Aug-04	31		114.7119	6.106567	0.727333	179.4545	0.07253	0.07253	113.6064399	0.01	0.006762	0.009298	0.041175	0.000299965	0.13064	0.000351376	68.54393	0.002346789	0.000969116	0.004596002	0.004	0.001114252	20.37543925
	Sep-04	30		113.8374	6.027043	0.720233	178.0984	0.072166	0.072166	112.4076729	0.01	0.006697	0.009181	0.040967	0.000297561	0.129716	0.000348731	68.01852	0.002337698	0.000960612	0.004555986	0.004	0.001104392	20.21989779
	Oct-04	31		113.0818	6.067178	0.725631	178.1619	0.072375	0.072375	114.2396998	0.01	0.0068	0.009315	0.041155	0.000301377	0.130608	0.000356471	69.11221	0.002341372	0.000966324	0.004610005	0.004	0.001122316	20.08562188
	Nov-04	30		112.8537	6.123808	0.733779	178.9375	0.072749	0.072749	116.4487613	0.01	0.006926	0.009498	0.04144	0.000306178	0.131855	0.000365324	70.43288	0.002350039	0.000975666	0.004677145	0.004	0.001143865	20.04161981
	Dec-04	31		112.242	6.148634	0.738169	178.7839	0.072623	0.072623	117.7488612	0.01	0.007003	0.009613	0.041471	0.000308744	0.132331	0.000373019	71.45699	0.002344923	0.000977415	0.004701508	0.004	0.001159091	19.90785941

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G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
5	Jan-05	31	1E	112.1747	6.252429	0.743479	183.0941	0.075014	0.075014	122.6844468	0.01	0.007202	0.009805	0.04202	0.000313075	0.134998	0.000379941	72.5489	0.002356724	0.00100227	0.004754181	0.004	0.001307614	19.77317775
	Feb-05	28		111.3951	6.306468	0.743143	185.4168	0.076665	0.076665	125.8875309	0.01	0.007323	0.009929	0.042329	0.000315332	0.13659	0.000382805	72.97157	0.002361474	0.001016727	0.004786712	0.004	0.001413941	19.54851796
	Mar-05	31		111.1933	6.388642	0.746905	188.5251	0.078546	0.078546	129.602796	0.01	0.007474	0.010068	0.042798	0.000318863	0.13872	0.000388339	73.83003	0.002374547	0.001035119	0.004832246	0.004	0.001524792	19.42186606
	Apr-05	30		113.8074	6.208763	0.735227	190.9399	0.078882	0.078882	126.7397019	0.01	0.007291	0.009733	0.042482	0.000311071	0.137078	0.000373091	71.70365	0.002365071	0.001034034	0.004688115	0.004	0.001543479	19.82786889
	May-05	31		114.3502	6.34648	0.74634	195.0142	0.080863	0.080863	131.425795	0.01	0.007507	0.009998	0.043129	0.00031721	0.140039	0.000384813	73.51066	0.002385516	0.001057079	0.004760686	0.004	0.001660218	19.80815131
	Jun-05	30		117.2764	6.203065	0.74081	197.7996	0.081084	0.081084	129.4484868	0.01	0.007385	0.009777	0.042892	0.000311976	0.138858	0.000374187	72.1026	0.002377281	0.001060602	0.004651266	0.004	0.001674349	20.27835153
	Jul-05	31		119.481	6.227848	0.747003	201.8574	0.08223	0.08223	131.2412446	0.01	0.007459	0.009852	0.043154	0.000313214	0.140128	0.000378114	72.79255	0.002384599	0.001075289	0.004632507	0.004	0.001749383	20.55480322
	Aug-05	31		120.5164	6.324034	0.758416	205.7757	0.083646	0.083646	135.2843343	0.01	0.007651	0.010098	0.043582	0.0003186	0.142364	0.000388483	74.40899	0.002392879	0.001097386	0.004686553	0.004	0.001846069	20.63889285
	Sep-05	30		120.5404	6.390604	0.765362	208.164	0.084625	0.084625	138.6219886	0.01	0.007804	0.010302	0.043818	0.000322778	0.143883	0.000396265	75.56777	0.002391785	0.001113519	0.004733411	0.004	0.001924765	20.57216668
	Oct-05	31		119.9637	6.354768	0.76162	208.3631	0.084826	0.084826	139.1241581	0.01	0.007808	0.010266	0.043684	0.000321997	0.143602	0.000394303	75.22078	0.002379503	0.001116122	0.004718695	0.004	0.001955132	20.45209751
	Nov-05	30		119.812	6.452232	0.769287	210.7668	0.086148	0.086148	142.7113955	0.01	0.007976	0.010482	0.04412	0.000327063	0.145658	0.000402794	76.51528	0.002391667	0.001133035	0.004788268	0.004	0.002034655	20.36334063
	Dec-05	31		119.5076	6.509826	0.774265	212.5181	0.086782	0.086782	145.5885673	0.01	0.008104	0.010654	0.044187	0.000329837	0.146754	0.000410966	77.6228	0.00238039	0.001143494	0.004805059	0.004	0.002113286	20.2119279
6	Jan-06	31	1E	118.7284	6.54857	0.776186	213.4395	0.087442	0.087442	147.836886	0.01	0.0082	0.010758	0.044299	0.000332191	0.14762	0.000415476	78.23124	0.002376424	0.001152175	0.004835053	0.004	0.002170286	20.03052294
	Feb-06	28		118.285	6.601249	0.778748	214.6618	0.088303	0.088303	149.9623976	0.01	0.008296	0.010894	0.044545	0.000334977	0.148812	0.000419839	78.87475	0.002383071	0.001161259	0.004875777	0.004	0.002223555	19.90646499
	Mar-06	31		117.697	6.646898	0.780656	215.6802	0.089091	0.089091	151.9836718	0.01	0.008382	0.010981	0.044742	0.000337263	0.149831	0.000423901	79.43995	0.00238643	0.001169485	0.004906933	0.004	0.002276523	19.76018406
	Apr-06	30		120.5038	6.56848	0.778622	217.9873	0.089418	0.089418	150.0520261	0.01	0.00828	0.010812	0.044776	0.000333789	0.149401	0.000416688	78.55643	0.002397865	0.001170877	0.004834231	0.004	0.002271005	20.22556342
	May-06	31		119.9836	6.526555	0.773214	217.5969	0.089398	0.089398	149.6152547	0.01	0.008241	0.010728	0.04461	0.000331849	0.148848	0.000413596	78.01568	0.002388217	0.001167968	0.004802313	0.004	0.002283137	20.11569
	Jun-06	30		120.6682	6.541823	0.775702	219.305	0.089937	0.089937	150.6998283	0.01	0.008287	0.010785	0.044715	0.000332769	0.149474	0.000416092	78.40122	0.002389397	0.001174917	0.004799034	0.004	0.002323746	20.17739639
	Jul-06	31		122.657	6.480806	0.774796	221.0738	0.089936	0.089936	149.6102212	0.01	0.008226	0.010686	0.04458	0.000329991	0.148951	0.000412838	77.97234	0.002384047	0.001175551	0.004727797	0.004	0.002333254	20.47242224
	Aug-06	31		123.7414	6.453873	0.77475	222.4191	0.090274	0.090274	149.4217808	0.01	0.008209	0.010636	0.044632	0.000329316	0.148997	0.000410602	77.72023	0.002388459	0.001179741	0.004708196	0.004	0.00234513	20.64665595
	Sep-06	30		123.1335	6.469164	0.77502	222.7754	0.090601	0.090601	150.6620185	0.01	0.008261	0.010698	0.044658	0.000330597	0.149383	0.000412683	77.97856	0.002384084	0.001184395	0.004725462	0.004	0.002377743	20.51433269
	Oct-06	31		122.6087	6.409971	0.770045	222.0636	0.09027	0.09027	150.0643463	0.01	0.008218	0.010617	0.04439	0.000328784	0.14848	0.000408841	77.34217	0.002368454	0.0011818	0.004698187	0.004	0.002375693	20.43121892
	Nov-06	30		121.4887	6.458886	0.772789	222.5088	0.09068	0.09068	152.4769393	0.01	0.008328	0.01077	0.044437	0.00033173	0.149281	0.000414862	78.13241	0.002359528	0.001189443	0.004737398	0.004	0.002427996	20.19045039
	Dec-06	31		121.0569	6.507633	0.777586	223.7061	0.090941	0.090941	155.0166703	0.01	0.008444	0.010941	0.044385	0.000334202	0.15002	0.00042316	79.22105	0.002341613	0.001197302	0.004747834	0.004	0.002493869	20.02285982
7	Jan-07	31	1E	120.4306	6.544854	0.780905	224.5019	0.091297	0.091297	157.1995954	0.01	0.008543	0.011069	0.044408	0.000336756	0.150699	0.000428779	79.974	0.002331763	0.001205444	0.004775106	0.004	0.002543174	19.86701533
	Feb-07	28		119.7033	6.575413	0.781988	224.8359	0.091643	0.091643	158.7054902	0.01	0.008612	0.011183	0.044463	0.000338675	0.151273	0.000432264	80.43236	0.002328271	0.001210247	0.004802197	0.004	0.00257863	19.70503567
	Mar-07	31		119.5246	6.637732	0.78674	226.2244	0.092406	0.092406	160.9469445	0.01	0.008716	0.01131	0.044707	0.000341798	0.152513	0.00043818	81.29512	0.002333822	0.001220143	0.004841267	0.004	0.002629613	19.62652936
	Apr-07	30		125.2746	6.464916	0.782969	229.1701	0.092182	0.092182	155.346027	0.01	0.00845	0.010919	0.04467	0.000334017	0.150875	0.000421275	79.21493	0.002358891	0.001214974	0.004699183	0.004	0.002548849	20.66487727
	May-07	31		125.3158	6.565967	0.790738	231.3103	0.093098	0.093098	158.4268758	0.01	0.008596	0.011125	0.044956	0.000337889	0.152636	0.000431855	80.7114	0.002362161	0.001226139	0.004732566	0.004	0.002626852	20.5639675
	Jun-07	30		125.9711	6.637514	0.798662	233.6995	0.093926	0.093926	160.989799	0.01	0.008722	0.011305	0.045233	0.000341607	0.154128	0.000439595	81.88527	0.002367996	0.00123925	0.004768682	0.004	0.002686582	20.60680387
	Jul-07	31		126.8027	6.675923	0.802674	235.4408	0.094691	0.094691	162.0256575	0.01	0.008771	0.011352	0.045534	0.000343371	0.155163	0.000442007	82.32607	0.002383823	0.001247304	0.00478864	0.004	0.002715181	20.72358282
	Aug-07	31		128.2184	6.545152	0.792941	234.6459	0.094248	0.094248	157.8343799	0.01	0.008561	0.011019	0.045384	0.000337486	0.153457	0.00042725	80.29901	0.002395688	0.001236377	0.004715411	0.004	0.00264062	21.05515142
	Sep-07	30		127.5676	6.620481	0.796622	235.5059	0.094887	0.094887	160.0171217	0.01	0.008663	0.011167	0.045579	0.000340206	0.154672	0.000434369	81.26296	0.002397897	0.001242255	0.004746542	0.004	0.002695359	20.87020111
	Oct-07	31		126.505	6.616424	0.794707	234.8274	0.094855	0.094855	160.5620883	0.01	0.00868	0.011175	0.045492	0.000340635	0.154546	0.000434505	81.2	0.002389604	0.001242722	0.004758442	0.004	0.002706926	20.68845729
	Nov-07	30		124.1003	6.615207	0.789393	232.7494	0.094651	0.094651	161.0774242	0.01	0.008693	0.011185	0.045324	0.000340821	0.154196	0.000434305	80.99096	0.002376284	0.001238554	0.004778787	0.004	0.002715401	20.28174548
	Dec-07	31		123.087	6.651235	0.790356	232.7192	0.094725	0.094725	162.5856459	0.01	0.008757	0.011279	0.045244	0.000341966	0.154555	0.000439678	81.61912	0.002362375	0.001239853	0.0047826	0.004	0.002757915	20.04057454
8	Jan-08	31	1E	122.8876	6.719016	0.796157	234.1204	0.095428	0.095428	165.0341279	0.01	0.008874	0.011431	0.045478	0.000345542	0.155837	0.000446519	82.61468	0.002366223	0.001250489	0.004827305	0.004	0.002809461	19.95911754
	Feb-08	28		122.1125	6.751503	0.7967	234.1328	0.095749	0.095749	166.2726716	0.01	0.008936	0.011542	0.045563	0.000347508	0.156401	0.00044956	82.99939	0.00236694	0.001254462	0.004861883	0.004	0.002833938	19.78266258
	Mar-08	31		121.8888	6.819087	0.800784	235.1963	0.096523	0.096523	168.2707622	0.01	0.009036	0.011675	0.045851	0.000350754	0.157684	0.000455336	83.81894	0.002377754	0.001263682	0.004910386	0.004	0.002874441	19.67375282
	Apr-08	30		127.5655	6.644811	0.796186	237.5116	0.09614	0.09614	162.1885592	0.01	0.008758	0.011284	0.045817	0.00034292	0.155896	0.000437777	81.6273	0.002406352	0.001256783	0.004778238	0.004	0.00277212	20.69010007
	May-08	31		126.8877	6.728701	0.800328	238.3499	0.096883	0.096883	164.6528422	0.01	0.008881	0.011461	0.046066	0.000346541	0.157283	0.000445816	82.70224	0.002411951	0.001265468	0.004829124	0.004	0.00282432	20.46776716
	Jun-08	30		128.121	6.615731	0.793426	237.7032	0.096108	0.096108	161.6520797	0.01	0.008741	0.011285	0.045719	0.000342064	0.155583	0.000437052	81.40762	0.002403654	0.001257583	0.004760477	0.004	0.002771152	20.66686858
	Jul-08	31		128.9961	6.753795	0.805577	241.0555	0.097396	0.097396	165.5252883	0.01	0.008938	0.011579	0.046193	0.000347667	0.158093	0.000451234	83.46839	0.002416299	0.001274824	0.004813651	0.004	0.002862222	20.65390644
	Aug-08	31		130.3341	6.820229	0.81371	243.6653	0.098399	0.098399	167.5999667	0.01	0.009054	0.011744	0.046611	0.000351775	0.15971	0.000457265	84.44859	0.002436127	0.001290806	0.004868339	0.004	0.002900132	20.79826682
	Sep-08	30		130.0372	6.928606	0.820118	245.1563	0.099603	0.099603	170.4835552	0.01	0.009205	0.011963	0.047112	0.000357006	0.161754	0.000465492	85.65415	0.002458319	0.001304675	0.004954513	0.004	0.002951555	20.65453775
	Oct-08	31		128.8043	6.964006	0.818513	244.4033	0.100036	0.100036	171.3805668	0.01	0.009253	0.012023	0.047285	0.000358966	0.162334	0.000467004	85.78501	0.002468176	0.001307806	0.005006807	0.004	0.00296	20.39609768
	Nov-08	30		126.4553	6.964519	0.811352	241.8834	0.099963	0.099963	171.3140273	0.01	0.00925	0.012022	0.047231	0.000359168	0.162058	0.000465318	85.35073	0.002467502	0.001303041	0.005043958	0.004	0.00294779	19.96763553
	Dec-08	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
9	Jan-09	31	1E	124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Feb-09	28		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.779305	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Mar-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Apr-09	30		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	May-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Jun-09	30		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Jul-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Aug-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Sep-09	30		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Oct-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Nov-09	30		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.7793055	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035
	Dec-09	31		124.963	6.979112	0.807955	240.5968	0.099822	0.099822	171.77930547	0.01	0.009269	0.012062	0.047097	0.000359165	0.161943	0.000467681	85.48255	0.002456394	0.001299371	0.005047233	0.004	0.00296249	19.63588035

1	Jan-01	31	2E	52.98832	15.47936	0.048311	34.8064	0.034056	0.034056	26.17050273	0.01	0.000938	0.002226	0.002548	9.32819E-06	0.043076	3.54614E-05	7.922838	0.000124717	9.18674E-05	0.000312272	0.004	4.91792E-05	3.659993001
	Feb-01	28		41.90682	11.10256	0.089404	39.32969	0.034303	0.034303	31.69530103	0.01	0.001396	0.002241	0.007425	4.2938E-05	0.044832	3.69856E-05	9.654153	0.000424038	0.000185749	0.000981141	0.004	0.000126933	4.003542644
	Mar-01	31		37.28139	8.37097	0.129903	46.10867	0.036242	0.036242	37.03453087	0.01	0.001798	0.002379	0.011605	7.021E-05	0.048858	4.22867E-05	11.81883	0.00068188	0.000265629	0.001509759	0.004	0.000195413	4.704923251
	Apr-01	30		35.9201	7.076689	0.158603	50.1364	0.035545	0.035545	41.44428359	0.01	0.002091	0.002702	0.012748	8.48873E-05	0.049475	5.07643E-05	13.65288	0.000734675	0.000313508	0.001746992	0.004	0.000240879	5.14577018
	May-01	31		37.67813	6.333112	0.195812	59.37146	0.041276	0.041276	47.01434653	0.01	0.002451	0.002937	0.017042	0.000107344	0.05821	5.86097E-05	16.22488	0.001009224	0.000379625	0.002204407	0.004	0.000300507	6.132645589
	Jun-01	30		40.97544	6.076559	0.230617	69.04737	0.047886	0.047886	52.41421036	0.01	0.002787	0.003174	0.021297	0.000128036	0.067872	6.59966E-05	18.72946	0.001284141	0.000441398	0.002635472	0.004	0.00035495	7.180680722
	Jul-01	31		44.90485	5.877592	0.257423	74.14511	0.046535	0.046535	55.62445207	0.01	0.002986	0.003592	0.020958	0.000134432	0.067752	7.71634E-05	20.64955	0.001241697	0.000471967	0.002666774	0.004	0.000386191	7.920220201
	Aug-01	31		49.44958	5.593391	0.28156	80.85918	0.047992	0.047992	57.40026373	0.01	0.003121	0.003763	0.022248	0.000142124	0.070575	8.28364E-05	22.13049	0.001322192	0.000503825	0.002769275	0.004	0.000411508	8.885061108
	Sep-01	30		54.13037	5.363239	0.30332	85.05209	0.044835	0.044835	58.84893319	0.01	0.003225	0.004117	0.020854	0.000143128	0.067873	9.20244E-05	23.50122	0.001212713	0.000522714	0.002669522	0.004	0.00042859	9.646932258
	Oct-01	31		57.26722	5.346958	0.32562	89.91195	0.045589	0.045589	62.00929393	0.01	0.003415	0.004429	0.021483	0.000150865	0.070047	0.000100554	25.1857	0.001240979	0.000551969	0.00277411	0.004	0.00045807	10.26235447
	Nov-01	30		57.50882	5.318758	0.337896	92.90504	0.048611	0.048611	64.51904057	0.01	0.003563	0.004537	0.023363	0.000159866	0.074492	0.000104205	26.25016	0.001362735	0.000574248	0.002976223	0.004	0.000482354	10.49171114
	Dec-01	31		59.42522	5.353086	0.357464	96.77351	0.049815	0.049815	67.88435944	0.01	0.003754	0.004807	0.024198	0.000168019	0.077163	0.000112422	27.85378	0.001405201	0.000601063	0.003108577	0.004	0.000512336	10.91078788
2	Jan-02	31	2E	57.97508	5.478644	0.364317	100.1805	0.057438	0.057438	70.74819797	0.01	0.003913	0.004682	0.028446	0.000182025	0.086702	0.000110654	28.58354	0.001695604	0.000629011	0.003503972	0.004	0.000538094	11.00351449
	Feb-02	28		59.5543	5.523151	0.380602	103.2425	0.058236	0.058236	73.55423817	0.01	0.004076	0.004944	0.029034	0.000188673	0.088782	0.000118719	30.05113	0.001723258	0.000649647	0.003604951	0.004	0.000564075	11.32231281
	Mar-02	31		61.02391	5.580732	0.397213	106.4855	0.05949	0.05949	76.58978398	0.01	0.004251	0.005191	0.029861	0.000196173	0.091408	0.000126993	31.6001	0.001766777	0.000672086	0.003728192	0.004	0.000591882	11.63934333
	Apr-02	30		66.8149	5.631834	0.42251	114.2684	0.062032	0.062032	79.10437127	0.01	0.004418	0.005393	0.031369	0.00020472	0.095494	0.000133858	33.3613	0.001860126	0.000708071	0.003849618	0.004	0.000619378	12.70929823
	May-02	31		72.18724	5.60487	0.450912	119.9584	0.060164	0.060164	82.28720438	0.01	0.004614	0.005848	0.030559	0.000209603	0.094816	0.000147791	35.59733	0.001783855	0.000736902	0.003822065	0.004	0.000651231	13.56737071
	Jun-02	30		76.18578	5.686504	0.475532	125.8046	0.061476	0.061476	85.86132688	0.01	0.004826	0.006172	0.03139	0.000218291	0.097708	0.000157991	37.60753	0.001824155	0.000769966	0.003937725	0.004	0.000684654	14.29969208
	Jul-02	31		78.14414	5.633855	0.482908	128.9819	0.06347	0.06347	86.20636436	0.01	0.004861	0.00613	0.032589	0.000221948	0.100259	0.000158361	38.06089	0.001906829	0.000782973	0.004012038	0.004	0.000692638	14.7276002
	Aug-02	31		83.74015	5.610476	0.510305	135.3258	0.062731	0.062731	89.16811031	0.01	0.005048	0.006508	0.032363	0.000227698	0.100712	0.000170247	40.15166	0.001873271	0.000814304	0.004019461	0.004	0.000722433	15.66400054
	Sep-02	30		87.78041	5.62625	0.534669	140.5179	0.062554	0.062554	92.44465366	0.01	0.005244	0.006867	0.032425	0.000234332	0.101831	0.000181532	42.13643	0.001859559	0.000843344	0.004070033	0.004	0.000753887	16.36282971
	Oct-02	31		86.06705	5.706687	0.534013	141.1314	0.066401	0.066401	93.61140485	0.01	0.005303	0.006757	0.034523	0.000240561	0.106453	0.000179485	42.25701	0.002004489	0.000852602	0.004266102	0.004	0.000763953	16.23696346
	Nov-02	30		84.80577	5.727879	0.534609	141.2648	0.06833	0.06833	94.52421523	0.01	0.005352	0.006729	0.035634	0.000244473	0.10894	0.000179932	42.51737	0.002079624	0.000857622	0.004378367	0.004	0.000772893	16.1172876
	Dec-02	31		85.18787	5.780552	0.54474	143.1757	0.06972	0.06972	96.6860728	0.01	0.005473	0.006864	0.036488	0.000250206	0.111342	0.000185143	43.53835	0.002129715	0.000872345	0.004488686	0.004	0.000793627	16.2524609
3	Jan-03	31	2E	83.42285	5.822273	0.542899	142.844	0.071993	0.071993	97.35560395	0.01	0.005504	0.006788	0.037758	0.000253844	0.114112	0.000184127	43.58537	0.00221776	0.000875023	0.004610588	0.004	0.000800306	16.05590637
	Feb-03	28		83.30053	5.806675	0.548323	143.3022	0.071977	0.071977	98.530096	0.01	0.005573	0.006903	0.037865	0.000256375	0.114621	0.000189032	44.31728	0.002218974	0.000880015	0.004643621	0.004	0.000813003	16.04869931
	Mar-03	31		83.52702	5.761069	0.555781	143.8142	0.071107	0.071107	99.88017889	0.01	0.005654	0.007067	0.037542	0.000258402	0.114246	0.000196197	45.29078	0.002187864	0.000885134	0.004643196	0.004	0.000827825	16.07210419
	Apr-03	30		89.6778	5.775172	0.580414	151.0012	0.071984	0.071984	101.97922	0.01	0.005799	0.007304	0.038132	0.00026431	0.116288	0.000204998	47.11193	0.002216763	0.000915884	0.004678227	0.004	0.000852701	17.1261504
	May-03	31		95.29421	5.811004	0.611976	158.0444	0.07184	0.07184	106.1781789	0.01	0.006052	0.007752	0.038214	0.000272786	0.117749	0.00022024	49.7821	0.002198735	0.000953982	0.004734226	0.004	0.000893472	18.07928053
	Jun-03	30		98.71216	5.85176	0.631561	162.75	0.072588	0.072588	108.8481007	0.01	0.006215	0.007999	0.038725	0.000279129	0.119663	0.000229565	51.50962	0.002220019	0.000978932	0.004801729	0.004	0.000920557	18.68241802
	Jul-03	31		100.0481	5.899679	0.640094	165.401	0.074364	0.074364	110.2457366	0.01	0.0063	0.008048	0.03972	0.000283858	0.122169	0.000232709	52.3017	0.002283327	0.000993523	0.004892283	0.004	0.000935002	18.97151135
	Aug-03	31		101.8503	5.968842	0.653741	168.7408	0.075883	0.075883	112.6209444	0.01	0.006439	0.008205	0.040602	0.000290155	0.124737	0.000239334	53.62059	0.002333402	0.001013652	0.004994315	0.004	0.000957783	19.32990133
	Sep-03	30		100.2086	5.995093	0.649211	167.9677	0.077578	0.077578	112.6155909	0.01	0.006433	0.008091	0.041516	0.000291803	0.126577	0.000237219	53.41488	0.002399123	0.001011879	0.005070788	0.004	0.000958721	19.12113517
	Oct-03	31		96.79127	5.947629	0.633127	164.4551	0.078475	0.078475	110.7016667	0.01	0.006318	0.007815	0.041981	0.000288962	0.126845	0.000230237	52.23677	0.002442756	0.00099362	0.005081421	0.004	0.000942911	18.58764575
	Nov-03	30		98.21394	5.938553	0.646166	166.4527	0.077864	0.077864	112.770522	0.01	0.006441	0.008047	0.041792	0.000292625	0.127033	0.000239752	53.66926	0.002417252	0.001006059	0.005096809	0.004	0.000964758	18.81098504
	Dec-03	31		97.59964	5.974833	0.649005	166.7518	0.078847	0.078847	113.8286555	0.01	0.006497	0.008077	0.04237	0.000295604	0.128518	0.000242338	54.14648	0.002453118	0.00101083	0.005164711	0.004	0.000975809	18.7497236

SRK Consulting
Project NorthMet
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G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
4	Jan-04	31	2E	94.55573	5.977845	0.636502	163.9883	0.08007	0.08007	112.8322238	0.01	0.006435	0.007893	0.042986	0.000295402	0.129441	0.000237449	53.32594	0.002504675	0.001000202	0.005216492	0.004	0.000965702	18.27222533
	Feb-04	28		94.9227	5.991028	0.643952	164.9834	0.080057	0.080057	114.4433358	0.01	0.006532	0.008059	0.043061	0.000299146	0.130071	0.000244494	54.36482	0.002502054	0.001009136	0.005256115	0.004	0.000981595	18.32017987
	Mar-04	31		94.78446	6.013277	0.648979	165.5626	0.080418	0.080418	115.845813	0.01	0.006615	0.008168	0.043314	0.00030269	0.130988	0.000250229	55.22054	0.00251315	0.001016182	0.005306059	0.004	0.000995238	18.29640152
	Apr-04	30		97.02591	6.112808	0.664007	169.4188	0.082156	0.082156	118.4471146	0.01	0.006771	0.008356	0.044293	0.000310008	0.133914	0.000258212	56.75756	0.002569605	0.001039021	0.005418682	0.004	0.001020122	18.70928284
	May-04	31		100.2384	6.256966	0.688918	174.9149	0.083927	0.083927	122.8809644	0.01	0.007031	0.008715	0.045341	0.000320827	0.137545	0.000272348	59.2945	0.002621276	0.001073501	0.005570131	0.004	0.001061995	19.28831241
	Jun-04	30		96.8487	6.315393	0.670003	172.0594	0.086852	0.086852	120.7846057	0.01	0.006901	0.008339	0.04676	0.000319603	0.139887	0.000260299	57.62636	0.00273588	0.001059377	0.00565712	0.004	0.001041119	18.81009451
	Jul-04	31		99.50966	6.391447	0.688527	176.1094	0.087703	0.087703	123.7677906	0.01	0.007082	0.008604	0.04732	0.000326754	0.142047	0.000271971	59.61199	0.002759476	0.001082562	0.005737742	0.004	0.001071554	19.26031906
	Aug-04	31		98.90892	6.303175	0.680869	174.7223	0.087157	0.087157	122.0474672	0.01	0.006991	0.008459	0.047041	0.000323322	0.140912	0.000269441	59.05808	0.00274763	0.001070681	0.005672165	0.004	0.001059638	19.12867336
	Sep-04	30		102.9218	6.201553	0.701921	178.4792	0.084632	0.084632	124.1961395	0.01	0.007137	0.008816	0.045905	0.000325927	0.139158	0.000285258	61.2871	0.00265188	0.00108697	0.005587663	0.004	0.001087075	19.70090734
	Oct-04	31		104.6356	6.195565	0.713257	180.7185	0.084388	0.084388	125.8505683	0.01	0.00724	0.008987	0.045864	0.000329341	0.139551	0.000293403	62.55101	0.002639223	0.001099378	0.005601079	0.004	0.001105343	19.97174029
	Nov-04	30		103.5606	6.192287	0.709543	179.8448	0.084841	0.084841	125.6766297	0.01	0.007228	0.008927	0.046102	0.00032955	0.139937	0.00029269	62.41218	0.002657368	0.001096204	0.005620721	0.004	0.001104336	19.80475494
	Dec-04	31		102.2214	6.190535	0.705225	178.6901	0.085259	0.085259	125.4587188	0.01	0.007212	0.008858	0.046325	0.000329583	0.140285	0.000291814	62.22624	0.002674914	0.00109177	0.005639934	0.004	0.001103383	19.59421975
5	Jan-05	31	2E	99.84668	6.189428	0.694386	176.2961	0.085941	0.085941	124.4441922	0.01	0.007149	0.008705	0.046639	0.000328712	0.140593	0.000287414	61.45528	0.002704579	0.00108197	0.005663939	0.004	0.001093001	19.20778151
	Feb-05	28		99.14057	6.169728	0.693205	176.0108	0.085751	0.085751	125.0574115	0.01	0.007176	0.008752	0.046464	0.000329174	0.140379	0.000290126	61.70807	0.002689083	0.001082063	0.005656225	0.004	0.00111449	19.04069316
	Mar-05	31		99.81299	6.200163	0.701571	178.1967	0.086112	0.086112	127.6357875	0.01	0.007307	0.008944	0.04653	0.000333106	0.141297	0.000298261	62.90723	0.002679968	0.00109643	0.005686868	0.004	0.001166614	19.09690662
	Apr-05	30		99.90505	6.165261	0.69823	178.8472	0.086338	0.086338	127.6611969	0.01	0.007293	0.008904	0.046436	0.000331765	0.141129	0.000297458	62.71065	0.002672612	0.001096622	0.005649602	0.004	0.001198042	19.05261868
	May-05	31		106.1685	6.314251	0.738622	189.2953	0.087933	0.087933	135.6038871	0.01	0.007726	0.009563	0.04711	0.000346085	0.145063	0.000321887	66.83144	0.002677018	0.001155886	0.005779113	0.004	0.001323939	20.03416052
	Jun-05	30		105.4073	6.259947	0.728268	188.7138	0.088236	0.088236	134.4472598	0.01	0.007641	0.009398	0.047009	0.000342312	0.144505	0.000316111	65.85871	0.002675519	0.001148192	0.005722304	0.004	0.001343977	19.85675191
	Jul-05	31		110.5878	6.303443	0.755373	196.7632	0.08887	0.08887	139.6145018	0.01	0.007915	0.009828	0.047103	0.000350062	0.146355	0.000332216	68.52605	0.00265258	0.001188906	0.005748956	0.004	0.001448984	20.62919502
	Aug-05	31		112.7268	6.3807	0.766637	201.2535	0.090627	0.090627	142.5563308	0.01	0.008058	0.009985	0.047776	0.000355071	0.148742	0.000337865	69.62921	0.002684753	0.001212487	0.005811371	0.004	0.001516916	20.96040264
	Sep-05	30		111.0371	6.391573	0.756028	200.2148	0.091798	0.091798	141.9065762	0.01	0.007997	0.009819	0.048157	0.000353232	0.149343	0.000331577	68.66944	0.002716135	0.001206435	0.005819181	0.004	0.001533885	20.67232342
	Oct-05	31		108.9957	6.302976	0.741695	197.8582	0.091196	0.091196	140.338101	0.01	0.007885	0.009638	0.047604	0.000347663	0.147644	0.000325636	67.47791	0.002684406	0.001190683	0.005729742	0.004	0.001548236	20.26095568
	Nov-05	30		111.4749	6.320333	0.757611	202.61	0.091316	0.091316	144.3201634	0.01	0.008083	0.009956	0.047409	0.00035235	0.148453	0.000337856	69.32816	0.002647592	0.001215971	0.005731553	0.004	0.001639282	20.57073768
	Dec-05	31		109.759	6.33753	0.74976	201.6643	0.092232	0.092232	144.277277	0.01	0.008056	0.009852	0.047688	0.000351448	0.149006	0.000334038	68.70851	0.002668626	0.001212137	0.005746426	0.004	0.001661017	20.27475034
6	Jan-06	31	2E	106.7196	6.327526	0.733678	198.5858	0.092838	0.092838	142.7494	0.01	0.007949	0.009633	0.047831	0.000348194	0.148807	0.0003259	67.32189	0.002688638	0.001197283	0.005741087	0.004	0.001658327	19.75954838
	Feb-06	28		106.711	6.357856	0.736684	199.9977	0.093421	0.093421	144.6149184	0.01	0.008033	0.009746	0.047938	0.000350489	0.149616	0.000329984	67.90339	0.002686714	0.001206689	0.005763366	0.004	0.001708061	19.7036428
	Mar-06	31		105.9208	6.386776	0.735313	200.3542	0.094131	0.094131	145.7540923	0.01	0.008075	0.009775	0.048117	0.000351667	0.150341	0.000331208	68.03801	0.002694118	0.00121069	0.0057856	0.004	0.001745617	19.53400434
	Apr-06	30		107.4622	6.485069	0.745013	204.0627	0.096003	0.096003	148.4571897	0.01	0.00821	0.009922	0.048905	0.00035696	0.152924	0.00033631	69.04918	0.002736518	0.001231559	0.005866509	0.004	0.001802024	19.77763121
	May-06	31		109.556	6.499625	0.756824	207.946	0.096244	0.096244	151.4000386	0.01	0.008355	0.010151	0.048806	0.000360448	0.153655	0.000345283	70.41547	0.00271265	0.001251248	0.005864796	0.004	0.001874551	20.03888788
	Jun-06	30		112.482	6.593622	0.774839	213.6035	0.09778	0.09778	155.5949924	0.01	0.008571	0.010447	0.049389	0.000367677	0.156247	0.000356046	72.28875	0.002731566	0.001282521	0.005940075	0.004	0.001956884	20.4813249
	Jul-06	31		112.3346	6.596625	0.771565	213.8673	0.098415	0.098415	155.3841119	0.01	0.008548	0.010377	0.049594	0.000367054	0.156647	0.000353392	71.91612	0.002747695	0.001282407	0.005939545	0.004	0.001970266	20.44771265
	Aug-06	31		113.0918	6.581531	0.772545	215.1734	0.098609	0.098609	155.7900076	0.01	0.00856	0.010385	0.049549	0.000366822	0.156715	0.000353938	71.99518	0.002741902	0.001286638	0.005917106	0.004	0.001997733	20.53388235
	Sep-06	30		114.3364	6.542322	0.777003	217.1056	0.098176	0.098176	156.9135256	0.01	0.008609	0.010483	0.049155	0.0003669	0.156237	0.000357989	72.52296	0.002706558	0.001294167	0.005871086	0.004	0.002040748	20.66479144
	Oct-06	31		112.9794	6.411756	0.765035	214.5447	0.096519	0.096519	154.8177866	0.01	0.008483	0.010333	0.048187	0.000360552	0.153483	0.000353144	71.44416	0.002647514	0.001276429	0.005748085	0.004	0.002034232	20.36840959
	Nov-06	30		115.0433	6.371465	0.776479	217.9392	0.095746	0.095746	157.5366061	0.01	0.008617	0.010581	0.047571	0.000362621	0.152986	0.000362838	72.79183	0.002587325	0.001293216	0.005702159	0.004	0.002104953	20.6014548
	Dec-06	31		113.8436	6.361934	0.770926	216.8817	0.095907	0.095907	157.2099969	0.01	0.008586	0.01051	0.047568	0.000361506	0.152839	0.000360134	72.30839	0.002589489	0.001288717	0.005698647	0.004	0.002110648	20.39579516
7	Jan-07	31	2E	110.4692	6.338051	0.752641	212.46	0.096068	0.096068	154.480297	0.01	0.008428	0.010229	0.047642	0.00035713	0.152113	0.000349484	70.5466	0.002611397	0.001267004	0.005689361	0.004	0.002070455	19.86687668
	Feb-07	28		109.6019	6.335102	0.749921	211.9696	0.096097	0.096097	154.808986	0.01	0.008435	0.010239	0.04756	0.000357053	0.152026	0.00034969	70.47366	0.002604424	0.001265958	0.00568786	0.004	0.002087274	19.69106277
	Mar-07	31		109.2949	6.375886	0.751745	212.7358	0.096782	0.096782	156.1678284	0.01	0.008496	0.010305	0.047799	0.00035927	0.15295	0.000352151	70.84729	0.002615077	0.001272798	0.005724602	0.004	0.002118243	19.61888909
	Apr-07	30		110.3417	6.453577	0.755904	214.8943	0.098467	0.098467	157.0955722	0.01	0.008544	0.010322	0.0486	0.000362369	0.15503	0.000352208	71.10808	0.002668334	0.001284072	0.005792187	0.004	0.002136414	19.81938358
	May-07	31		116.2509	6.566143	0.790488	224.8824	0.099947	0.099947	164.1772922	0.01	0.008917	0.010887	0.049081	0.000374012	0.158347	0.000373234	74.61707	0.002663634	0.001337472	0.005875061	0.004	0.00227268	20.70336913
	Jun-07	30		114.3221	6.663188	0.780128	222.9416	0.102192	0.102192	162.5344308	0.01	0.008827	0.010643	0.050301	0.000374318	0.160486	0.000363113	73.3456	0.002762534	0.001329784	0.00597592	0.004	0.002232728	20.49803762
	Jul-07	31		113.748	6.732227	0.777152	222.8494	0.103691	0.103691	162.303705	0.01	0.00881	0.010553	0.051058	0.000375479	0.162088	0.000359481	72.96011	0.00281935	0.00133022	0.00603794	0.004	0.002228151	20.44845634
	Aug-07	31		112.2383	6.633665	0.763734	219.7641	0.102495	0.102495	159.4555611	0.01	0.008652	0.01034	0.05043	0.000369165	0.159893	0.000352379	71.63202	0.002789182	0.001309167	0.005939749	0.004	0.002198359	20.16639077
	Sep-07	30		117.1378	6.66762	0.790787	227.5704	0.1027	0.1027	164.8676031	0.01	0.008934	0.010807	0.050274	0.000376581	0.161324	0.000370388	74.46101	0.002747068	0.001348388	0.00594588	0.004	0.002315355	20.85219113
	Oct-07	31		113.6904	6.58352	0.768868	221.908	0.101844	0.101844	160.6048496	0.01	0.0087	0.010448	0.049909	0.000368945	0.159201	0.000357255	72.22979	0.002744703	0.001316554	0.005876433	0.004	0.002249298	20.30953262
	Nov-07	30		113.0888	6.486383	0.764469	220.7043	0.100221	0.100221	160.0015501	0.01	0.008658	0.010441	0.048983	0.000365327	0.157021	0.000357919	72.01039	0.002680682	0.001307635	0.005779042	0.004	0.002261389	20.12587043
	Dec-07	31		113.8388	6.486951	0.770946	222.4675	0.10006	0.10006	161.8229698	0.01	0.008745	0.010586	0.048777	0.00036722	0.157149	0.000363773	72.82326	0.002655959	0.001317571	0.005772558	0.004	0.002306516	20.19162492

SRK Consulting
Project NorthMet
Number 1UP005.001
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G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
8	Jan-08	31	2E	111.4517	6.498444	0.757195	218.9701	0.10051	0.10051	160.2382441	0.01	0.008687	0.010521	0.049018	0.000366416	0.157168	0.000358597	71.79759	0.00268709	0.001308414	0.005827092	0.004	0.002262	19.64581263
	Feb-08	28		109.8203	6.489014	0.748227	216.6242	0.100424	0.100424	159.4579378	0.01	0.008664	0.010529	0.048943	0.000365705	0.156767	0.000356871	71.27681	0.002689493	0.001302481	0.005846881	0.004	0.002242002	19.23017144
	Mar-08	31		109.777	6.538841	0.750279	217.3075	0.101116	0.101116	161.0483703	0.01	0.008764	0.010702	0.049199	0.000369237	0.157831	0.000361659	71.88614	0.002702568	0.001313598	0.005912413	0.004	0.002263392	19.07130463
	Apr-08	30		110.1999	6.606682	0.751037	218.1603	0.102458	0.102458	161.6127029	0.01	0.008812	0.010766	0.049857	0.000372244	0.159488	0.00036221	72.04484	0.002749723	0.001322652	0.005991721	0.004	0.002262799	19.06116564
	May-08	31		116.3174	6.728973	0.785699	228.2817	0.104026	0.104026	169.1036708	0.01	0.009226	0.011429	0.050348	0.000385057	0.162991	0.000385794	75.82129	0.002745439	0.00138037	0.006095331	0.004	0.002400654	19.85361143
	Jun-08	30		113.9004	6.695772	0.767957	223.9298	0.104034	0.104034	165.5529716	0.01	0.009051	0.011162	0.050451	0.0003804	0.162121	0.000374496	73.98968	0.002774454	0.001358737	0.006088348	0.004	0.002330394	19.44115342
	Jul-08	31		119.8545	6.855789	0.80242	234.0616	0.106308	0.106308	172.9742446	0.01	0.009461	0.011788	0.051342	0.00039415	0.166468	0.00039641	77.6299	0.002799854	0.001417451	0.006230158	0.004	0.002460619	20.24984248
	Aug-08	31		114.867	6.854077	0.772104	226.1416	0.107076	0.107076	166.9935913	0.01	0.009155	0.011262	0.051986	0.000387247	0.16597	0.000375089	74.3661	0.002882193	0.001378995	0.006265061	0.004	0.002332268	19.52598828
	Sep-08	30		115.1923	6.903322	0.774023	227.0041	0.107913	0.107913	167.7920024	0.01	0.009206	0.011335	0.052373	0.000389569	0.167111	0.000377045	74.68527	0.002907413	0.00138628	0.006313986	0.004	0.00234363	19.51600502
	Oct-08	31		112.5571	6.852205	0.757995	222.6644	0.107297	0.107297	164.8506026	0.01	0.009053	0.011115	0.052122	0.000384588	0.165661	0.000368717	73.19275	0.00290671	0.001363974	0.00627687	0.004	0.002292564	19.05460027
	Nov-08	30		111.3089	6.768706	0.750353	220.4209	0.105825	0.105825	163.7193646	0.01	0.008992	0.011084	0.051321	0.000380779	0.163597	0.000368073	72.74093	0.002855429	0.001351467	0.006197572	0.004	0.002286864	18.74346365
	Dec-08	31		111.8294	6.757081	0.755024	221.5606	0.105333	0.105333	165.3303359	0.01	0.009079	0.011261	0.050948	0.000382253	0.163325	0.000374811	73.55934	0.00282065	0.001359527	0.006183559	0.004	0.002325831	18.69729241
9	Jan-09	31	2E	117.1357	6.816208	0.780604	230.4416	0.102684	0.102684	168.7226514	0.01	0.009161	0.011567	0.049089	0.000370138	0.162613	0.000421775	79.49609	0.002642109	0.00132513	0.005608006	0.004	0.002670624	18.97389023
	Feb-09	28		116.5187	6.767126	0.783436	230.7396	0.102839	0.102839	169.8066709	0.01	0.009205	0.01158	0.049156	0.000371772	0.162785	0.000423574	79.73029	0.00264211	0.001330419	0.005633585	0.004	0.002699205	18.8836711
	Mar-09	31		116.0134	6.688562	0.784763	230.7375	0.102698	0.102698	170.2278502	0.01	0.009214	0.011532	0.049086	0.000372055	0.162436	0.000423703	79.69638	0.002635463	0.001332675	0.005634504	0.004	0.002718118	18.82059621
	Apr-09	30		116.2992	6.666081	0.79334	232.6504	0.103212	0.103212	172.5492556	0.01	0.009324	0.011638	0.049295	0.000375891	0.163308	0.000429074	80.52944	0.002639074	0.001347269	0.005682255	0.004	0.002768391	18.86256635
	May-09	31		112.3647	6.52673	0.772636	226.5368	0.102067	0.102067	168.2609386	0.01	0.009082	0.011227	0.048873	0.000368169	0.160792	0.000415508	78.24488	0.002632398	0.001314182	0.005613675	0.004	0.002700332	18.30389446
	Jun-09	30		113.0866	6.484477	0.782157	228.7572	0.102209	0.102209	170.6106114	0.01	0.009196	0.011358	0.048873	0.000371628	0.161231	0.000421589	79.15578	0.002620523	0.001329652	0.005640887	0.004	0.002752764	18.40081688
	Jul-09	31		115.5956	6.600039	0.805477	235.0692	0.104846	0.104846	176.0780195	0.01	0.009477	0.011668	0.050112	0.000382597	0.165386	0.000434591	81.46674	0.002681534	0.001369414	0.005801525	0.004	0.002851982	18.81157774
	Aug-09	31		111.3461	6.513596	0.780874	228.222	0.104368	0.104368	170.7364682	0.01	0.009185	0.011168	0.050093	0.000374237	0.163556	0.000417317	78.73472	0.002709523	0.001330711	0.005753886	0.004	0.002757903	18.24191012
	Sep-09	30		110.0731	6.395564	0.776634	226.52	0.103173	0.103173	170.1135609	0.01	0.00914	0.011096	0.049483	0.000371772	0.161771	0.000415698	78.27356	0.00266936	0.00132328	0.005703396	0.004	0.002758535	18.02580983
	Oct-09	31		110.9493	6.373987	0.788231	229.2381	0.103495	0.103495	173.0832509	0.01	0.009285	0.011272	0.049554	0.000376292	0.162567	0.000423572	79.4647	0.002659297	0.00134231	0.005744241	0.004	0.002820839	18.13781291
	Nov-09	30		109.3064	6.270901	0.781712	226.9524	0.102447	0.102447	172.0003795	0.01	0.009217	0.011162	0.049042	0.000373344	0.160892	0.000420418	78.78583	0.002628716	0.001331501	0.005698446	0.004	0.002810815	17.87393668
	Dec-09	31		109.9788	6.248506	0.791658	229.2431	0.102715	0.102715	174.5882608	0.01	0.009343	0.011311	0.0491	0.000377256	0.161558	0.000427215	79.80747	0.002619625	0.001347867	0.005734237	0.004	0.002865581	17.95770327
10	Jan-10	31	Combined	108.3513	6.215057	0.788097	229.2884	0.102731	0.102731	172.7602791	0.01	0.009251	0.011093	0.049218	0.00037624	0.16102	0.000429363	78.68031	0.002638414	0.001383094	0.005944104	0.004	0.002840681	17.70701802
	Feb-10	28		108.4224	6.177843	0.79552	232.0441	0.102632	0.102632	173.5936486	0.01	0.009299	0.011121	0.049161	0.000378765	0.160881	0.000438854	78.83954	0.002630403	0.001430337	0.00613927	0.004	0.002867239	17.6752656
	Mar-10	31		109.1634	6.171488	0.80835	236.4112	0.103097	0.103097	175.6079738	0.01	0.009407	0.011207	0.049359	0.000383645	0.161619	0.000451908	79.52254	0.002634193	0.001489441	0.006378481	0.004	0.002914746	17.74877483
	Apr-10	30		108.1457	6.087481	0.804563	236.2502	0.102286	0.102286	173.7009248	0.01	0.009311	0.01103	0.049013	0.000381202	0.160068	0.000453242	78.4895	0.002619421	0.001514961	0.00649905	0.004	0.002891356	17.57651816
	May-10	31		110.5789	6.167805	0.829528	244.1113	0.104186	0.104186	178.3798136	0.01	0.009563	0.011293	0.049888	0.00039169	0.163105	0.000473026	80.3931	0.002657941	0.001594874	0.006821272	0.004	0.002983451	17.92142079
	Jun-10	30		111.0178	6.246307	0.83839	247.6506	0.105941	0.105941	179.4880131	0.01	0.009628	0.011285	0.050826	0.000396673	0.165335	0.000480621	80.68189	0.002720093	0.00164239	0.007077241	0.004	0.003004262	18.01446208
	Jul-10	31		108.9717	6.273587	0.827503	245.6749	0.106728	0.106728	176.2797048	0.01	0.009465	0.010959	0.051404	0.000393952	0.16558	0.000474387	79.02748	0.002779114	0.001649618	0.007216922	0.004	0.00294343	17.76336021
	Aug-10	31		109.0514	6.290485	0.832992	248.02	0.107442	0.107442	176.7348135	0.01	0.009493	0.010928	0.051795	0.000396565	0.166396	0.000480516	79.05379	0.00280513	0.001687576	0.007403858	0.004	0.002956423	17.77663192
	Sep-10	30		105.869	6.106752	0.812618	242.5974	0.104705	0.104705	171.7410917	0.01	0.009229	0.010575	0.050512	0.000386705	0.161929	0.000471451	76.67107	0.002739022	0.001670221	0.007341059	0.004	0.002878316	17.25449269
	Oct-10	31		107.8499	6.109937	0.833682	249.0232	0.105286	0.105286	175.7282467	0.01	0.009441	0.010825	0.050689	0.000394414	0.163206	0.000489778	78.29847	0.002730821	0.001738724	0.007578518	0.004	0.002963	17.49508489
	Nov-10	30		107.252	6.073564	0.834182	249.6273	0.105013	0.105013	175.3609676	0.01	0.009422	0.010763	0.05057	0.000394389	0.162659	0.000493317	77.975	0.002724331	0.001762284	0.007687324	0.004	0.002963453	17.38235808
	Dec-10	31		105.8202	6.065632	0.82773	248.3715	0.105104	0.105104	173.5161908	0.01	0.009327	0.010573	0.050707	0.000392464	0.16232	0.000490796	76.98738	0.002744196	0.001769552	0.007772214	0.004	0.002931263	17.18127751
11	Jan-11	31	Combined	105.6038	6.047887	0.830809	249.7282	0.105135	0.105135	173.7523999	0.01	0.00934	0.010547	0.050725	0.000393753	0.162259	0.000495847	76.9464	0.002744446	0.001797332	0.007895744	0.004	0.002941907	17.12962157
	Feb-11	28		105.5642	6.034304	0.834559	251.2314	0.1052	0.1052	174.1909969	0.01	0.009365	0.010556	0.050754	0.000395355	0.162308	0.000501027	77.0177	0.002744523	0.001823929	0.008011597	0.004	0.002955582	17.10376886
	Mar-11	31		105.479	6.012289	0.837448	252.5227	0.105158	0.105158	174.3446436	0.01	0.009375	0.010531	0.050734	0.000396365	0.162154	0.000505542	76.9676	0.00274238	0.001849167	0.008118858	0.004	0.002964668	17.07427353
	Apr-11	30		107.4537	6.10683	0.857439	258.7791	0.107098	0.107098	178.0626595	0.01	0.009574	0.01073	0.051672	0.000405249	0.165155	0.00052028	78.48322	0.00279085	0.001910341	0.008381851	0.004	0.003035327	17.37601391
	May-11	31		104.0097	6.054597	0.832105	251.9139	0.106161	0.106161	172.2486907	0.01	0.009268	0.010278	0.051404	0.000395737	0.162927	0.000502857	75.7983	0.002802577	0.001866571	0.008288911	0.004	0.002926121	16.90843569
	Jun-11	30		106.9167	6.18038	0.859198	260.2489	0.108678	0.108678	177.4507481	0.01	0.009546	0.010577	0.0526	0.000407592	0.166911	0.000522215	77.981	0.002861715	0.001942896	0.00860503	0.004	0.003023756	17.34982409
	Jul-11	31		104.6466	6.107301	0.841747	255.5585	0.107518	0.107518	173.2352549	0.01	0.009324	0.01026	0.052145	0.000400249	0.164682	0.000510767	76.0497	0.002851255	0.001915025	0.008529987	0.004	0.002948575	17.0302371
	Aug-11	31		106.761	6.170812	0.86223	261.854	0.108974	0.108974	177.051538	0.01	0.009527	0.010478	0.052812	0.000408644	0.167089	0.000526336	77.63088	0.002879476	0.00197627	0.008769204	0.004	0.003023952	17.33582793
	Sep-11	30		105.2582	6.115074	0.852576	259.2605	0.108119	0.108119	174.6931369	0.01	0.009402	0.010299	0.052451	0.00040449	0.165566	0.000521056	76.50559	0.002866144	0.001965591	0.008746642	0.004	0.002984258	17.10917606
	Oct-11	31		106.3253	6.136516	0.86494	263.0823	0.108776	0.108776	176.9192131	0.01	0.00952	0.010418	0.052742	0.00040937	0.166702	0.000531422	77.38431	0.002875575	0.002007423	0.008909025	0.004	0.003030925	17.2513255
	Nov-11	30		104.6281	6.132606	0.853511	260.0568	0.108672	0.108672	174.2976169	0.01	0.009382	0.010203	0.052799	0.000405561	0.166091	0.00052354	76.14223	0.00289384	0.001989914	0.008893344	0.004	0.002980287	17.02721049
	Dec-11	31		104.6161	6.123808	0.856531	261.1133	0.108703	0.108703	174.6402606	0.01	0.0094	0.010201	0.052817	0.000406641	0.166134	0.000527164	76.20446	0.002893581	0.002008115	0.008970876	0.004	0.002990957	17.0144998

SRK Consulting
Project NorthMet
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G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
12	Jan-12	31	Combined	104.5105	6.117288	0.858344	260.3393	0.108426	0.108426	174.2476256	0.01	0.009375	0.010225	0.052856	0.000407692	0.166162	0.000521553	75.63224	0.002903662	0.002003761	0.008985472	0.004	0.002968673	17.09633977
	Feb-12	28		104.3204	6.128721	0.858821	259.4106	0.10843	0.10843	173.683296	0.01	0.009344	0.010237	0.053034	0.000408611	0.166478	0.000515334	75.03617	0.002924267	0.001996783	0.00900049	0.004	0.002942805	17.16527255
	Mar-12	31		103.1227	6.094963	0.851144	255.9846	0.107603	0.107603	171.4315717	0.01	0.009222	0.010132	0.052824	0.000405824	0.165462	0.000503604	73.69097	0.002925734	0.001970144	0.008935201	0.004	0.002886466	17.08198484
	Apr-12	30		104.6867	6.183906	0.865354	259.1715	0.109043	0.109043	173.5453571	0.01	0.009334	0.0103	0.053692	0.000412766	0.168043	0.000505716	74.26113	0.002982056	0.001994973	0.009079736	0.004	0.00290762	17.43316373
	May-12	31		103.0247	6.25446	0.852328	254.7149	0.109799	0.109799	170.3081613	0.01	0.009164	0.010075	0.054356	0.000409886	0.168803	0.000488244	72.54207	0.003051113	0.001953807	0.009027759	0.004	0.002823102	17.34031059
	Jun-12	30		103.1476	6.320136	0.854135	254.4744	0.11071	0.11071	170.0234352	0.01	0.009149	0.010071	0.055	0.000412051	0.170259	0.000482232	72.11665	0.003103218	0.001949459	0.009074778	0.004	0.002799356	17.47820153
	Jul-12	31		103.6843	6.407612	0.859609	255.2174	0.111984	0.111984	170.3877485	0.01	0.009168	0.010102	0.055831	0.000415693	0.172321	0.000478104	71.96496	0.003165582	0.001952448	0.00915362	0.004	0.002787325	17.68773517
	Aug-12	31		98.54485	6.122563	0.81448	241.2491	0.106831	0.106831	160.517314	0.01	0.008639	0.00952	0.053456	0.000394605	0.164378	0.000445324	67.57469	0.003047745	0.001839776	0.00868507	0.004	0.002608081	16.92863164
	Sep-12	30		99.99996	6.102452	0.829139	244.2369	0.106547	0.106547	162.7530242	0.01	0.008753	0.009734	0.053375	0.000399615	0.164796	0.000450881	68.22336	0.003034619	0.001868121	0.008776492	0.004	0.002644142	17.19120627
	Oct-12	31		101.0765	6.118041	0.840707	246.4531	0.10677	0.10677	164.4210407	0.01	0.008837	0.009886	0.053588	0.000404189	0.165745	0.000453498	68.62599	0.003045482	0.001888379	0.008865034	0.004	0.002665532	17.42101625
	Nov-12	30		98.88264	6.090031	0.823481	240.8914	0.105961	0.105961	160.5861376	0.01	0.008633	0.009642	0.053366	0.000397853	0.164296	0.000437613	66.7846	0.003051923	0.001841604	0.008732523	0.004	0.002584073	17.16384927
	Dec-12	31		98.71451	6.075523	0.824123	240.1582	0.105589	0.105589	160.1915088	0.01	0.008608	0.009647	0.053295	0.000398027	0.164065	0.000433773	66.35922	0.003052256	0.00183706	0.008730309	0.004	0.002568712	17.19715288
13	Jan-13	31	Combined	97.97082	6.025975	0.816911	238.6109	0.104843	0.104843	159.5150775	0.01	0.008609	0.009723	0.052847	0.000397197	0.16288	0.000436253	66.14103	0.003028179	0.00184122	0.008754056	0.004	0.002546826	16.82160171
	Feb-13	28		98.38857	6.011402	0.819729	239.7985	0.104751	0.104751	160.68832	0.01	0.008705	0.009925	0.052719	0.000400294	0.162912	0.000444038	66.67623	0.003017629	0.001866035	0.008854584	0.004	0.002559123	16.65681129
	Mar-13	31		98.43571	5.993703	0.819363	240.1361	0.104579	0.104579	161.2765767	0.01	0.00877	0.010074	0.052557	0.000402241	0.162709	0.00045	66.97301	0.003007593	0.001884211	0.008934054	0.004	0.002559942	16.42894664
	Apr-13	30		99.81594	6.029009	0.827099	242.9852	0.105405	0.105405	163.168874	0.01	0.008907	0.010304	0.052905	0.000407616	0.164028	0.000459288	67.8569	0.003027526	0.001918596	0.009082863	0.004	0.002582053	16.44194949
	May-13	31		98.9366	6.065429	0.818002	241.1313	0.105966	0.105966	162.0027717	0.01	0.008877	0.010279	0.053185	0.000407007	0.164399	0.000457292	67.44498	0.003056987	0.001912079	0.00911245	0.004	0.002546245	16.15017966
	Jun-13	30		98.18919	6.011771	0.809228	239.1064	0.10514	0.10514	160.6798687	0.01	0.008834	0.01028	0.052726	0.000404642	0.163024	0.000456466	66.97102	0.003033742	0.001905975	0.009089069	0.004	0.002516185	15.85212766
	Jul-13	31		101.8352	6.184776	0.839148	248.1873	0.108343	0.108343	167.1889745	0.01	0.009219	0.010808	0.054245	0.000420826	0.16822	0.000479457	69.71726	0.003116152	0.001993624	0.009480185	0.004	0.002614002	16.21801342
	Aug-13	31		100.2958	6.182732	0.824024	244.5294	0.108217	0.108217	164.6556022	0.01	0.009108	0.010674	0.054198	0.000416821	0.167482	0.000472703	68.73848	0.003127685	0.00196919	0.009426758	0.004	0.002557812	15.8651607
	Sep-13	30		100.2143	6.164111	0.822662	244.4708	0.107989	0.107989	164.863087	0.01	0.009144	0.010771	0.05403	0.000417746	0.167165	0.00047636	68.86531	0.003117849	0.001979785	0.009473637	0.004	0.0025547	15.68152681
	Oct-13	31		100.539	6.160141	0.825028	245.3737	0.108009	0.108009	165.7712573	0.01	0.009219	0.010919	0.053987	0.000420235	0.167325	0.000482308	69.27807	0.003114017	0.001998875	0.009554871	0.004	0.002563505	15.55071654
	Nov-13	30		99.39205	6.152094	0.814671	242.772	0.107782	0.107782	164.1060439	0.01	0.009149	0.010849	0.053882	0.00041759	0.166683	0.000478359	68.62822	0.003117066	0.00198346	0.009523572	0.004	0.0025259	15.26597419
	Dec-13	31		99.62532	6.149667	0.81633	243.4582	0.107811	0.107811	164.8357421	0.01	0.009211	0.010974	0.053852	0.000419677	0.166823	0.000483362	68.96319	0.003114593	0.00199945	0.009593722	0.004	0.00253208	15.14123122
14	Jan-14	31	Combined	99.58272	6.132032	0.815801	243.732	0.107625	0.107625	165.1723963	0.01	0.00925	0.011051	0.053688	0.000420227	0.166527	0.000488241	69.19916	0.00310288	0.002012147	0.009641731	0.004	0.002536499	14.96427782
	Feb-14	28		99.73448	6.114831	0.816872	244.4018	0.107453	0.107453	165.7810823	0.01	0.009302	0.011158	0.053533	0.000421354	0.166329	0.000493733	69.53736	0.003090457	0.002027422	0.009697238	0.004	0.002546162	14.82821695
	Mar-14	31		99.91652	6.097573	0.818321	245.1804	0.107293	0.107293	166.4808666	0.01	0.009359	0.011263	0.053378	0.000422607	0.166145	0.000499752	69.91508	0.003077617	0.002044349	0.009757554	0.004	0.002557442	14.68805829
	Apr-14	30		100.1738	6.078931	0.81945	245.894	0.10712	0.10712	167.0097051	0.01	0.009407	0.011355	0.053225	0.000423557	0.165927	0.000504934	70.23075	0.003065507	0.002059048	0.009807214	0.004	0.002565962	14.57568578
	May-14	31		100.9434	6.176033	0.825136	248.1666	0.108804	0.108804	168.5405196	0.01	0.00951	0.011469	0.054048	0.000428215	0.168219	0.00051112	70.96216	0.00311877	0.002082801	0.009947988	0.004	0.002583703	14.59360617
	Jun-14	30		99.49078	6.113605	0.811073	244.5268	0.107729	0.107729	165.859909	0.01	0.009375	0.011302	0.053503	0.000422183	0.166276	0.000504424	69.93931	0.003092657	0.002055058	0.009834549	0.004	0.002537639	14.30558722
	Jul-14	31		102.0848	6.209894	0.832198	251.0804	0.109632	0.109632	170.4984093	0.01	0.009652	0.011686	0.054358	0.00043296	0.169438	0.0005228	71.96458	0.00313439	0.002121018	0.010109746	0.004	0.002612081	14.51055664
	Aug-14	31		102.5476	6.28228	0.835284	252.5134	0.110885	0.110885	171.4369823	0.01	0.00972	0.011757	0.05497	0.000436057	0.171091	0.000526938	72.43835	0.003175016	0.002136854	0.010209966	0.004	0.002621317	14.49841316
	Sep-14	30		102.2422	6.292683	0.832346	252.0449	0.111067	0.111067	171.1288555	0.01	0.009716	0.011753	0.055043	0.000435731	0.171181	0.000527478	72.37644	0.003182563	0.002137193	0.010227389	0.004	0.002612882	14.37286263
	Oct-14	31		100.1686	6.153248	0.81482	247.0512	0.108695	0.108695	167.7645398	0.01	0.009537	0.011554	0.053825	0.000427045	0.167498	0.000519492	71.02238	0.00311114	0.002100836	0.010045406	0.004	0.002560829	13.97705963
	Nov-14	30		100.5036	6.14787	0.81769	248.1208	0.10871	0.10871	168.6394014	0.01	0.009599	0.01166	0.053775	0.00042879	0.167606	0.000525003	71.44487	0.003104673	0.002117481	0.010106951	0.004	0.002575216	13.9050753
	Dec-14	31		100.5429	6.129595	0.818127	248.3846	0.10846	0.10846	168.9470308	0.01	0.009628	0.011721	0.053609	0.000429202	0.167307	0.000528539	71.6274	0.003092515	0.002126629	0.010136803	0.004	0.002580429	13.79607173
15	Jan-15	31	Combined	100.9407	6.13026	0.823209	248.6083	0.107983	0.107983	169.1970835	0.01	0.009681	0.011881	0.053747	0.000430616	0.167771	0.000525642	71.35345	0.003103617	0.00213068	0.010208879	0.004	0.002573841	13.814416
	Feb-15	28		100.5341	6.120926	0.821119	246.9553	0.107308	0.107308	168.0684961	0.01	0.009651	0.011919	0.053769	0.000429084	0.167612	0.00051786	70.55085	0.003112228	0.002115753	0.010207173	0.004	0.002544483	13.75760308
	Mar-15	31		100.2411	6.113099	0.820206	245.5577	0.106648	0.106648	167.135622	0.01	0.009634	0.011967	0.053814	0.000427953	0.167549	0.000510654	69.80782	0.003121598	0.002103595	0.010217176	0.004	0.002518054	13.71109792
	Apr-15	30		98.99606	6.109968	0.809953	241.7498	0.106005	0.106005	164.2912978	0.01	0.009503	0.01183	0.053875	0.000423058	0.16703	0.000496009	68.32465	0.003140134	0.002065023	0.010133962	0.004	0.002458238	13.60196296
	May-15	31		99.3306	6.137516	0.813832	241.8933	0.106013	0.106013	164.3785266	0.01	0.009541	0.011942	0.054225	0.000424448	0.167931	0.000492282	68.04121	0.003166688	0.00206586	0.010200653	0.004	0.002448225	13.64343576
	Jun-15	30		99.87708	6.194572	0.818849	242.5295	0.106534	0.106534	164.7118596	0.01	0.009591	0.012057	0.054825	0.00042677	0.169473	0.000488977	67.88973	0.00320994	0.002069169	0.010287314	0.004	0.002440967	13.73372879
	Jul-15	31		98.24161	6.124334	0.804686	237.6338	0.104882	0.104882	161.1041712	0.01	0.009412	0.011865	0.054304	0.00041922	0.167402	0.000473543	66.14436	0.003189875	0.002022877	0.010133573	0.004	0.002374155	13.54876267
	Aug-15	31		100.3505	6.220202	0.823542	242.1197	0.106154	0.106154	164.2591754	0.01	0.009627	0.01222	0.055268	0.000427781	0.170513	0.000480329	67.1336	0.003247105	0.002063876	0.010370807	0.004	0.002413645	13.7967032
	Sep-15	30		95.94128	6.071292	0.786543	230.9532	0.103102	0.103102	156.3059487	0.01	0.009185	0.011637	0.053976	0.000410046	0.165511	0.000450634	63.67743	0.003189983	0.001959126	0.009966079	0.004	0.002278368	13.29907696
	Oct-15	31		97.39129	6.075378	0.800442	233.8363	0.102895	0.102895	158.5021857	0.01	0.009344	0.011948	0.054143	0.00041523	0.16653	0.000456145	64.27406	0.003194438	0.001990077	0.010119909	0.004	0.002308178	13.41189581
	Nov-15	30		96.58102	6.036936	0.794878	231.462	0.101881	0.101881	156.9112643	0.01	0.009275	0.011908	0.053873	0.000412006	0.165544	0.000448435	63.38362	0.003183402	0.001969553	0.010066696	0.004	0.002276088	13.29817911
	Dec-15	31		96.8474	6.034359	0.798434	231.556	0.101484	0.101484	157.0582634	0.01	0.009309	0.012018	0.053936	0.000412864	0.165792	0.000446476	63.18768	0.003189076	0.001971961	0.0101129	0.004	0.002271508	13.30445318

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Project NorthMet
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G:\PolyMet Mining\1UP005.01_Northmet_project_2004\Water_Quality_Predictions\Operational_Tailings\Model\[PolyMet Water Balance_1E-2E_v27.7.xls]Summary
Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Alkalinity	Chloride	Fluoride	Hardness	Nitrate + Nitrite, as N	Nitrogen, Ammonia as N	Sulfate	Aluminum	Antimony	Arsenic	Barium	Beryllium	Boron	Cadmium	Calcium	Chromium	Cobalt	Copper	Iron	Lead	Magnesium
Fixed Standards				#N/A	230	2	#N/A	#N/A	#N/A	250	0.125	0.031	0.148	2	0.004	0.5	f(H)	#N/A	f(H)	0.005	f(H)	0.3	f(H)	#N/A
16	Jan-16	31	Combined	95.67725	6.03705	0.789179	228.289	0.101119	0.101119	154.7588005	0.01	0.009193	0.011875	0.053979	0.000408846	0.165347	0.000435175	62.05265	0.003203805	0.001939232	0.010030617	0.004	0.002223751	13.19729661
	Feb-16	28		95.50749	6.030708	0.788537	227.3646	0.100705	0.100705	154.1933269	0.01	0.00918	0.011913	0.053974	0.000408231	0.16525	0.0004309	61.62047	0.0032078	0.001931123	0.010030026	0.004	0.002207207	13.16737862
	Mar-16	31		95.737	6.045751	0.7914	227.3668	0.100634	0.100634	154.27661	0.01	0.009206	0.011997	0.054168	0.000409259	0.165776	0.000428403	61.42956	0.003223274	0.001931326	0.010071244	0.004	0.002199839	13.18871245
	Apr-16	30		96.54198	6.103766	0.798097	228.6232	0.101309	0.101309	155.0861427	0.01	0.009275	0.012127	0.054744	0.000412443	0.16738	0.000427731	61.55973	0.003262889	0.001940496	0.010162977	0.004	0.002202355	13.30648576
	May-16	31		96.4154	6.135617	0.797426	227.8527	0.101522	0.101522	154.5254949	0.01	0.009259	0.012127	0.055061	0.00041234	0.168014	0.000422665	61.15013	0.003289549	0.00193118	0.010174125	0.004	0.002183611	13.31599426
	Jun-16	30		97.03358	6.193719	0.802686	228.7729	0.102205	0.102205	155.1105141	0.01	0.009312	0.012228	0.055625	0.000415006	0.169525	0.000421319	61.20507	0.003329074	0.001937083	0.010252355	0.004	0.002182802	13.41516311
	Jul-16	31		97.65193	6.270855	0.807918	229.7531	0.103194	0.103194	155.7078623	0.01	0.009365	0.012314	0.056347	0.000417949	0.171399	0.000419599	61.27152	0.003379735	0.001942412	0.010337318	0.004	0.002180996	13.52949267
	Aug-16	31		95.44873	6.236769	0.788553	224.1551	0.102364	0.102364	151.6052491	0.01	0.00913	0.011969	0.056023	0.000409392	0.169604	0.000403639	59.5502	0.003374694	0.001886505	0.010134038	0.004	0.002108901	13.32213441
	Sep-16	30		95.32555	6.209515	0.788233	223.3808	0.101683	0.101683	151.1624502	0.01	0.009121	0.012009	0.055837	0.000408575	0.169104	0.000400775	59.1998	0.003364824	0.001881113	0.010125898	0.004	0.002097362	13.28260388
	Oct-16	31		95.73559	6.221013	0.792603	223.9208	0.101629	0.101629	151.6390408	0.01	0.009166	0.012117	0.055995	0.000410226	0.16964	0.000400333	59.20508	0.003375724	0.001886995	0.010179473	0.004	0.002098524	13.31698294
	Nov-16	30		95.08318	6.187326	0.787874	222.0484	0.100851	0.100851	150.4205489	0.01	0.009107	0.012072	0.055726	0.000407623	0.168737	0.000395012	58.57477	0.003362927	0.00187087	0.010125819	0.004	0.002075093	13.22476767
	Dec-16	31		95.1057	6.170188	0.789019	221.7039	0.100347	0.100347	150.301994	0.01	0.009116	0.01213	0.055625	0.000407568	0.168514	0.000393222	58.35753	0.003357726	0.001869527	0.010136344	0.004	0.0020687	13.20281629
17	Jan-17	31	Combined	94.1357	6.165149	0.780944	219.2133	0.100056	0.100056	148.660414	0.01	0.009026	0.01202	0.05555	0.00040609	0.167962	0.000385707	57.56223	0.003362491	0.00184741	0.010070866	0.004	0.002034213	13.12461177
	Feb-17	28		94.27098	6.171539	0.782424	219.2014	0.099974	0.099974	148.8111934	0.01	0.009047	0.012102	0.055619	0.000408384	0.168226	0.000384421	57.45318	0.003370128	0.001849783	0.010104013	0.004	0.00202911	13.14658178
	Mar-17	31		94.35075	6.181951	0.783516	219.0698	0.099948	0.099948	148.8795067	0.01	0.009063	0.012164	0.05572	0.000410622	0.168537	0.000382674	57.30299	0.003380508	0.001850945	0.010134517	0.004	0.002022053	13.16793011
	Apr-17	30		95.02854	6.225338	0.788937	220.1653	0.100465	0.100465	149.6999556	0.01	0.009124	0.012289	0.05612	0.000414942	0.169753	0.000382953	57.46547	0.00340928	0.001861646	0.010215156	0.004	0.002025633	13.27435292
	May-17	31		95.05557	6.251543	0.789183	219.8924	0.1007	0.1007	149.5878483	0.01	0.009127	0.012318	0.056345	0.000416926	0.170306	0.00038041	57.27732	0.003429086	0.001859725	0.010238734	0.004	0.002015348	13.30598607
	Jun-17	30		95.86489	6.3163	0.795789	221.3849	0.101569	0.101569	150.6700596	0.01	0.009203	0.012453	0.056927	0.000421991	0.172005	0.000381237	57.55347	0.003469524	0.001873128	0.010339325	0.004	0.002022251	13.43829871
	Jul-17	31		93.57884	6.186869	0.775141	215.5055	0.099369	0.099369	146.509512	0.01	0.008957	0.012131	0.055761	0.000412707	0.168253	0.000368336	55.86986	0.003405516	0.001821188	0.010086552	0.004	0.001957676	13.16580442
	Aug-17	31		94.61259	6.237977	0.784006	217.4876	0.100017	0.100017	148.0034526	0.01	0.009059	0.012317	0.056241	0.000418415	0.169824	0.00037091	56.28715	0.003437004	0.001840821	0.01020465	0.004	0.001972193	13.30337889
	Sep-17	30		94.29034	6.24325	0.781407	216.516	0.099949	0.099949	147.4033011	0.01	0.00903	0.012297	0.056273	0.000418652	0.169788	0.000367463	55.94417	0.003444305	0.00183262	0.010190523	0.004	0.00195676	13.28427884
	Oct-17	31		94.35888	6.249606	0.782391	216.4019	0.099889	0.099889	147.4585516	0.01	0.009042	0.012347	0.056332	0.000420371	0.169995	0.000366206	55.83065	0.00345116	0.001833553	0.010213119	0.004	0.001951602	13.29777054
	Nov-17	30		93.94018	6.223822	0.77928	215.1887	0.099325	0.099325	146.7543646	0.01	0.009007	0.012333	0.056102	0.000419833	0.169323	0.000363152	55.44017	0.003440039	0.001824988	0.010182138	0.004	0.001936772	13.24233302
	Dec-17	31		94.07234	6.215255	0.780955	215.1948	0.099029	0.099029	146.9301949	0.01	0.009027	0.012405	0.056041	0.000421532	0.169281	0.000362688	55.36751	0.00343774	0.00182815	0.010205729	0.004	0.001934725	13.24799541
18	Jan-18	31	Combined	93.21285	6.205676	0.77449	214.0077	0.098728	0.098728	145.8050836	0.01	0.00897	0.012305	0.055954	0.000421411	0.168797	0.000359617	54.85932	0.003436293	0.001820901	0.010192898	0.004	0.001922659	13.17372583
	Feb-18	28		93.46962	6.204365	0.777665	215.1151	0.098542	0.098542	146.4262397	0.01	0.009024	0.01241	0.055985	0.000425215	0.169072	0.000362079	54.97692	0.003437029	0.001836828	0.010275862	0.004	0.001936494	13.19944262
	Mar-18	31		93.74771	6.208037	0.781157	216.3285	0.09843	0.09843	147.1063333	0.01	0.009082	0.01251	0.056062	0.000429319	0.169461	0.000364676	55.10929	0.003440719	0.001853911	0.010365926	0.004	0.001951302	13.23172474
	Apr-18	30		93.94474	6.206523	0.783474	217.2435	0.098259	0.098259	147.5406995	0.01	0.009123	0.012587	0.056091	0.000432641	0.169676	0.000366532	55.16708	0.003441903	0.001867383	0.010436995	0.004	0.001962286	13.25765447
	May-18	31		94.78638	6.247341	0.791538	219.7102	0.098747	0.098747	149.0754788	0.01	0.009233	0.012757	0.056501	0.000439114	0.171068	0.000371202	55.62741	0.003466132	0.00189479	0.010584673	0.004	0.00198812	13.36988255
	Jun-18	30		94.32449	6.217852	0.787587	218.9497	0.098159	0.098159	148.2812617	0.01	0.009196	0.012711	0.05626	0.00043903	0.17033	0.000369529	55.26068	0.003452752	0.001891429	0.010571169	0.004	0.001981124	13.3220043
	Jul-18	31		94.9694	6.290234	0.793281	220.9363	0.099182	0.099182	149.3720343	0.01	0.009273	0.012804	0.056915	0.000444696	0.172165	0.000372094	55.6055	0.003495934	0.001910707	0.010697583	0.004	0.001997924	13.44617234
	Aug-18	31		95.33846	6.341922	0.796756	222.2737	0.09988	0.09988	150.0478824	0.01	0.009325	0.012864	0.057382	0.000449003	0.173455	0.000373674	55.79536	0.003527361	0.001924512	0.010791793	0.004	0.002009201	13.5277853
	Sep-18	30		94.33643	6.28909	0.788727	220.3314	0.098935	0.098935	148.5406975	0.01	0.009241	0.012747	0.056913	0.000446494	0.171988	0.000370028	55.17244	0.003500238	0.001910362	0.01072263	0.004	0.001991637	13.40410259
	Oct-18	31		93.92383	6.215475	0.78633	219.6465	0.097611	0.097611	148.0343712	0.01	0.009223	0.012763	0.056303	0.000446265	0.170477	0.000370133	54.86932	0.003459739	0.001911685	0.010707956	0.004	0.00199105	13.31174148
	Nov-18	30		94.51063	6.198321	0.792528	221.2877	0.097165	0.097165	149.1506739	0.01	0.009307	0.012931	0.056209	0.000450698	0.170604	0.000374504	55.16043	0.003450075	0.001934021	0.01080575	0.004	0.00201273	13.34973568
	Dec-18	31		93.75308	6.188197	0.786514	219.9757	0.096922	0.096922	148.0657303	0.01	0.009246	0.012824	0.056102	0.000449447	0.170076	0.000371375	54.7192	0.003446877	0.001923357	0.010768722	0.004	0.001998978	13.27899561
19	Jan-19	31	Combined	93.65551	6.172259	0.785307	219.2806	0.096578	0.096578	148.0991121	0.01	0.009246	0.012895	0.055902	0.000454059	0.169693	0.000370022	54.53708	0.003439802	0.001924685	0.010773258	0.004	0.001987183	13.29342901
	Feb-19	28		93.81704	6.172747	0.786234	219.2337	0.096499	0.096499	148.5075292	0.01	0.00927	0.013001	0.055859	0.000459302	0.169772	0.000369794	54.51842	0.003441652	0.00193078	0.010805166	0.004	0.001981923	13.33951393
	Mar-19	31		93.72103	6.166013	0.784984	218.5917	0.096313	0.096313	148.5235551	0.01	0.009268	0.013058	0.05574	0.000463638	0.169563	0.000368321	54.35044	0.003439803	0.001931428	0.010810488	0.004	0.001970228	13.3594344
	Apr-19	30		94.74319	6.225948	0.792884	220.5135	0.097176	0.097176	150.2344126	0.01	0.009373	0.013268	0.056233	0.000473012	0.171235	0.000371215	54.8137	0.003475199	0.001954404	0.010937999	0.004	0.001981915	13.53459727
	May-19	31		94.19988	6.288307	0.78693	219.0753	0.098181	0.098181	149.4331796	0.01	0.009313	0.013165	0.056668	0.000475314	0.172053	0.000365844	54.45263	0.003514212	0.001939755	0.010909232	0.004	0.00195483	13.57077374
	Jun-19	30		95.57407	6.414755	0.79765	221.9825	0.100122	0.100122	151.7250192	0.01	0.009451	0.013388	0.057731	0.000486646	0.175187	0.000369428	55.17015	0.003587378	0.001968213	0.011089526	0.004	0.001972489	13.82720563
	Jul-19	31		94.00017	6.371305	0.782575	217.9101	0.099463	0.099463	149.0498496	0.01	0.009277	0.013139	0.057245	0.000482473	0.173375	0.000360208	54.13322	0.003567193	0.001931001	0.010916211	0.004	0.001923729	13.69157273
	Aug-19	31		93.91174	6.331788	0.78105	217.1191	0.098759	0.098759	148.8689023	0.01	0.009266	0.013193	0.056864	0.000485362	0.172513	0.000359061	53.91204	0.003546706	0.001930641	0.010899648	0.004	0.001913033	13.68768369
	Sep-19	30		94.13502	6.318651	0.782727	217.1978	0.09845	0.09845	149.3366439	0.01	0.009295	0.013305	0.056715	0.000490115	0.172363	0.000359575	53.92419	0.00354026	0.001938366	0.01093047	0.004	0.001911275	13.72337108
	Oct-19	31		92.71168	6.20851	0.770411	213.4824	0.096656	0.096656	147.1275254	0.01	0.009156	0.013161	0.055689	0.000486132	0.169439	0.000353362	52.98947	0.003479964	0.001910739	0.01076901	0.004	0.001874649	13.5324968
	Nov-19	30		92.90069	6.210963	0.771765	213.5703	0.096613	0.096613	147.5423555	0.01	0.009181	0.013251	0.055671	0.000490563	0.169568	0.000353507	53.00768	0.003482409	0.001916904	0.010800069	0.004	0.001872045	13.57464605
	Dec-19	31		92.56577	6.185171	0.768739	212.4763	0.096139	0.096139	147.1222563	0.01	0.009153	0.013255	0.055396	0.000492226	0.168868	0.000351534	52.73254	0.003469139	0.001911926	0.010771473	0.004	0.001858597	13.54569079
20	Jan-20	31	Combined	92.07396	6.135853	0.764219	210.6872	0.095289	0.095289	146.8796814	0.01	0.009125	0.013323	0.054865	0.000499447	0.167628	0.000349022	52.41936	0.003443042	0.001910037	0.01076834	0.004	0.001837178	13.53037789
	Feb-20	28		91.9128	6.097221	0.762528	209.6933	0.094598	0.094598	147.097552	0.01	0.00913	0.013442	0.054449	0.000507196	0.166783	0.000348082	52.28814	0.003422509	0.001914533	0.010794471	0.004	0.001824373	13.54547354
	Mar-20	31		92.39584	6.103063	0.766228	210.1441	0.094597	0.094597	148.3917806	0.01	0.009199	0.013653	0.054423	0.000519142	0.167137	0.000349533	52.52452	0.003427062	0.00193307	0.010900432	0.004	0.001823692	13.66164536
	Apr-20	30		92.63718	6.11086	0.766508	209.9159	0.0947	0.0947	148.9182541	0.01	0.009221	0.013766	0.054419	0.000528159	0.167322	0.000348721	52.55312	0.003434371	0.001940758	0.010956504	0.004	0.001813338	13.7674415
	May-20	31		92.81562	6.186383	0.766929	209.963	0.095893	0.095893	149.599512	0.01	0.009246	0.013834	0.054969	0.000537787	0.168806	0.000347204	52.68223	0.003479613	0.001947017	0.011038831	0.004	0.001802459	13.90483583
	Jun-20	30		91.74475	6.149824	0.75659	207.0294	0.095345	0.095345	148.0692697	0.01	0.009139	0.013716	0.054552	0.000538855	0.167444	0.000341109	52.03577	0.00346196	0.00192583	0.010951201	0.004	0.001767249	13.83556761
	Jul-20	31		92.83857	6.195135	0.76512	208.8726	0.095972	0.095972	150.220762	0.01	0.009262	0.013998	0.05489	0.000553104	0.168873	0.000344739	52.60072	0.003488826	0.001955549	0.011118873	0.004	0.001778725	14.03871643
	Aug-20	31		93.53583	6.267371	0.770232	210.0403	0.097071	0.097071	151.7419276	0.01	0.009344	0.014173	0.055439	0.000564978	0.170597	0.000346053	53.0004	0.00353137	0.001974501	0.011252124	0.004	0.001781089	14.21827657
	Sep-20	30		92.6235	6.245537	0.761898	207.6557	0.096738	0.096738	150.5800487	0.01	0.00926	0.014083	0.055156	0.000566433	0.169641	0.000341109	52.4938	0.003521116	0.001957832	0.011189162	0.004	0.001752491	14.1603537
	Oct-20	31		92.75255	6.238135	0.762686	207.4275	0.096542	0.096542	151.1862027	0.01	0.009289	0.014209	0.055019	0.000574684	0.169543	0.000341219	52.53516	0.003517989	0.001967026	0.011244031	0.004	0.001746535	14.21878099
	Nov-20	30		90.64118	6.142768	0.744517	202.4224	0.09507	0.09507	148.018914	0.01	0.009082	0.01392	0.054087	0.000568052	0.166526	0.000331848	51.35423	0.003466114	0.001924053	0.011032507	0.004	0.001696067	13.97614947
	Dec-20	31		91.00656	6.105637	0.74769	202.6192	0.09436	0.09436	149.0470101	0.01	0.00914	0.014125	0.053713	0.000577468	0.166009	0.000333828	51.49906	0.003445402	0.001940877	0.011106601	0.004	0.001697548	14.03257204

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
1	Jan-01	31	1E	0.005312893	3.33254E-07	0.000149	0.208027046	3.6E-05	1.5E-05	0.514499	2.69E-05	0.000635	0.017988	9.489987
	Feb-01	28		0.010129039	6.87263E-07	0.000457	1.105801681	0.000147	2.83E-05	4.515716	5E-05	0.001433	0.055274	21.24701
	Mar-01	31		0.032325032	1.35223E-06	0.000957	1.760765101	0.000242	6.05E-05	7.232725	7.17E-05	0.002239	0.066308	34.87454
	Apr-01	30		0.051615228	2.01698E-06	0.001467	2.158948058	0.000306	8.95E-05	8.676682	9.35E-05	0.002898	0.066308	45.35466
	May-01	31		0.07575041	2.69887E-06	0.001873	2.405889654	0.000356	0.000123	9.358559	0.000114	0.00357	0.066308	57.91099
	Jun-01	30		0.110768359	3.54919E-06	0.002441	2.629374155	0.000409	0.000168	9.95379	0.000129	0.004183	0.066308	70.02501
	Jul-01	31		0.145210528	4.35202E-06	0.003002	2.831233047	0.00046	0.000212	10.45024	0.000145	0.004786	0.066308	80.96066
	Aug-01	31		0.188959027	5.23035E-06	0.00351	2.949363189	0.000503	0.000263	10.61927	0.000152	0.005317	0.066308	94.15932
	Sep-01	30		0.20581146	5.68931E-06	0.003766	3.040426058	0.000528	0.000286	10.70919	0.000165	0.005733	0.066308	102.0895
	Oct-01	31		0.215965985	6.32498E-06	0.004294	3.208357028	0.000558	0.000304	11.08603	0.000183	0.006153	0.066308	108.9589
	Nov-01	30		0.221977193	6.87319E-06	0.004767	3.328725658	0.00058	0.000315	11.30809	0.000198	0.006454	0.066308	113.8911
	Dec-01	31		0.227871837	7.26247E-06	0.005043	3.458409223	0.000604	0.000329	11.54982	0.000217	0.006877	0.066308	120.2259
2	Jan-02	31	1E	0.238408057	7.82417E-06	0.005524	3.591480829	0.000633	0.000347	11.83423	0.000233	0.007328	0.066308	126.9024
	Feb-02	28		0.256155472	8.31579E-06	0.005914	3.691710718	0.000662	0.000371	12.02127	0.000245	0.00772	0.066308	132.4819
	Mar-02	31		0.273375035	8.80923E-06	0.006323	3.798177861	0.000691	0.000395	12.23551	0.000257	0.008132	0.066308	138.4121
	Apr-02	30		0.31145812	9.2626E-06	0.006435	3.805987899	0.000715	0.000436	12.15158	0.000252	0.008465	0.066308	148.8178
	May-02	31		0.324527411	9.61377E-06	0.006688	3.880680184	0.000737	0.000455	12.27413	0.000263	0.008812	0.066308	154.3213
	Jun-02	30		0.335793995	1.00919E-05	0.007042	4.002646872	0.000762	0.000472	12.5437	0.000276	0.009215	0.066308	161.1991
	Jul-02	31		0.352823078	1.04197E-05	0.007187	4.012161884	0.000773	0.000491	12.48786	0.000275	0.009396	0.066308	167.3733
	Aug-02	31		0.364122356	1.07719E-05	0.007434	4.081191452	0.000791	0.000506	12.61464	0.000283	0.009677	0.066308	172.674
	Sep-02	30		0.366149276	1.11606E-05	0.007755	4.209173244	0.000812	0.000515	12.90321	0.0003	0.010063	0.066308	178.1511
	Oct-02	31		0.368077008	1.16532E-05	0.00819	4.358894352	0.000836	0.000523	13.26432	0.000318	0.010457	0.066308	184.066
	Nov-02	30		0.373053221	1.20325E-05	0.008531	4.456591279	0.000854	0.000533	13.4798	0.00033	0.010736	0.066308	187.9267
	Dec-02	31		0.378357284	1.23226E-05	0.00878	4.545691407	0.000873	0.000544	13.67128	0.000342	0.011044	0.066308	191.9383
3	Jan-03	31	1E	0.384572947	1.26131E-05	0.009058	4.619019253	0.000892	0.000555	13.83975	0.000353	0.011375	0.066308	195.8399
	Feb-03	28		0.390572765	1.27975E-05	0.009233	4.646847983	0.000903	0.000565	13.87187	0.000359	0.011561	0.066308	197.5759
	Mar-03	31		0.394536425	1.29082E-05	0.009375	4.650045263	0.00091	0.000571	13.8416	0.000362	0.011689	0.066308	198.3619
	Apr-03	30		0.420450189	1.28186E-05	0.009007	4.525162778	0.000904	0.000593	13.48221	0.000341	0.011624	0.066308	203.3887
	May-03	31		0.420397187	1.30156E-05	0.009189	4.607327344	0.00092	0.000598	13.66985	0.000355	0.011965	0.066308	207.2642
	Jun-03	30		0.424584096	1.32972E-05	0.009394	4.684891403	0.000935	0.000606	13.8521	0.000365	0.012259	0.066308	212.196
	Jul-03	31		0.427396457	1.35335E-05	0.009568	4.746274122	0.000946	0.000613	13.99263	0.000373	0.012506	0.066308	216.5293
	Aug-03	31		0.43021369	1.3874E-05	0.009868	4.859032617	0.000967	0.000621	14.27732	0.000387	0.012875	0.066308	221.5863
	Sep-03	30		0.431431864	1.41424E-05	0.010097	4.95669466	0.000984	0.000628	14.51387	0.000401	0.013217	0.066308	226.0175
	Oct-03	31		0.434597277	1.42966E-05	0.010257	4.980966694	0.000991	0.000633	14.56035	0.000405	0.013326	0.066308	227.3242
	Nov-03	30		0.440667454	1.45337E-05	0.010482	5.048705328	0.001008	0.000643	14.72896	0.000414	0.013562	0.066308	229.9434
	Dec-03	31		0.4430163	1.47317E-05	0.010662	5.127130409	0.001024	0.00065	14.92169	0.000426	0.013863	0.066308	233.4702
4	Jan-04	31	1E	0.445017064	1.48693E-05	0.010827	5.165954771	0.001035	0.000656	15.02572	0.000433	0.014101	0.066308	235.6092
	Feb-04	28		0.449258339	1.50006E-05	0.010959	5.202273279	0.001046	0.000664	15.11138	0.000439	0.014319	0.066308	237.4785
	Mar-04	31		0.45280218	1.5119E-05	0.011101	5.239777255	0.001058	0.000671	15.20798	0.000446	0.014554	0.066308	239.5245
	Apr-04	30		0.463729426	1.51655E-05	0.011052	5.241357145	0.001066	0.000683	15.21528	0.000444	0.014722	0.066308	243.1007
	May-04	31		0.469307267	1.54577E-05	0.011295	5.378816704	0.001095	0.000697	15.58468	0.000463	0.015289	0.066308	249.9406
	Jun-04	30		0.475064912	1.55491E-05	0.01135	5.398260571	0.001103	0.000704	15.63119	0.000465	0.015455	0.066308	252.4125
	Jul-04	31		0.485778658	1.56976E-05	0.011465	5.446426678	0.001119	0.000718	15.76896	0.00047	0.015723	0.066308	255.7645
	Aug-04	31		0.495730434	1.55492E-05	0.011278	5.353786934	0.00111	0.000725	15.52425	0.000456	0.015555	0.066308	254.782
	Sep-04	30		0.494645716	1.5367E-05	0.011133	5.287446624	0.001102	0.000722	15.3258	0.000451	0.015469	0.066308	252.8317
	Oct-04	31		0.493517841	1.55242E-05	0.011322	5.347482134	0.001113	0.000725	15.47541	0.000461	0.015717	0.066308	255.0065
	Nov-04	30		0.493265448	1.57497E-05	0.011556	5.428779146	0.001127	0.000729	15.6819	0.000472	0.016012	0.066308	258.1189
	Dec-04	31		0.490065843	1.58226E-05	0.011655	5.475837274	0.001135	0.000729	15.79342	0.000482	0.016248	0.066308	260.1223

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
5	Jan-05	31	1E	0.489167906	1.59264E-05	0.011965	5.59321688	0.00116	0.00074	17.13285	0.000504	0.01914	0.066308	262.291
	Feb-05	28		0.488078021	1.59486E-05	0.012149	5.654759903	0.001175	0.000747	18.05687	0.000517	0.021243	0.066308	262.4206
	Mar-05	31		0.488508704	1.60132E-05	0.012377	5.741100657	0.001195	0.000756	19.04606	0.000534	0.023414	0.066308	264.0402
	Apr-05	30		0.49001714	1.56127E-05	0.012017	5.602282551	0.001174	0.000753	19.11334	0.000518	0.024153	0.066308	260.4083
	May-05	31		0.490790695	1.57933E-05	0.012317	5.746694881	0.001204	0.000766	20.19717	0.000542	0.026377	0.066308	264.8334
	Jun-05	30		0.491372335	1.55605E-05	0.012089	5.658770378	0.001189	0.000763	20.27123	0.000531	0.026932	0.066308	263.257
	Jul-05	31		0.491516812	1.55435E-05	0.012122	5.713636514	0.001201	0.000769	20.94989	0.000542	0.028501	0.066308	266.1152
	Aug-05	31		0.489655316	1.57528E-05	0.012422	5.846131448	0.001225	0.000777	21.86413	0.000563	0.030334	0.066308	270.4923
	Sep-05	30		0.486179665	1.59226E-05	0.012693	5.947329438	0.001242	0.000781	22.59279	0.000579	0.031815	0.066308	273.1074
	Oct-05	31		0.483026412	1.58685E-05	0.012736	5.9358274	0.00124	0.000779	22.82669	0.00058	0.032465	0.066308	271.748
	Nov-05	30		0.482818277	1.60554E-05	0.013017	6.045040725	0.001261	0.000787	23.56792	0.000597	0.03394	0.066308	274.6109
	Dec-05	31		0.476821185	1.61113E-05	0.013189	6.130519606	0.001275	0.000789	24.27225	0.000614	0.035457	0.066308	276.7497
6	Jan-06	31	1E	0.473814466	1.6177E-05	0.013365	6.185761129	0.001285	0.000791	24.77721	0.000625	0.036542	0.066308	277.5205
	Feb-06	28		0.473645036	1.626E-05	0.013516	6.243972862	0.001297	0.000795	25.25228	0.000635	0.037561	0.066308	278.6147
	Mar-06	31		0.472776802	1.63025E-05	0.013657	6.293367888	0.001308	0.000799	25.72051	0.000645	0.038586	0.066308	279.4222
	Apr-06	30		0.477981258	1.61171E-05	0.013417	6.227919137	0.001299	0.000802	25.64715	0.000635	0.038689	0.066308	279.1341
	May-06	31		0.476233437	1.59765E-05	0.013345	6.191111546	0.001294	0.0008	25.70637	0.000633	0.039021	0.066308	277.3334
	Jun-06	30		0.475477953	1.59714E-05	0.013382	6.22266647	0.001301	0.000802	26.06686	0.000639	0.039864	0.066308	278.5488
	Jul-06	31		0.475115876	1.58074E-05	0.013207	6.186805259	0.001295	0.000801	26.12895	0.000636	0.040216	0.066308	278.6934
	Aug-06	31		0.476749283	1.57621E-05	0.013175	6.174361539	0.001294	0.000803	26.22823	0.000634	0.040532	0.066308	278.7817
	Sep-06	30		0.474580293	1.57944E-05	0.013279	6.202845465	0.001299	0.000803	26.51052	0.00064	0.041165	0.066308	278.8814
	Oct-06	31		0.471480357	1.57177E-05	0.013257	6.165475279	0.00129	0.000799	26.4578	0.000636	0.041185	0.066308	276.9523
	Nov-06	30		0.466799733	1.58212E-05	0.013465	6.234168568	0.001301	0.000799	26.92843	0.000648	0.042147	0.066308	277.9322
	Dec-06	31		0.459220398	1.58762E-05	0.013624	6.315354615	0.001313	0.000798	27.52231	0.000664	0.043406	0.066308	279.9573
7	Jan-07	31	1E	0.454499338	1.5968E-05	0.013811	6.379101896	0.001323	0.000798	27.97197	0.000676	0.044327	0.066308	281.1937
	Feb-07	28		0.452151285	1.60291E-05	0.013931	6.421380806	0.00133	0.000799	28.2839	0.000683	0.044997	0.066308	281.6701
	Mar-07	31		0.451410341	1.61188E-05	0.014096	6.490153916	0.001343	0.000804	28.75666	0.000695	0.045959	0.066308	283.4986
	Apr-07	30		0.463793036	1.58106E-05	0.01356	6.328011988	0.001319	0.000806	28.02315	0.000666	0.04472	0.066308	282.5841
	May-07	31		0.46111967	1.58767E-05	0.013712	6.432155449	0.001339	0.000812	28.73975	0.000685	0.046212	0.066308	285.9007
	Jun-07	30		0.459889275	1.60029E-05	0.013888	6.523094841	0.001355	0.000817	29.30783	0.000699	0.047347	0.066308	289.0043
	Jul-07	31		0.463085135	1.60388E-05	0.013942	6.558100447	0.001364	0.000823	29.58124	0.000704	0.047922	0.066308	290.5842
	Aug-07	31		0.471056134	1.57982E-05	0.013613	6.410868767	0.001341	0.000821	28.87013	0.00068	0.046653	0.066308	286.8936
	Sep-07	30		0.469208823	1.58296E-05	0.013719	6.479163037	0.001355	0.000825	29.35981	0.000693	0.047694	0.066308	288.5364
	Oct-07	31		0.46676449	1.58356E-05	0.013797	6.483677419	0.001355	0.000824	29.44893	0.000695	0.047908	0.066308	287.6314
	Nov-07	30		0.463098935	1.58139E-05	0.013874	6.477678909	0.001353	0.00082	29.48674	0.000696	0.048042	0.066308	285.4364
	Dec-07	31		0.457675281	1.57893E-05	0.01394	6.520457308	0.00136	0.000819	29.85159	0.000707	0.04886	0.066308	286.0105
8	Jan-08	31	1E	0.456209666	1.59097E-05	0.014135	6.599844551	0.001375	0.000823	30.33882	0.000719	0.04981	0.066308	288.1579
	Feb-08	28		0.455254794	1.59664E-05	0.014246	6.633378723	0.001381	0.000825	30.54857	0.000725	0.050312	0.066308	288.3912
	Mar-08	31		0.456149796	1.60438E-05	0.014402	6.692774056	0.001394	0.000831	30.91818	0.000735	0.051152	0.066308	289.9867
	Apr-08	30		0.469936438	1.5745E-05	0.013858	6.515736913	0.001367	0.000832	29.98683	0.000703	0.04956	0.066308	288.7038
	May-08	31		0.468827054	1.58094E-05	0.014028	6.588587328	0.001382	0.000838	30.45087	0.000717	0.050646	0.066308	290.4695
	Jun-08	30		0.469853341	1.5626E-05	0.0138	6.486050127	0.001363	0.000832	29.92764	0.000702	0.049879	0.066308	288.0604
	Jul-08	31		0.468648914	1.57507E-05	0.014007	6.624421779	0.001391	0.000842	30.77818	0.000726	0.051696	0.066308	293.1461
	Aug-08	31		0.471839162	1.59034E-05	0.014199	6.697689487	0.001406	0.00085	31.1518	0.000736	0.052548	0.066308	296.1846
	Sep-08	30		0.474876031	1.60601E-05	0.014441	6.786851943	0.001426	0.00086	31.62863	0.000749	0.053612	0.066308	298.5995
	Oct-08	31		0.476975626	1.60904E-05	0.014561	6.796762293	0.00143	0.000863	31.67917	0.000751	0.053895	0.066308	297.8623
	Nov-08	30		0.477390359	1.60469E-05	0.014615	6.765477492	0.001427	0.000862	31.51197	0.000748	0.053784	0.066308	295.0161
	Dec-08	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
9	Jan-09	31	1E	0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Feb-09	28		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Mar-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Apr-09	30		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	May-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Jun-09	30		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Jul-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Aug-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Sep-09	30		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Oct-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Nov-09	30		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795
	Dec-09	31		0.473931198	1.59587E-05	0.014619	6.764532597	0.001428	0.00086	31.59661	0.000752	0.054182	0.066308	293.9795

1	Jan-01	31	2E	0.005461201	5.67732E-07	0.001522	5.892935149	0.000666	1.28E-05	28.99714	1.83E-05	0.00244	0.066308	34.8194
	Feb-01	28		0.084035362	2.62216E-06	0.002962	4.452691215	0.000562	0.000105	20.98175	3.09E-05	0.00253	0.066308	40.55068
	Mar-01	31		0.15001162	4.21098E-06	0.004049	3.597193731	0.000516	0.000184	16.0001	4.49E-05	0.002839	0.066308	48.83522
	Apr-01	30		0.160575272	5.31743E-06	0.004923	3.30578381	0.000493	0.000202	13.93188	6.4E-05	0.003073	0.066308	55.22309
	May-01	31		0.229355951	6.37468E-06	0.0056	3.112091102	0.000525	0.000282	12.44344	7.48E-05	0.00365	0.066308	65.69827
	Jun-01	30		0.298176875	7.28356E-06	0.006165	3.074666999	0.000574	0.000362	11.81072	8.32E-05	0.004257	0.066308	76.257
	Jul-01	31		0.282797368	7.9607E-06	0.006701	3.194858495	0.000578	0.000352	11.88761	0.000105	0.004573	0.066308	84.08865
	Aug-01	31		0.302000753	8.40307E-06	0.006905	3.174155424	0.00059	0.000377	11.48628	0.000113	0.004906	0.066308	91.75229
	Sep-01	30		0.270051759	8.86741E-06	0.007256	3.281102768	0.000578	0.000348	11.59348	0.000132	0.005093	0.066308	98.30585
	Oct-01	31		0.27404779	9.42612E-06	0.007683	3.398294893	0.000596	0.000357	11.78442	0.000147	0.005419	0.066308	105.0392
	Nov-01	30		0.304401936	9.76868E-06	0.007913	3.397379247	0.000621	0.000392	11.602	0.000151	0.005683	0.066308	108.6375
	Dec-01	31		0.31221127	1.02858E-05	0.008341	3.510290357	0.000642	0.000406	11.81195	0.000165	0.006001	0.066308	114.3612
2	Jan-02	31	2E	0.388481721	1.0526E-05	0.008452	3.433863693	0.000693	0.000488	11.47277	0.000156	0.006305	0.066308	116.5626
	Feb-02	28		0.392703344	1.0945E-05	0.008791	3.540017059	0.000711	0.000497	11.6882	0.000168	0.006599	0.066308	121.5344
	Mar-02	31		0.401051206	1.13787E-05	0.009146	3.644539312	0.000732	0.000511	11.90206	0.000181	0.006919	0.066308	126.7018
	Apr-02	30		0.423045085	1.18548E-05	0.009403	3.749575174	0.000761	0.000538	12.13032	0.000189	0.007335	0.066308	135.4969
	May-02	31		0.398179279	1.24835E-05	0.009912	3.957666421	0.000768	0.000519	12.63957	0.000214	0.007724	0.066308	144.6042
	Jun-02	30		0.404927263	1.30724E-05	0.010362	4.118040998	0.000794	0.000533	13.03919	0.000229	0.008137	0.066308	152.6308
	Jul-02	31		0.426709028	1.31469E-05	0.010329	4.083983173	0.000806	0.000556	12.86588	0.000227	0.00829	0.066308	155.5223
	Aug-02	31		0.413774192	1.37429E-05	0.01078	4.259726848	0.000818	0.000549	13.28147	0.000247	0.008681	0.066308	164.5897
	Sep-02	30		0.406110628	1.43215E-05	0.011245	4.426611946	0.000834	0.000547	13.68636	0.000266	0.009054	0.066308	172.4151
	Oct-02	31		0.444608063	1.43655E-05	0.01126	4.373514326	0.000858	0.000588	13.5113	0.000259	0.009157	0.066308	172.1979
	Nov-02	30		0.464159235	1.4414E-05	0.011295	4.346401629	0.000871	0.000609	13.39008	0.000258	0.00925	0.066308	172.3546
	Dec-02	31		0.475369841	1.46822E-05	0.01152	4.404751348	0.000889	0.000624	13.51577	0.000265	0.009473	0.066308	175.457
3	Jan-03	31	2E	0.498761891	1.46689E-05	0.011506	4.361648385	0.000903	0.000649	13.37194	0.000261	0.009532	0.066308	174.7654
	Feb-03	28		0.497617988	1.48071E-05	0.011632	4.394682037	0.000909	0.00065	13.41221	0.000268	0.009677	0.066308	176.561
	Mar-03	31		0.487401704	1.49846E-05	0.011807	4.448509122	0.000911	0.000643	13.49946	0.000279	0.009854	0.066308	179.0849
	Apr-03	30		0.492193392	1.54224E-05	0.012059	4.574730866	0.00093	0.000653	13.8183	0.000291	0.010253	0.066308	187.9641
	May-03	31		0.482223454	1.61581E-05	0.01265	4.79721483	0.000951	0.000651	14.39451	0.000315	0.010766	0.066308	198.5452
	Jun-03	30		0.484719415	1.65921E-05	0.012978	4.921680861	0.00097	0.000658	14.71397	0.000328	0.011125	0.066308	205.3353
	Jul-03	31		0.500317497	1.67772E-05	0.013098	4.955020043	0.000986	0.000677	14.80036	0.000331	0.011325	0.066308	208.5002
	Aug-03	31		0.511214142	1.71092E-05	0.013358	5.039850844	0.001007	0.000692	15.02383	0.000339	0.011618	0.066308	213.2641
	Sep-03	30		0.529262935	1.70137E-05	0.013277	4.986094306	0.001015	0.000711	14.88109	0.000333	0.011619	0.066308	211.892
	Oct-03	31		0.543430419	1.66167E-05	0.012953	4.842815031	0.001009	0.000722	14.48343	0.000321	0.011422	0.066308	206.7586
	Nov-03	30		0.53385954	1.69142E-05	0.013218	4.940878205	0.001017	0.000717	14.71299	0.000335	0.011695	0.066308	211.25
	Dec-03	31		0.542469193	1.6995E-05	0.013299	4.955947402	0.001028	0.000727	14.75449	0.000338	0.011811	0.066308	212.188

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
4	Jan-04	31	2E	0.557904966	1.6722E-05	0.013117	4.85970007	0.001028	0.000741	14.4705	0.000328	0.011751	0.066308	208.1767
	Feb-04	28		0.55523669	1.69108E-05	0.013312	4.925334486	0.001037	0.000742	14.60777	0.000337	0.01201	0.066308	210.9648
	Mar-04	31		0.556625744	1.70462E-05	0.013465	4.970585809	0.001047	0.000747	14.70232	0.000344	0.012237	0.066308	213.0009
	Apr-04	30		0.568918205	1.73958E-05	0.013745	5.075227585	0.001071	0.000764	14.98492	0.000354	0.012622	0.066308	218.533
	May-04	31		0.577825578	1.80049E-05	0.014264	5.266437419	0.001105	0.000781	15.50772	0.000373	0.013197	0.066308	227.2424
	Jun-04	30		0.611836448	1.75709E-05	0.013887	5.103499319	0.001109	0.000812	15.10891	0.000351	0.012962	0.066308	221.1144
	Jul-04	31		0.614531464	1.79744E-05	0.014222	5.239631067	0.001131	0.000821	15.47082	0.000366	0.013413	0.066308	227.9189
	Aug-04	31		0.612958249	1.76987E-05	0.013978	5.160272699	0.001121	0.000817	15.23766	0.000361	0.013336	0.066308	225.9958
	Sep-04	30		0.583611058	1.80756E-05	0.014299	5.31093708	0.001122	0.000793	15.58518	0.000384	0.013773	0.066308	233.9093
	Oct-04	31		0.578033666	1.83099E-05	0.014507	5.391791376	0.00113	0.000792	15.7872	0.000395	0.014051	0.066308	238.1758
	Nov-04	30		0.583255702	1.82284E-05	0.014457	5.361729759	0.001132	0.000797	15.70656	0.000393	0.014055	0.066308	237.1424
	Dec-04	31		0.588365333	1.81263E-05	0.014397	5.328452729	0.001132	0.000802	15.62346	0.000391	0.01405	0.066308	235.8123
5	Jan-05	31	2E	0.597833087	1.78857E-05	0.014241	5.25196665	0.00113	0.00081	15.40783	0.000382	0.013981	0.066308	232.2994
	Feb-05	28		0.593047182	1.78474E-05	0.014276	5.262418929	0.001131	0.000807	15.55105	0.000387	0.014459	0.066308	232.2422
	Mar-05	31		0.587886707	1.80322E-05	0.014523	5.354473026	0.001144	0.000808	16.04156	0.000402	0.015448	0.066308	235.464
	Apr-05	30		0.586085204	1.78789E-05	0.014441	5.335313419	0.001143	0.000807	16.26106	0.000403	0.0162	0.066308	234.7915
	May-05	31		0.578546279	1.88012E-05	0.01532	5.677139799	0.001189	0.000816	17.65562	0.000444	0.018379	0.066308	249.107
	Jun-05	30		0.579796459	1.84822E-05	0.015088	5.599291471	0.001181	0.000817	17.72837	0.000439	0.01897	0.066308	245.9512
	Jul-05	31		0.567917225	1.90205E-05	0.015625	5.82397773	0.001207	0.000817	18.83468	0.000469	0.020911	0.066308	255.7817
	Aug-05	31		0.573804855	1.92401E-05	0.015871	5.923080406	0.001228	0.000829	19.50323	0.000481	0.02221	0.066308	259.8957
	Sep-05	30		0.583626351	1.89784E-05	0.015697	5.851876162	0.001228	0.000838	19.5602	0.000474	0.022665	0.066308	256.3168
	Oct-05	31		0.577125389	1.85844E-05	0.015431	5.755941907	0.001213	0.00083	19.55723	0.000469	0.023132	0.066308	251.6525
	Nov-05	30		0.562964168	1.89034E-05	0.015815	5.912571832	0.001229	0.000825	20.45732	0.000493	0.024845	0.066308	257.5414
	Dec-05	31		0.56927627	1.87212E-05	0.015727	5.869998457	0.00123	0.000832	20.58083	0.00049	0.025334	0.066308	254.7781
6	Jan-06	31	2E	0.576964047	1.83558E-05	0.015481	5.763661312	0.001223	0.000837	20.42644	0.000479	0.025448	0.066308	249.2
	Feb-06	28		0.574736125	1.84184E-05	0.015624	5.817716186	0.001232	0.000839	20.87264	0.000488	0.026438	0.066308	250.4201
	Mar-06	31		0.575914867	1.83853E-05	0.015681	5.834647555	0.001238	0.000843	21.18101	0.000493	0.027213	0.066308	250.0577
	Apr-06	30		0.584776045	1.85895E-05	0.015906	5.925011386	0.00126	0.000858	21.74131	0.000503	0.028289	0.066308	253.5819
	May-06	31		0.575208547	1.87987E-05	0.016171	6.040445872	0.001273	0.000856	22.44946	0.000521	0.029697	0.066308	258.0642
	Jun-06	30		0.575993704	1.91857E-05	0.016577	6.202090694	0.001299	0.000866	23.29748	0.000541	0.031223	0.066308	264.5565
	Jul-06	31		0.580845579	1.90686E-05	0.016499	6.176952536	0.0013	0.000871	23.38362	0.000539	0.031562	0.066308	263.4889
	Aug-06	31		0.578949538	1.90241E-05	0.016493	6.186702267	0.001301	0.000871	23.62107	0.000542	0.032166	0.066308	264.0407
	Sep-06	30		0.568187345	1.90545E-05	0.016577	6.232571322	0.001302	0.000863	24.01715	0.000552	0.033053	0.066308	265.8956
	Oct-06	31		0.554512574	1.87104E-05	0.01632	6.142957374	0.001281	0.000847	23.85548	0.000547	0.033092	0.066308	261.9856
	Nov-06	30		0.535288683	1.89135E-05	0.016594	6.257936403	0.001287	0.000834	24.54478	0.000567	0.034462	0.066308	266.3054
	Dec-06	31		0.536547787	1.87886E-05	0.016532	6.225076858	0.001284	0.000835	24.55062	0.000564	0.034615	0.066308	264.2535
7	Jan-07	31	2E	0.545843947	1.83973E-05	0.016212	6.085599539	0.001271	0.000839	24.06191	0.000547	0.033972	0.066308	257.6834
	Feb-07	28		0.543815809	1.83382E-05	0.016219	6.084227374	0.001271	0.000838	24.18222	0.000549	0.034344	0.066308	256.778
	Mar-07	31		0.545514994	1.83894E-05	0.01633	6.120667979	0.00128	0.000842	24.46265	0.000554	0.034948	0.066308	257.4127
	Apr-07	30		0.559116683	1.84633E-05	0.016387	6.1477313	0.001293	0.000858	24.65267	0.000555	0.035316	0.066308	258.8881
	May-07	31		0.550170141	1.91726E-05	0.017111	6.445994424	0.001333	0.000865	26.0923	0.000593	0.037814	0.066308	271.2765
	Jun-07	30		0.579164753	1.89848E-05	0.0169	6.34949481	0.001338	0.000889	25.6776	0.000574	0.037074	0.066308	267.2608
	Jul-07	31		0.595034247	1.89153E-05	0.016829	6.321687124	0.001346	0.000904	25.61816	0.000568	0.037009	0.066308	266.0954
	Aug-07	31		0.589830468	1.85334E-05	0.016487	6.206690914	0.001326	0.000894	25.24686	0.000557	0.036589	0.066308	261.6227
	Sep-07	30		0.572386812	1.90349E-05	0.017026	6.443361014	0.001351	0.00089	26.4557	0.000591	0.03878	0.066308	271.4998
	Oct-07	31		0.576457589	1.85241E-05	0.016553	6.258209933	0.001326	0.000885	25.71375	0.000569	0.037649	0.066308	263.7025
	Nov-07	30		0.559664923	1.83599E-05	0.016466	6.237273281	0.001313	0.000868	25.77302	0.000573	0.037967	0.066308	262.3996
	Dec-07	31		0.551054474	1.84679E-05	0.016636	6.308265227	0.00132	0.000864	26.20887	0.000585	0.038822	0.066308	264.6973

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
8	Jan-08	31	2E	0.561666865	1.8233E-05	0.016526	6.204053204	0.001313	0.000871	25.67263	0.000573	0.038524	0.066308	259.8933
	Feb-08	28		0.563441264	1.80747E-05	0.016477	6.145388069	0.001308	0.000872	25.39305	0.000568	0.038559	0.066308	256.8842
	Mar-08	31		0.565571481	1.81557E-05	0.016666	6.182533146	0.001317	0.000877	25.55926	0.000574	0.039305	0.066308	257.7499
	Apr-08	30		0.577960808	1.81899E-05	0.016737	6.185287678	0.001327	0.000891	25.53392	0.000573	0.039588	0.066308	258.104
	May-08	31		0.568733242	1.89075E-05	0.017526	6.488661941	0.001369	0.000899	26.95694	0.000614	0.042416	0.066308	270.7826
	Jun-08	30		0.580600184	1.85309E-05	0.017171	6.32819437	0.001353	0.000903	26.19612	0.000592	0.041362	0.066308	264.5177
	Jul-08	31		0.579574019	1.92592E-05	0.017951	6.624317541	0.001399	0.000918	27.55817	0.00063	0.044004	0.066308	276.9235
	Aug-08	31		0.608719659	1.86632E-05	0.017344	6.350550304	0.001376	0.000933	26.21325	0.00059	0.041788	0.066308	265.8055
	Sep-08	30		0.61479243	1.86987E-05	0.017416	6.36947023	0.001384	0.000941	26.30898	0.000592	0.042176	0.066308	266.5603
	Oct-08	31		0.617842753	1.83391E-05	0.017102	6.237092541	0.001368	0.000938	25.73122	0.000577	0.041397	0.066308	260.9396
	Nov-08	30		0.605074636	1.81248E-05	0.01697	6.188530217	0.001353	0.000924	25.60303	0.000577	0.041471	0.066308	258.5324
	Dec-08	31		0.593906765	1.81903E-05	0.017129	6.247731407	0.001357	0.000917	25.95393	0.000589	0.042373	0.066308	260.3834
9	Jan-09	31	2E	0.534976858	1.69161E-05	0.015826	6.49238962	0.001393	0.000891	29.07584	0.000672	0.048476	0.066308	276.3265
	Feb-09	28		0.534389714	1.69509E-05	0.015971	6.515266968	0.001397	0.000891	29.41664	0.000676	0.048766	0.066308	276.5392
	Mar-09	31		0.532704772	1.69264E-05	0.016057	6.51523564	0.001395	0.00089	29.6654	0.000677	0.048879	0.066308	276.1951
	Apr-09	30		0.531783352	1.70828E-05	0.016331	6.587524793	0.001406	0.000893	30.23669	0.000687	0.049576	0.066308	278.4453
	May-09	31		0.534975478	1.6596E-05	0.015904	6.399002525	0.001378	0.000886	29.55194	0.000664	0.048106	0.066308	270.4491
	Jun-09	30		0.529771217	1.67704E-05	0.016193	6.478614681	0.001387	0.000885	30.14204	0.000675	0.048878	0.066308	273.1195
	Jul-09	31		0.541031208	1.72403E-05	0.016757	6.670754215	0.001425	0.000907	31.25087	0.000697	0.050456	0.066308	280.5729
	Aug-09	31		0.554535038	1.66738E-05	0.016181	6.442121655	0.001399	0.000909	30.29285	0.000666	0.048548	0.066308	271.4155
	Sep-09	30		0.544729042	1.6561E-05	0.016168	6.407980854	0.001387	0.000897	30.31449	0.000665	0.048416	0.066308	269.3762
	Oct-09	31		0.539357274	1.67875E-05	0.016518	6.510149664	0.001399	0.000897	31.00147	0.00068	0.049382	0.066308	272.8075
	Nov-09	30		0.532583056	1.66313E-05	0.016445	6.456901119	0.001386	0.000888	30.90716	0.000675	0.049066	0.066308	270.0287
	Dec-09	31		0.527845338	1.6824E-05	0.016751	6.544677459	0.001396	0.000888	31.51228	0.000688	0.049904	0.066308	272.9211
10	Jan-10	31	Combined	0.535120599	1.65939E-05	0.016901	6.446350073	0.001389	0.000891	30.9621	0.000676	0.050313	0.066308	269.0786
	Feb-10	28		0.532388157	1.66295E-05	0.017317	6.459146118	0.001391	0.00089	30.98997	0.00068	0.051545	0.066308	269.3451
	Mar-10	31		0.531682367	1.67676E-05	0.017874	6.512944465	0.001401	0.000893	31.22631	0.000688	0.053202	0.066308	271.3508
	Apr-10	30		0.529879348	1.65619E-05	0.017973	6.424879765	0.001387	0.000887	30.74903	0.000679	0.053487	0.066308	268.0658
	May-10	31		0.535814705	1.69564E-05	0.018793	6.579118578	0.001418	0.000902	31.47191	0.000699	0.05593	0.066308	274.2322
	Jun-10	30		0.551697284	1.70307E-05	0.019144	6.597309284	0.001433	0.00092	31.49033	0.000699	0.056943	0.066308	275.3353
	Jul-10	31		0.571078368	1.67063E-05	0.018956	6.452743599	0.001426	0.000932	30.69404	0.000677	0.056326	0.066308	270.1763
	Aug-10	31		0.57786341	1.67172E-05	0.019239	6.450930882	0.001432	0.00094	30.64028	0.000676	0.057151	0.066308	270.2965
	Sep-10	30		0.565276441	1.62209E-05	0.018909	6.25360062	0.001393	0.000917	29.6615	0.000656	0.056159	0.066308	262.2058
	Oct-10	31		0.559291799	1.65489E-05	0.019658	6.387756863	0.001412	0.000919	30.31741	0.000675	0.05841	0.066308	267.2543
	Nov-10	30		0.558121136	1.64792E-05	0.019827	6.358877771	0.001408	0.000916	30.15575	0.000673	0.058905	0.066308	265.9837
	Dec-10	31		0.565523937	1.6277E-05	0.019762	6.27272317	0.001401	0.00092	29.6941	0.000662	0.058682	0.066308	262.6933
11	Jan-11	31	Combined	0.565561975	1.62607E-05	0.019989	6.267491053	0.001401	0.00092	29.64584	0.000662	0.059359	0.066308	262.3786
	Feb-11	28		0.565305843	1.62762E-05	0.020217	6.272975204	0.001403	0.00092	29.64592	0.000664	0.06004	0.066308	262.45
	Mar-11	31		0.564753565	1.62597E-05	0.02042	6.267305223	0.001403	0.00092	29.59737	0.000664	0.060648	0.066308	262.2036
	Apr-11	30		0.574247743	1.65711E-05	0.021032	6.391625116	0.001431	0.000937	30.17082	0.000679	0.062473	0.066308	267.225
	May-11	31		0.583312936	1.60192E-05	0.020368	6.167215315	0.001402	0.000934	29.02794	0.000648	0.060455	0.066308	258.6052
	Jun-11	30		0.594192553	1.64696E-05	0.021163	6.346590945	0.001439	0.000955	29.86995	0.00067	0.06283	0.066308	265.8648
	Jul-11	31		0.595658652	1.60706E-05	0.020727	6.186381699	0.001415	0.000948	29.0605	0.000649	0.061517	0.066308	259.7334
	Aug-11	31		0.599591702	1.63902E-05	0.021367	6.316956261	0.00144	0.00096	29.68061	0.000666	0.063436	0.066308	264.9341
	Sep-11	30		0.59844182	1.61542E-05	0.021172	6.224323778	0.001425	0.000954	29.21324	0.000655	0.062847	0.066308	261.1951
	Oct-11	31		0.598894024	1.63261E-05	0.021601	6.297223179	0.001438	0.000959	29.56013	0.000665	0.064135	0.066308	263.9714
	Nov-11	30		0.606500566	1.60727E-05	0.021306	6.192925743	0.001427	0.000961	29.01876	0.00065	0.06323	0.066308	259.9517
	Dec-11	31		0.606196196	1.60774E-05	0.021464	6.19819105	0.001428	0.000961	29.03634	0.000652	0.063703	0.066308	260.0546

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Operational Tailings Pond Chemistry Predictions

Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
12	Jan-12	31	Combined	0.609559748	1.61437E-05	0.021493	6.207214308	0.001426	0.000962	28.91992	0.000648	0.063004	0.066308	258.9644
	Feb-12	28		0.615873915	1.61928E-05	0.021469	6.207617309	0.001425	0.000965	28.76558	0.000643	0.062234	0.066308	257.7616
	Mar-12	31		0.618729285	1.6082E-05	0.021227	6.146741926	0.001411	0.000962	28.3232	0.000631	0.060801	0.066308	254.0642
	Apr-12	30		0.632022221	1.63793E-05	0.02155	6.244220058	0.00143	0.000978	28.62649	0.000637	0.06104	0.066308	256.9313
	May-12	31		0.653995245	1.61793E-05	0.021054	6.139340604	0.001424	0.000992	27.94872	0.000615	0.058929	0.066308	252.2622
	Jun-12	30		0.668486479	1.6247E-05	0.021017	6.145529681	0.00143	0.001005	27.82439	0.000609	0.058193	0.066308	251.7688
	Jul-12	31		0.685082802	1.63689E-05	0.021059	6.17619737	0.001442	0.001021	27.81958	0.000606	0.057684	0.066308	252.2528
	Aug-12	31		0.66314583	1.55187E-05	0.019819	5.837680074	0.001369	0.000978	26.15229	0.000566	0.05373	0.066308	238.1806
	Sep-12	30		0.657597091	1.57988E-05	0.020247	5.942819962	0.001376	0.000976	26.55226	0.000577	0.054373	0.066308	240.8788
	Oct-12	31		0.659066684	1.60246E-05	0.020554	6.023742994	0.001385	0.000979	26.82637	0.000584	0.054667	0.066308	242.8286
	Nov-12	30		0.664671807	1.57206E-05	0.020019	5.893183447	0.001366	0.000976	26.1157	0.000565	0.052746	0.066308	237.1783
	Dec-12	31		0.665299296	1.57422E-05	0.020021	5.894426713	0.001362	0.000975	26.02969	0.000562	0.052266	0.066308	236.2545
13	Jan-13	31	Combined	0.659736986	1.56144E-05	0.020079	5.839070137	0.001353	0.000969	25.68047	0.00056	0.052621	0.066308	234.1649
	Feb-13	28		0.65597238	1.56814E-05	0.020387	5.858753605	0.001356	0.000968	25.67925	0.000567	0.053604	0.066308	234.8214
	Mar-13	31		0.652940955	1.56814E-05	0.020609	5.853249133	0.001356	0.000966	25.56369	0.00057	0.054373	0.066308	234.6238
	Apr-13	30		0.656651471	1.58306E-05	0.020987	5.90110504	0.001368	0.000974	25.67879	0.000578	0.055548	0.066308	236.8816
	May-13	31		0.665894491	1.56738E-05	0.020858	5.829203313	0.001366	0.000981	25.25293	0.00057	0.05536	0.066308	234.6536
	Jun-13	30		0.661082878	1.55121E-05	0.020781	5.760803524	0.001354	0.000974	24.86824	0.000565	0.055306	0.066308	232.2451
	Jul-13	31		0.677184382	1.60881E-05	0.021783	5.972892563	0.0014	0.001003	25.71557	0.000591	0.058127	0.066308	240.5993
	Aug-13	31		0.682873429	1.58131E-05	0.021447	5.857211112	0.001388	0.001005	25.11398	0.000577	0.057357	0.066308	236.7064
	Sep-13	30		0.680192899	1.57945E-05	0.021578	5.845581463	0.001387	0.001003	24.99414	0.000579	0.057834	0.066308	236.267
	Oct-13	31		0.678447607	1.58344E-05	0.021811	5.859342489	0.00139	0.001003	24.98932	0.000584	0.058587	0.066308	236.758
	Nov-13	30		0.680981885	1.5642E-05	0.021606	5.780636652	0.001381	0.001003	24.57384	0.000575	0.058141	0.066308	233.9656
	Dec-13	31		0.679757976	1.56694E-05	0.021799	5.789583899	0.001383	0.001003	24.5537	0.000579	0.058776	0.066308	234.2876
14	Jan-14	31	Combined	0.676363157	1.56398E-05	0.021931	5.778440616	0.001382	0.001001	24.48953	0.000582	0.059394	0.066308	234.1479
	Feb-14	28		0.672494007	1.56501E-05	0.022101	5.781432337	0.001382	0.000999	24.48427	0.000586	0.060082	0.066308	234.4313
	Mar-14	31		0.668447237	1.56582E-05	0.02229	5.785341434	0.001383	0.000996	24.48885	0.00059	0.060835	0.066308	234.7965
	Apr-14	30		0.664738146	1.56616E-05	0.022447	5.786285424	0.001383	0.000994	24.47791	0.000594	0.061487	0.066308	235.1213
	May-14	31		0.67764655	1.57603E-05	0.022657	5.81817065	0.0014	0.001011	24.58522	0.000598	0.062266	0.066308	237.019
	Jun-14	30		0.673204077	1.54805E-05	0.022302	5.70931268	0.001381	0.001001	24.09593	0.000587	0.061476	0.066308	233.283
	Jul-14	31		0.680066019	1.58621E-05	0.023045	5.853281402	0.001411	0.001018	24.70116	0.000607	0.063731	0.066308	239.177
	Aug-14	31		0.690133663	1.5912E-05	0.023173	5.867528998	0.001423	0.00103	24.7368	0.000609	0.064257	0.066308	240.3085
	Sep-14	30		0.692492823	1.58494E-05	0.023145	5.841099613	0.001422	0.001032	24.60386	0.000607	0.064341	0.066308	239.6375
	Oct-14	31		0.676541006	1.55013E-05	0.022742	5.712200233	0.001392	0.00101	24.04886	0.000596	0.063383	0.066308	234.6319
	Nov-14	30		0.674016531	1.55442E-05	0.022932	5.728946154	0.001395	0.001009	24.11188	0.0006	0.064067	0.066308	235.3893
	Dec-14	31		0.67048891	1.55303E-05	0.023036	5.726642927	0.001394	0.001007	24.09576	0.000603	0.06451	0.066308	235.3959
15	Jan-15	31	Combined	0.673550918	1.56538E-05	0.023175	5.752100793	0.001393	0.001008	24.17602	0.000601	0.06418	0.066308	234.7882
	Feb-15	28		0.677189963	1.56495E-05	0.023071	5.728986833	0.001385	0.001007	24.04178	0.000593	0.063253	0.066308	232.5529
	Mar-15	31		0.680881344	1.56604E-05	0.023005	5.712284409	0.001378	0.001007	23.94035	0.000586	0.062397	0.066308	230.5086
	Apr-15	30		0.688784131	1.54986E-05	0.022588	5.628626678	0.001364	0.001007	23.54289	0.000569	0.060639	0.066308	226.3608
	May-15	31		0.696102122	1.55979E-05	0.022656	5.645784486	0.001365	0.001013	23.58568	0.000565	0.060207	0.066308	225.8247
	Jun-15	30		0.707644332	1.57213E-05	0.022732	5.670820059	0.001371	0.001023	23.65652	0.000562	0.059828	0.066308	225.8185
	Jul-15	31		0.705857871	1.54721E-05	0.022239	5.560445637	0.001347	0.001013	23.15921	0.000544	0.057969	0.066308	220.7047
	Aug-15	31		0.718530951	1.58529E-05	0.022777	5.683219989	0.001369	0.00103	23.65357	0.000554	0.058818	0.066308	224.192
	Sep-15	30		0.710794489	1.51733E-05	0.021573	5.416713678	0.001318	0.001005	22.49418	0.000518	0.055213	0.066308	213.5253
	Oct-15	31		0.710190048	1.54525E-05	0.022035	5.507055587	0.001326	0.001007	22.86522	0.000527	0.055901	0.066308	215.4774
	Nov-15	30		0.708910754	1.5367E-05	0.021852	5.462300854	0.001314	0.001001	22.65588	0.000518	0.054974	0.066308	212.7889
	Dec-15	31		0.710496881	1.54433E-05	0.021944	5.479089854	0.001312	0.001002	22.71028	0.000518	0.05475	0.066308	212.3261

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Year	Month	Days/Month	Active Cell	Manganese	Mercury	Nickel	Potassium	Selenium	Silver	Sodium	Thallium	Zinc	Acidity	Hardness
Fixed Standards				0.05	#N/A	f(H)	#N/A	0.005	0.001	#N/A	0.00028	f(H)		
16	Jan-16	31	Combined	0.716746019	1.5284E-05	0.021579	5.407327602	0.001302	0.001002	22.36582	0.000504	0.053382	0.066308	209.0546
	Feb-16	28		0.718485258	1.52902E-05	0.021533	5.398188258	0.001298	0.001002	22.29296	0.0005	0.052868	0.066308	207.8537
	Mar-16	31		0.722733134	1.53572E-05	0.021586	5.41142478	0.001298	0.001005	22.31713	0.000498	0.052574	0.066308	207.4655
	Apr-16	30		0.732762802	1.54996E-05	0.02172	5.450305744	0.001307	0.001015	22.44331	0.000498	0.052506	0.066308	208.2747
	May-16	31		0.740582291	1.55004E-05	0.021631	5.438843593	0.001307	0.001021	22.36031	0.000492	0.051899	0.066308	207.2924
	Jun-16	30		0.750784987	1.56157E-05	0.021721	5.468506369	0.001315	0.001031	22.44917	0.000491	0.051747	0.066308	207.8375
	Jul-16	31		0.763966782	1.57296E-05	0.021791	5.497358597	0.001325	0.001044	22.53376	0.000489	0.05155	0.066308	208.4737
	Aug-16	31		0.766478572	1.53691E-05	0.02111	5.357221746	0.001304	0.001038	21.91381	0.00047	0.04961	0.066308	203.3278
	Sep-16	30		0.764366334	1.53714E-05	0.021101	5.350681098	0.001298	0.001034	21.86532	0.000467	0.049267	0.066308	202.2913
	Oct-16	31		0.766992403	1.54636E-05	0.021219	5.375930925	0.0013	0.001037	21.94878	0.000468	0.049221	0.066308	202.446
	Nov-16	30		0.764790265	1.53821E-05	0.021068	5.33985034	0.00129	0.001031	21.7777	0.000462	0.048575	0.066308	200.4947
	Dec-16	31		0.763632961	1.54103E-05	0.021105	5.343570788	0.001287	0.001029	21.77558	0.000461	0.048363	0.066308	199.8626
17	Jan-17	31	Combined	0.766618697	1.52711E-05	0.020869	5.303746906	0.00128	0.001028	21.50103	0.000451	0.047516	0.066308	197.5575
	Feb-17	28		0.768714465	1.53187E-05	0.020949	5.328791546	0.001282	0.00103	21.5078	0.000449	0.047421	0.066308	197.3759
	Mar-17	31		0.771646926	1.53529E-05	0.021014	5.350670665	0.001284	0.001033	21.50029	0.000446	0.047274	0.066308	197.0892
	Apr-17	30		0.778792994	1.54638E-05	0.021178	5.400317515	0.001293	0.001041	21.60566	0.000446	0.047377	0.066308	197.9324
	May-17	31		0.784381	1.54737E-05	0.021184	5.414269477	0.001296	0.001046	21.56818	0.000442	0.04713	0.066308	197.5934
	Jun-17	30		0.794407119	1.56091E-05	0.021369	5.471382377	0.001308	0.001057	21.70775	0.000442	0.047296	0.066308	198.8265
	Jul-17	31		0.781132621	1.52052E-05	0.020779	5.337611462	0.001277	0.001036	21.08984	0.000426	0.045763	0.066308	193.5066
	Aug-17	31		0.788395547	1.53801E-05	0.021057	5.410014552	0.00129	0.001046	21.29925	0.000429	0.046142	0.066308	195.1134
	Sep-17	30		0.791030959	1.5336E-05	0.020983	5.402416563	0.001288	0.001047	21.19301	0.000424	0.045769	0.066308	194.1795
	Oct-17	31		0.792970641	1.53581E-05	0.021034	5.419765232	0.001289	0.001048	21.18978	0.000422	0.045667	0.066308	193.9519
	Nov-17	30		0.790756539	1.5302E-05	0.020973	5.408402635	0.001284	0.001045	21.07775	0.000418	0.045337	0.066308	192.75
	Dec-17	31		0.79013034	1.53357E-05	0.021062	5.430221772	0.001284	0.001044	21.099	0.000418	0.045329	0.066308	192.5921
18	Jan-18	31	Combined	0.791008747	1.51839E-05	0.020949	5.413088878	0.001281	0.001043	20.98844	0.000409	0.045122	0.066308	191.0192
	Feb-18	28		0.790885362	1.52265E-05	0.021154	5.462330424	0.001285	0.001044	21.14105	0.000409	0.045582	0.066308	191.4183
	Mar-18	31		0.791530763	1.52671E-05	0.021371	5.514104355	0.00129	0.001046	21.30582	0.000408	0.046069	0.066308	191.8812
	Apr-18	30		0.791695354	1.5288E-05	0.02154	5.55548237	0.001293	0.001047	21.43058	0.000407	0.046453	0.066308	192.132
	May-18	31		0.797070903	1.54192E-05	0.021874	5.63785098	0.001306	0.001055	21.71564	0.000409	0.047193	0.066308	193.7418
	Jun-18	30		0.794377432	1.53126E-05	0.021827	5.631109474	0.001301	0.001051	21.65235	0.000404	0.047122	0.066308	192.6303
	Jul-18	31		0.805176127	1.53955E-05	0.022027	5.692685156	0.001316	0.001064	21.8533	0.000403	0.047587	0.066308	194.0011
	Aug-18	31		0.813184443	1.54364E-05	0.022168	5.737712412	0.001326	0.001073	21.99234	0.000401	0.047921	0.066308	194.8105
	Sep-18	30		0.807408503	1.52577E-05	0.021995	5.698902338	0.001315	0.001065	21.81182	0.000394	0.047573	0.066308	192.748
	Oct-18	31		0.797199359	1.51805E-05	0.022051	5.702772569	0.001307	0.001053	21.80017	0.000392	0.047706	0.066308	191.6121
	Nov-18	30		0.793821705	1.52722E-05	0.02236	5.769023351	0.001311	0.001052	22.02812	0.000395	0.04838	0.066308	192.4944
	Dec-18	31		0.794059365	1.51363E-05	0.02221	5.741165523	0.001306	0.00105	21.89413	0.000389	0.048083	0.066308	191.1029
19	Jan-19	31	Combined	0.792476067	1.51312E-05	0.022324	5.784381041	0.001308	0.001049	21.80983	0.000387	0.04808	0.066308	190.7082
	Feb-19	28		0.792902439	1.51713E-05	0.022482	5.838177121	0.001312	0.00105	21.79118	0.000386	0.048201	0.066308	190.8513
	Mar-19	31		0.792707474	1.51648E-05	0.022574	5.877046903	0.001315	0.001051	21.70719	0.000383	0.04817	0.066308	190.5143
	Apr-19	30		0.800997929	1.53349E-05	0.022924	5.981843647	0.001332	0.001062	21.87792	0.000386	0.048701	0.066308	192.3905
	May-19	31		0.812373677	1.52454E-05	0.022747	5.974932239	0.001338	0.001072	21.64632	0.000378	0.048142	0.066308	191.6389
	Jun-19	30		0.830242652	1.54738E-05	0.023125	6.096361167	0.001364	0.001095	21.89049	0.00038	0.048754	0.066308	194.4835
	Jul-19	31		0.827346147	1.51933E-05	0.022692	6.015858708	0.00135	0.001088	21.41038	0.000369	0.047679	0.066308	191.3395
	Aug-19	31		0.822274865	1.51666E-05	0.022774	6.044961572	0.001348	0.001082	21.32568	0.000367	0.047669	0.066308	190.7719
	Sep-19	30		0.820395817	1.52053E-05	0.022953	6.098054334	0.001351	0.001081	21.33596	0.000367	0.04787	0.066308	190.9491
	Oct-19	31		0.806373352	1.49707E-05	0.022697	6.0394136	0.001332	0.001064	20.96092	0.000361	0.047172	0.066308	187.8326
	Nov-19	30		0.806893105	1.50042E-05	0.022839	6.085848993	0.001336	0.001065	20.96285	0.00036	0.047312	0.066308	188.0515
	Dec-19	31		0.803914081	1.4951E-05	0.022842	6.096525672	0.001333	0.001062	20.84481	0.000358	0.047168	0.066308	187.2462
20	Jan-20	31	Combined	0.797628997	1.48798E-05	0.022984	6.159272616	0.001334	0.001056	20.64992	0.000356	0.047164	0.066308	186.4022
	Feb-20	28		0.792377604	1.48666E-05	0.023195	6.234795416	0.001337	0.001053	20.54279	0.000355	0.04733	0.066308	186.137
	Mar-20	31		0.792980046	1.49533E-05	0.023584	6.35940686	0.001351	0.001057	20.57594	0.000357	0.047844	0.066308	187.2046
	Apr-20	30		0.794896664	1.49737E-05	0.023797	6.444577412	0.001361	0.001061	20.50768	0.000357	0.048029	0.066308	187.7113
	May-20	31		0.806804294	1.50029E-05	0.023945	6.525143593	0.001378	0.001075	20.44295	0.000354	0.048103	0.066308	188.5987
	Jun-20	30		0.803689271	1.48186E-05	0.02376	6.508554849	0.001373	0.001071	20.09557	0.000348	0.047523	0.066308	186.7015
	Jul-20	31		0.809498931	1.49972E-05	0.024268	6.663686464	0.001394	0.001081	20.26274	0.000352	0.048305	0.066308	188.9464
	Aug-20	31		0.819977365	1.51135E-05	0.024596	6.781042703	0.001414	0.001096	20.33541	0.000353	0.04875	0.066308	190.682
	Sep-20	30		0.818491683	1.49678E-05	0.024457	6.772335747	0.001411	0.001093	20.05486	0.000348	0.04829	0.066308	189.1803
	Oct-20	31		0.817518637	1.4988E-05	0.024694	6.854668505	0.001419	0.001094	20.02168	0.000348	0.048564	0.066308	189.5239
	Nov-20	30		0.806496085	1.46419E-05	0.024207	6.749967203	0.001398	0.001079	19.48781	0.000338	0.047452	0.066308	185.5804
	Dec-20	31		0.800490636	1.47049E-05	0.024577	6.855887354	0.001404	0.001075	19.52739	0.000341	0.047982	0.066308	186.1738