Avalon Rare Metals Inc.

RESPONSE TO THE DEFICIENCY LIST FOR THE THOR LAKE RARE EARTH ELEMENT PROJECT DEVELOPER'S ASSESSMENT REPORT

PART 1

Submitted To:
MACKENZIE VALLEY ENVIRONMENTAL IMPACT REVIEW BOARD

September 2011

Response to the Deficiency List for the Thor Lake Rare Earth Element Project Developer's Assessment Report

Part 1

Avalon Rare Metals Inc. (Avalon) is pleased to provide the following responses to Part 1 of the deficiency list provided in Mackenzie Valley Environmental Impact Review Board's (MVEIRB) letter dated August 25, 2011. The Part 2 responses will be provided by the end of September 2011.

This deficiency list provides specific direction from the MVEIRB to Avalon regarding the results of the conformity analysis and identifies two categories of information that require additional information:

Part 1: includes information without which the environmental assessment cannot proceed. The developer must respond to these items before the process will move into the next phase.

Part 2: includes information the Review Board needs to determine whether the proposed development is likely to cause a significant impact on the environment but may be submitted at a later date. The developer may submit responses to these items at its convenience but prior to the environmental assessment process reaching the technical reports step. For Part 2 items please provide a schedule of when and how these items will be addressed within the environmental assessment.

The numbering of headings and line items refers to sections and points within the Final Terms of Reference (MVEIRB 2011). Sections of the quoted Terms of Reference are in italics. Specific questions asked by the MVEIRB are highlighted in bold.

1.0 SECTION 3.2.4 DESCRIPTION OF EXISTING ENVIRONMENT

MVEIRB Request #1

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

15. Terrain, surficial geology, structural geology, mineralogy, bedrock geology (type, depth, composition, and permeability), seismic activity records and risk factors, permafrost locations and types within the environmental assessment study area. In particular:

c. identify the chemical composition of host rock and ore bodies at the mine site including:

ii. uranium, thorium and beryllium content in ore.

The information need identified by the Review Board is as follows:

Appendix F (SGS Environmental Characterization of ore, concentrate and tailings Interim Report Feb 28, 2011) is not yet complete. Submit the final Report on characterization of ore, concentrate and tailings to the Review Board.

Avalon Response #1

Avalon is pleased to submit as Attachment 1 to this Deficiency Response document the SGS Final Report dated August 30, 2011 entitled: *Environmental Characterization of Ore, Concentrate and Tailings From the Nechalacho Rare Earth Element Project – Phase 2.* This report serves to replace the Interim Report dated February 28, 2011 which was previously provided as Appendix F in the Avalon DAR.

MVEIRB Request #2

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

> *f. a description of existing fractures and faults at the project sites.*

The information need identified by the Review Board is as follows:

The specific locations of significant water bearing fractures and faults is not presented on the maps or discussed in the text. Given the complex geologic history and the intrusive nature of the deposits, and given that this mine lies beneath Thor Lake, fracture zones may be an important aspect of groundwater flow. Please provide test results from a more robust investigation into the nature of faulting above the underground mine.

Avalon Response #2

Knight Piesold previously completed a review of the historic hydrogeological information for the site in 2009 (results presented in KPL Memorandum NB09-00655 – Appendix C.2 in the DAR) during which no areas of concern were identified and all hydrogeological parameters appeared favourable for underground mine development at the site. However, to further this theory, a robust geomechanical/hydrogeological site investigation program was carried out in 2010.

The 2010 investigations were used to define the rock mass characteristics and hydraulic characteristics in and around the Nechalacho Deposit. The work included the drilling of eight (8) oriented core drillholes, detailed geomechanical core logging, packer testing and the installation of two (2) thermistors. Further to these investigations, Avalon site geology staff continue to collect rock mass quality data from exploration drillholes for incorporation into the rock mass quality database.

Based on the data from the 2010 geomechanical investigations, hydraulic conductivity values estimated from the 2010 packer testing results are relatively low, ranging from approximately $3x10^{-9}$ m/s to $2x10^{-7}$ m/s near surface (as presented in KPL Memorandum NB10-00587 – Appendix C.8 in the DAR), which is consistent with expected values for intrusive and metamorphic crystalline rock (Freeze and Cherry 1979). Results of the geomechanical program (as presented in KPL Memorandum Cont. No. NB10-00570 – Appendix C.9 in the DAR) suggested that the Rock Mass Rating in the area of the deposit indicates GOOD to VERY GOOD rock with the design values typically being in the upper end of the GOOD range. Flat-lying (horizontal) joints form the dominant joint set.

Vertical to sub-vertical joint sets are also present although not as prominent. The deposit area is surrounded by a Sodalite Cumulate zone, a cap rock of the Nechalacho mineralized intrusion that was subsequently partially eroded away. The sodalite cumulate material is partially hydrothermally altered to a mixture of illitic clays and sericite, but these alteration minerals make up 10 to 30% of the rock overall and perhaps a maximum of 60% in any one location. The remaining 70 to 90% is feldspar and nepheline – unaltered silicate minerals. There are no records of drill fluid loss within this zone and it is expected to have very low hydraulic conductivity.

Based on the work completed to date, no significant water bearing fractures or faults have been encountered in the vicinity of the mine workings. All investigations have shown very few regions of reduced rock mass quality (e.g., shear, faults, rubble or broken zones) with only some slightly lower RQD zones close to surface. The rock mass quality increases significantly with depth. The previously described results and conclusion are supported by reports from past mining in the T Zone, where it was reported that "there was little to no water incursion into the mine workings" (Trueman 2010). Avalon is pleased to submit the Trueman (2010) letter as Attachment 2 to this Deficiency Response document.

References:

Freeze, Alan R., and John A Cherry. 1979. Groundwater. Hamel Hampstead: Prentice Hall International, Englewood Cliffs, NJ.

Trueman, D.L. 2010. Mining of the T Zone, Thor Lake, NWT. Letter from D.L. Trueman of Trace Engineering, Richmond, B.C. to D. Swisher of Avalon Rare Metals Inc., dated February 3, 2010.

2.0 SECTION 3.2.5 DEVELOPMENT DESCRIPTION

MVEIRB Request #3

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

Appendix A: Scope of Development, Pine Point, milling effluent discharge.

The information need identified by the Review Board is as follows:

The Knight Piesold document in Appendix C5 (Nov 3, 2010 p5) outlines preliminary characteristics assumed for hydrometallurgical tailings. It is stated that physical and geochemical tailings test work will be completed as soon as hydrometallurgical tailings samples are available to confirm tailings parameters.

Section 6.5.2.2 of the DAR on page 726 states that tailings properties solids from the proposed milling process will be made up of gypsum (85%), leach residue (6%) and miscellaneous other solids (9%). Appendix C19 indicates that assumptions have been

made regarding the physical characteristics of the tailings. The geochemical characteristics of the "leach residue" and "miscellaneous other solids" portion of the tailings solids in particular are not described. Section 4.8.3.1 of the DAR on page 518 describes the miscellaneous other solids as "e.g. hydroxides" but without further elaboration.

Please thoroughly describe the geochemical characteristics of the leach residue (6%) and miscellaneous other solids (9%) portions of the tailings solids to be released from the hydrometallurgical plant into the L-37 pit. A complete geochemical characterization of tailings from the hydromet plant is also required.

Avalon Response #3

As a result of Avalon's decision to complete the processing of the rare metals products produced at the Pine Point Hydrometallurgical facility at another processing plant to be located in the south, the previously identified leach residue will no longer be produced at the Pine Point Hydrometallurgical Plant site.

More specifically all of the acid-baked residue will be shipped south and there will be no leach residue in the hydrometallurgical tailings that will be directed to the L-37 Pit.

The miscellaneous other solids (approximately 9%) portion of the tailings solids will consist of ferric and other insoluble hydroxide precipitates, and excess limestone will be added to ensure stability of the tailings directed to the L-37 pit.

As a result, the Pine Point Hydrometallurgical Plant will produce less tailings, approximately 100,000 t/a, compared to the 171,000 t/a quantity provided in the DAR. However, to be conservative in the assessment, it was decided to leave the higher, more conservative, quantity in the DAR.

3.0 SECTION 3.3.2 KEY LINE OF INQUIRY: WATER QUALITY

MVEIRB Request #4

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

Avalon proposes to have an underground mine in the proximity of lakes (proposed tailings management facility) that have been drawn down, in addition to bypassing the flow of volumes of water around Murky Lake by pumping directly from Drizzle Lake into Thor Lake while discharging effluent into, and recycling certain volumes of water from this watershed. This complex water management within a small area – and any potential impact(s) that may come from it – deserves a thorough analysis in this environmental assessment.

Thor Lake

Potential Pathways for Impacts to Water Quality from Project Components

For the locally impacted watershed and downstream water bodies (up to, and including a reasonable local area after, the confluence with Great Slave Lake) Avalon must:

1. *Describe impacts to water quality from the following sources:*

   a. *the water quality resulting from processing ore to concentrate, including an analysis of pathways and destinations for the end-products of concentrate, all reagent chemicals, process byproducts, hydrocarbons, sludge, incinerator residue, explosives, greywater constituents and any other potentially hazardous products used at the mine site that enter the water treatment stream;*

   g. *the tailings management facility supernatant water quality and quantity due to inputs to the facility from points 1a through 1f, as well as due to leachate from the tailings. On this matter, Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity, and any other metals or substances of concern. Include analysis of percent water content of tailings;*

   h. *describe how metals solubility under site conditions (both acidic and neutral) has been considered in long term mine planning and engineering designs;*

   i. *a comparison of the contaminant levels to natural background variability. Avalon will both list the constituent contaminants and estimate their respective amounts from the above sources at the mine site. Also describe how each of the above sources, alone or in combination, may contribute to the leaching of metals, creation of acid rock drainage, or otherwise affect water quality. Avalon will include all results of testing to support such conclusions.*

The information need identified by the Review Board is as follows:

A comprehensive analysis of the water quality coming out of the Thor Lake process plant is required. Please provide expected concentrations of all constituents Avalon will discharge into the TMF (tailings facility).

Avalon Response #4

The expected concentrations of all constituents contained in the tailings and process water (effluent) to be discharged from the proposed Nechalacho Flotation Plant to the Tailings Management Facility (TMF) are provided in the SGS (2011) Final Report (see Attachment 1). Specifically, Tables 19 and 20 in the SGS (2011) Final Report present the results of shake flask extraction tests on nine (9) different flotation tailings samples. A variety of tailings samples were tested in order to get a measure of the variability of tailings extraction response. The tailings samples designated as Pilot Plant 1 Tailings (PP1 Tls) and Pilot Plant 2 Tailings (PP2 Tls) were generated in a pilot plant operation at Xstrata Process Support (XPS), the other tailings samples came from locked cycle flotation tests. It should be noted that the shake flask extraction results are very similar for all samples tested.

All values reported, including radionuclides and metals were exceedingly low and typically several magnitudes below applicable MMER values. In particular, the concentrations of radionuclides measured were below the detection limit for the three radionuclide parameters measured (^{226}Ra, ^{228}Ra, and ^{210}Pb). To facilitate review of the data presented, these tables have been reproduced in their entirety below.

Table 19: Shake Flask Extraction Results – Tailings

Parameter	Unit	*MMER	F25 Tls	F28 Tls	F29 Tls	F33 Tls
Initial pH	units		8.30	8.59	8.62	8.86
Final pH	units		8.44	8.66	8.66	8.91
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.2	< 0.1	< 0.3	< 0.1
^{210}Pb	Bq/L		0.2	< 0.1	< 0.1	< 0.1
General and Metals Analyses						
pH	units	6.0-9.5	7.91	7.87	7.81	7.90
F	mg/L		1.29	1.23	1.39	2.40
Cl	mg/L		1.4	1.7	1.9	2.6
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0024	0.0027	0.0031	0.0079
Ca	mg/L		13.1	12.8	13.0	13.1
Cu	mg/L	0.30	0.0042	0.0020	0.0029	0.0049
Fe	mg/L		0.304	0.081	0.123	0.041
K	mg/L		2.33	3.44	3.47	7.79
Mg	mg/L		2.41	2.20	2.10	2.46
Na	mg/L		6.70	6.75	9.29	9.95
Ni	mg/L	0.50	0.0023	0.0012	0.0016	0.0019
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		7.72	6.44	6.17	5.74
Th	mg/L		0.00280	0.000702	0.00186	0.000354
U	mg/L		0.00132	0.00119	0.00131	0.00410
Zn	mg/L	0.50	0.008	0.006	0.006	0.004

Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.

Source: SGS 2011

Table 20: Shake Flask Extraction Results – Tailings

Parameter	Unit	*MMER	F36 Tls	F37 Tls	Master Tls	PP1 Tls	PP2 Tls
Initial pH	units		8.84	8.92	8.52	9.28	9.08
Final pH	units		8.84	8.95	8.59	8.81	8.82
Radionuclide Analyses							
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.1	< 0.1	< 0.1	< 0.3	< 0.3
^{210}Pb	Bq/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
General and Metals Analyses							
pH	units	6.0-9.5	8.02	8.09	7.81	7.95	8.12
F	mg/L		2.33	2.71	1.40	1.83	4.43
Cl	mg/L		3.3	3.6	1.8	3.6	5.0
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0081	0.0066	0.0032	0.0199	0.0060
Ca	mg/L		13.8	14.1	13.3	21.0	14.5
Cu	mg/L	0.30	0.0063	0.0056	0.0028	0.0010	0.0008
Fe	mg/L		0.079	0.056	0.198	0.041	0.072
K	mg/L		8.52	7.96	2.69	8.76	12.8
Mg	mg/L		2.70	2.50	2.30	3.20	5.31
Na	mg/L		10.3	10.9	9.18	13.4	17.4
Ni	mg/L	0.50	0.0020	0.0015	0.0018	0.0059	0.0015
Se	mg/L		< 0.001	0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		5.85	5.58	7.56	4.72	3.35
Th	mg/L		0.000577	0.000420	0.002330	0.000832	0.000377
U	mg/L		0.00429	0.00514	0.00136	0.00535	0.00535
Zn	mg/L	0.50	0.008	0.010	0.011	0.003	0.010

Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.

Source: SGS 2011

MVEIRB Request #5

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

See the previously described Terms of Reference.

The information need identified by the Review Board is as follows:

Track and account for all inputs that may affect water quality – including but not limited to ore and its constituent minerals and elements, as well as reagents – from discharge into the tailings facility to the point of discharge from the tailings facility (TMF). According to the criteria listed in section 3.3.1 of the ToR, demonstrate how the TMF functions to produce the downstream concentrations Avalon presents in the DAR for the 5-day decant concentration. Include and analysis as to how this may change over time as Avalon changes or otherwise optimizes its production process.

Avalon Response #5

The expected concentrations of all constituents contained in the tailings decant water to be released from the Tailings Management Facility (TMF) to Drizzle Lake and the downstream receiving environment are provided in the SGS (2011) Final Report (see Attachment 1). Specifically, Tables 24 and 25 in the SGS (2011) Final Report present analytical data for two

(2) samples of TMF tailings decant solution from the XPS Pilot Plant 1 and 2 (PP1 and PP2, respectively).

Each table presents the analysis of the fresh and aged tailings solutions (PP1 Tls Decant Day 5 and Day 60 and PP2 Tls Decant Day 5 and Day 61). As will be noted, the decant solution assays were determined on a "Total" basis and on a "Dissolved" basis. The dissolved analyses were made after filtering on a 0.45 micrometre filter.

As can also be noted, all values reported, including radionuclides and metals, are exceedingly low and typically several magnitudes below applicable MMER values. In particular, the concentrations of radionuclides measured were below the detection limit for the three radionuclide parameters measured. To facilitate review of the data presented, these tables have been reproduced in their entirety below.

Table 24: ICP-OES/MS Fresh and Aged Decant Solution Results – PP1 Tls

Parameter	Unit	*MMER	PP1 Tls Decant Day 5		PP1 Tls Decant Day 60	
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	---	0.02	---
^{228}Ra	Bq/L		0.3	---	< 0.3	---
^{210}Pb	Bq/L		< 0.1	---	< 0.1	---
General Analyses						
pH	units	6.0-9.5	8.20	---	8.16	---
Alkalinity	mg/L as $CaCO_3$		119	---	126	---
EMF	mV		284	---	207	---
Conductivity	µS/cm		617	---	662	---
TDS	mg/L		400	---	406	---
TSS	mg/L	15.00	14	---	< 2	---
Cl	mg/L		44	---	44	---
SO_4	mg/L		100	---	110	---
F	mg/L		4.43	---	4.46	---
TOC	mg/L		12.2	---	7.2	---
Metals Analyses			**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0022	0.0025	0.0019	0.0019
Ca	mg/L		43.7	40.0	41.2	40.9
Cu	mg/L	0.30	0.0023	0.0024	0.0012	0.0027
Fe	mg/L		0.570	0.025	0.025	< 0.002
K	mg/L		28.8	27.0	26.4	26.4
Mg	mg/L		9.14	8.15	8.56	8.43
Mn	mg/L		0.0788	0.0488	0.00808	0.00140
Na	mg/L		70.4	66.0	66.5	66.5
Ni	mg/L	0.50	0.0070	0.0066	0.0048	0.0046
Pb	mg/L	0.20	0.00060	0.00033	0.00051	0.00011
Se	mg/L		< 0.001	0.001	< 0.001	< 0.001
Si	mg/L		8.10	6.24	6.31	6.23
Th	mg/L		0.000694	0.000082	0.000385	0.000084
U	mg/L		0.00880	0.00836	0.00865	0.00863
Y	mg/L		0.00877	0.000376	0.000174	0.000091
Zn	mg/L	0.50	0.007	0.004	0.003	< 0.002

Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.

Source: SGS 2011

Table 25: ICP-OES/MS Fresh and Aged Decant Solution Results – PP2 Tls

Parameter	Unit	*MMER	PP2 Tls Decant Day 5		PP2 Tls Decant Day 61	
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	---	< 0.01	---
^{228}Ra	Bq/L		< 0.4	---	< 0.1	---
^{210}Pb	Bq/L		0.1	---	0.1	---
General Analyses						
pH	units	6.0-9.5	8.41	---	8.39	---
Alkalinity	mg/L as $CaCO_3$		148	---	154	---
EMF	mV		178	---	190	---
Conductivity	µS/cm		603	---	576	---
TDS	mg/L		354	---	371	---
TSS	mg/L	15.00	2	---	5	---
Cl	mg/L		63	---	68	---
SO_4	mg/L		29	---	31	---
F	mg/L		9.53	---	9.19	---
TOC	mg/L		17.1	---	11.0	---
Metals			**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0047	0.0048	0.0049	0.0049
Ca	mg/L		21.8	22.1	22.1	21.5
Cu	mg/L	0.30	0.0007	0.0027	0.0018	0.0018
Fe	mg/L		0.706	0.020	0.041	0.003
K	mg/L		37.0	36.8	39.6	38.4
Mg	mg/L		12.3	12.3	12.4	12.0
Mn	mg/L		0.0317	0.0240	0.0217	0.0216
Na	mg/L		74.5	74.8	77.3	73.5
Ni	mg/L	0.50	0.0068	0.0065	0.0061	0.0060
Pb	mg/L	0.20	0.00026	0.00011	0.00029	0.00008
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		8.19	4.70	4.88	4.63
Th	mg/L		0.00140	0.000193	0.000020	< 0.000004
U	mg/L		0.00784	0.00742	0.00698	0.00685
Y	mg/L		0.00436	0.000464	0.000512	0.000231
Zn	mg/L	0.50	0.002	0.003	< 0.002	< 0.002

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Source: SGS 2011

Reference:

SGS Canada Inc. 2011, August. Environmental Characterisation of Ore, Concentrate and Tailings from the Nechalacho Rare Earth Element Project – Phase 2. Prepared for Avalon Rare Metals Inc. Project 11806-007 – Final Report. August 30, 2011 (Replaces Interim Report of February 28, 2011).

MVEIRB Request #6

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

2. *Provide test results for substances that may leach from the concentrate that Avalon produces including levels of uranium, thorium, beryllium, any other radioactive element or minerals (regardless of level of radioactivity), as well as any other metals.*

The information need identified by the Review Board is as follows:

The Table of Concordance directs to Section 4.7.4 for this information, but this section does not contain relevant data or information relating to the concentrations of leachate expected from various substances. Section 4.7.3.1 does provide a reference to data contained in Appendix F for analysis of Shake Flask extraction results. The report does not identify which materials may be potential contaminants or evaluate the shake flask results. Please provide test results from a more robust investigation into the nature of effects to water quality from the parameters listed in this line item.

Avalon Response #6

In preparing its response to this item, Avalon acknowledges that the Table of Concordance should have directed the reader to Section 4.7.3 and more specifically 4.7.3.1, rather than to Section 4.7.4 for information on the mineralogical characterization of the concentrate, ore, tailings and waste rock. As noted by the MVEIRB, a very general discussion on the shake flask tests that were conducted is provided in this section, and the reader is directed to the SGS (2011) final report (see Attachment 1) for the detailed Shake Flask extraction results.

In hindsight, the Table of Concordance should also have directed the reader to Section 9.1.3 of the DAR, where the possible environmental effects associated with the accidental release of concentrate into Great Slave Lake from a barge are discussed in considerable detail.

Table 9.1-1 in this section, adapted from SGS (2011) presents the shake flask extraction results for the fresh concentrate produced from the pilot plant and provides a comparison with current MMER criteria. As can be noted, all values reported, including radionuclides and metals, are exceedingly low and at least two magnitudes below applicable MMER values. In particular, the concentrations of radionuclides measured were below the detection limit for the three radionuclide parameters measured (^{226}Ra, ^{228}Ra, and ^{210}Pb). To facilitate review of the data presented, Table 9.1-1 from the DAR is reproduced in its entirety below.

TABLE 9.1-1: SHAKE FLASK EXTRACTION RESULTS – CONCENTRATE			
Parameter	**Unit**	**MMER***	**PP1 Conc**
Initial pH	units		8.90
Final pH	units		8.80
Radionuclide Analyses			
^{226}Ra	Bq/L	0.37	< 0.01
^{228}Ra	Bq/L		< 0.3
^{210}Pb	Bq/L		< 0.1
General and Metals Analyses			
pH	units	6.0-9.5	7.78
F	mg/L		1.08
Cl	mg/L		2.0
Hg	mg/L		< 0.0001
As	mg/L	0.50	0.0019
Ca	mg/L		10.4
Cu	mg/L	0.30	0.0006
Fe	mg/L		0.014
K	mg/L		1.73
Mg	mg/L		1.53
Na	mg/L		4.56
Ni	mg/L	0.50	0.0004
Se	mg/L		< 0.001
Si	mg/L		2.65
Th	mg/L		0.000039
U	mg/L		0.00154
Zn	mg/L	0.50	0.004

*Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2022-222.

MVEIRB Request #7

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

Other Potential Pathways for Impacts to Water Quality

8. Describe effects to the local water table. Include a discussion of:

a. the immediate effects of de-watering or drawdown of Ring Lake and Buck Lake;

b. the long-term effects from a reduced local water table around the Ring Lake and Buck Lake area (the tailings management facility);

c. *the effects from groundwater loss through inflows to the underground mine;*

d. *any other mechanisms for groundwater loss to occur, as well as changes to groundwater flow regimes;*

e. *how the above changes may affect the refresh rates for Drizzle, Murky, Egg and Thor Lakes and other lakes in the vicinity of the mine site these changes may potentially affect;*

f. *how the above changes may contribute to changes in local permafrost and active layers; and*

g. *how the above changes may translate into surface water impacts, groundwater impacts or effluent water quality.*

The information need identified by the Review Board is as follows:

The input parameters used for the groundwater model, specifically hydraulic conductivity, do not reflect the full range of potential conditions at the mine site. High hydraulic conductivity values that were considered "not representative of bedrock at the depth of the deposit" were not used in the model and not considered in the sensitivity analysis. Additionally the current geologic and hydrogeologic analysis has not been conducted at a thorough enough scale to identify areas of potential higher groundwater inflows. The analysis of inflow does not consider the potential for higher inflows. Please provide the results of an analysis that incorporates these missing key points.

Avalon Response #7

Groundwater inflows to the underground mine have been estimated by Knight Piesold using a numerical model for a range of permeability values that were based on packer testing data. The range of permeability values used in the model (i.e., $4x10^{-9}$ m/s to $2x10^{-8}$ m/s) are deemed to be representative to slightly conservative of the existing conditions present around the deposit. To date no evidence of water bearing fractures/faults have been encountered that would justify the use of higher permeability values at depth in the mine. The lower permeability results noted by the Review Board (i.e., $1x10^{-7}$ m/s) were obtained from select near surface packer tests and are not applicable to the rock quality associated with the underground workings.

The results of the inflow modeling indicated that groundwater would flow downward as a response to underground mine dewatering. The major sources of water that will contribute to flows into the mine include recharge from precipitation and water from nearby surface water bodies including Thor Lake, Long Lake and Elbow Lake.

To assess the effects of mine dewatering, the flows from these different sources were partitioned in the numerical model and compared to the estimated flow into the lakes from runoff and precipitation. In each case, the loss of water from each lake was less than 10% of the inflow to the lake.

As stated in our response to item 3.2.4(f)., based on the work completed to date, no significant water bearing fractures or faults have been encountered in the vicinity of the mine workings and all investigations have shown very few regions of reduced rock mass quality with only some slightly lower RQD zones close to surface. The lower permeability results noted by the Review Board were obtained near surface and are not applicable to the rock quality associated with the underground workings. The rock mass quality increases significantly with depth. The previously discussed results and conclusion are supported by reports from past mining in the T Zone, where it was reported that "there was little to no water incursion into the mine workings" (Trueman 2010).

During mine development, the chance of high, long-term groundwater inflows resulting from a higher permeability zone, although not expected, can be reduced during advancement of the ramp. Further investigations will be undertaken in advance of the face during ramp development to avoid potentially high groundwater inflows. Should higher than manageable flows be observed during the investigation, the area can be grouted prior to advancing the ramp through the area.

During the closure and post closure period, the underground workings will be allowed to flood. It is estimated that 95% of the void space of the underground mine will be filled with paste backfill and the remaining space flooded with groundwater.

Reference:

Trueman, D.L. 2010. Mining of the T Zone, Thor Lake, NWT. Letter from D.L. Trueman of Trace Engineering, Richmond, B.C. to D. Swisher of Avalon Rare Metals Inc., dated February 3, 2010.

MVEIRB Request #8

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

Pine Point

Potential Pathways for Impacts to Water Quality from Project Components

At the Pine Point processing site, Avalon proposes to deposit tailings into a porous pit and use a second pit to hold supernatant water – this requires thorough analysis. For the locally impacted watershed and downstream water bodies of the Pine Point processing site (up to, and including a reasonable local area after, the confluence with Great Slave Lake):

12. Describe impacts to water quality from the following sources:

a. the water quality resulting from processing concentrate, including an analysis of pathways and destinations for reagent chemicals, process byproducts, hydrocarbons, sludge, incinerator residue, explosives, greywater constituents and any other potentially hazardous products used at the project site that enter the water treatment stream.

The information need identified by the Review Board is as follows:

Although the pathways are generally described, the water quality parameters for the listed constituent streams are not reported in the DAR.

A comprehensive analysis of the water quality coming out of the Hydrometallurgical process plant is required. Please provide expected concentrations of all constituents Avalon will discharge into the L-37 tailings facility (HMF).

Avalon Response #8

Section 4.8.3.1 of the DAR provided a general description of the composition of the proposed Hydrometallurgical Plant tailings. As indicated, the Hydrometallurgical tailings properties will consist of solids from the proposed milling process made up predominantly of gypsum (approximately 85%) with some leach residue (approximately 6%) and miscellaneous other solids (approximately 9%) and are expected to be similar to phosphogypsum tailings in terms of void ratio, dry densities and consolidation properties.

As a result of Avalon's decision to complete the processing of the rare metals products produced at the Pine Point Hydrometallurgical facility at another processing plant to be located in the south, the previously identified leach residue will no longer be produced at the Pine Point Hydrometallurgical Plant site.

More specifically all of the acid-baked residue will be shipped south and there will be no leach residue in the hydrometallurgical tailings that will be directed to the L-37 Pit. In addition, the split plant will also result in the production of less hydrometallurgical tailings, probably less than 100,000 t/a, compared to the 171,000 t/a quantity provided in the DAR. However, to be conservative in the assessment, it was decided to leave the higher, more conservative quantity in the DAR.

Regarding the anticipated concentrations of the constituents present in the hydrometallurgical tailings that will be directed to the L-37 Pit (HTF), Table 6.5-6 in the DAR summarizes the chemical properties of the water component of the tailings solution based on test work completed by SGS (2011). This table is re-presented as follows.

TABLE 6.5-6: SOLUTION ANALYSIS RESULTS – HYDROMET SOLUTIONS			
Parameter	**Unit**	**MMER***	**CH-WT1 PLS +Wash Simulated Hydromet Tls Filtrate**
Radionuclide Analyses			
^{226}Ra	Bq/L	.37	0.10
^{228}Ra	Bq/L		<0.2
^{210}Pb	Bq/L		<0.1
General Analyses			
pH	Units	6.0-9.5	7.73
Alkalinity	mg/L as $CaCO_3$		118
EMF	mV		214
Conductivity	µS/cm		13,400
TDS	mg/L		16,800
TSS	mg/L	15.00	---
Cl	mg/L		55
SO4	mg/L		11,000
F	mg/L		1.82
TOC	mg/L		53.9
NH_3+NH_4	as N mg/L		91.7
Metal Analyses			**Diss**
Hg	mg/L		<0.0001
As	mg/L	.50	0.0022
Ca	mg/L		393
Cu	mg/L	.30	0.0226
Fe	mg/L		0.150
K	mg/L		86.8
Li	mg/L		2.18
Mg	mg/L		1,530
Mn	mg/L		6.15
Na	mg/L		1,580
Ni	mg/L	.50	0.0701
Pb	mg/L	.20	0.00052
Se	mg/L		0.005
Si	mg/L		2.47
Sr	mg/L		11.2
Th	mg/L		0.002945
U	mg/L		0.0239
Zn	mg/L	.50	<0.002

*Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2022-222.

A comparison of the projected chemical properties of the HTF tailings water with the historically documented groundwater quality results shows that the concentrations of all metals parameters in the tailings water will be well below the applicable MMER criteria and lower than or within the same range of concentrations for these parameters in the existing groundwater of the area. In particular, the concentrations of arsenic, mercury, iron, lead and zinc are expected to be lower, and the concentrations of copper and nickel will be within the same range as existing conditions.

The pH of the tailings water is expected to be slightly above neutral (7.7), while conductivity, sodium, chloride and other parameters that contribute to water hardness, including calcium, magnesium and sulphate will be elevated compared to current background conditions.

However, these elevated levels are expected to rapidly diffuse and dilute to natural background values within the Presqu'ile Formation. The radionuclide parameters including ^{226}Ra, ^{228}Ra and ^{210}Pb are all expected to be at or below detection limits.

As previously stated in Section 4.8.3.1 of the DAR, the principle objective of the HTF design is to ensure protection of the environment during operations and in the long-term (after closure) to achieve effective reclamation. The design takes into account the following requirements:

- Permanent, secure and total confinement of all tailings solids within an historic open pit with adequate capacity and stability;
- Removal of excess supernatant water from the HTF for infiltration into the Presqu'ile aquifer through the N-42 historic open pit; and
- Inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and that design criteria and assumptions are met.

Since the projected concentrations of all of the parameters of potential concern will be lower than or within the range of existing groundwater quality conditions, the anticipated effects on groundwater quality in the Pine Point area are expected to be insignificant.

MVEIRB Request #9

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

See the previously described Terms of Reference.

The information need identified by the Review Board is as follows:

Track and account for all inputs that may affect water quality – including but not limited to concentrate and its constituent minerals and elements, as well as reagents – from discharge into the L-37 tailings facility (HTF) to the point of discharge from the L-37 tailings facility (HTF), as well as justify downstream concentrations going into the N-42 pit and beyond the N-42 pit discharge point. According to the criteria listed in section 3.3.1 of the ToR, demonstrate how the L-37 tailings facility (HTF) functions to produce the downstream concentrations Avalon presents in the DAR at the N-42 pit point of discharge and beyond the N-42 pit discharge point. Include and analysis as to how this may change over time as Avalon changes or otherwise optimizes its production process.

Avalon Response #9

As discussed in Section 4.8.3.1 of the DAR, and as noted in the response to the previous question, the hydrometallurgical plant tailings stream will initially be directed into the L-37 tailings facility (HTF) where the solids component of the tailings will settle. As part of the design of the HTF, a temporary separator dyke will be installed near the northern side of the pit (see Figure 4.8-3 in the DAR). This dyke will allow supernatant water to collect in the northern portion of the pit and northward sloping tailings to cover the remainder of the pit bottom.

Excess supernatant water collected in the northern portion of the L-37 pit, will then be pumped by pipeline to the N-42 historic open pit for infiltration into the Presqu'ile aquifer. As was noted in response to the previous question, a comparison of the projected chemical properties of the tailings water with the historically documented groundwater quality results shows that the concentrations of all metals parameters in the HTF tailings water will be well below the applicable MMER criteria and lower than or within the same range of concentrations for these parameters in the existing groundwater of the area. In particular, the concentrations of arsenic, mercury, iron, lead and zinc are expected to be lower, and the concentrations of copper and nickel will be within the same range as existing conditions.

The pH of the tailings water is expected to be slightly above neutral (7.7), while conductivity, sodium, chloride and other parameters that contribute to water hardness, including calcium, magnesium and sulphate will be elevated compared to current background conditions.

However, these elevated levels are expected to rapidly diffuse and dilute to natural background values within the Presqu'ile Formation. The radionuclide parameters including ^{226}Ra, ^{228}Ra and ^{210}Pb are all expected to be at or below detection limits.

As previously stated in Section 4.8.3.1 of the DAR, the principle objective of the HTF design is to ensure protection of the environment during operations and in the long-term (after closure) in order to achieve effective reclamation. The design takes into account the following requirements:

- Permanent, secure and total confinement of all tailings solids within an historic open pit with adequate capacity and stability;
- Removal of excess supernatant water from the HTF for infiltration into the Presqu'ile aquifer through the N-42 historic open pit; and
- Inclusion of monitoring features for all aspects of the facility to ensure performance goals are achieved and that design criteria and assumptions are met.

Since the projected concentrations of all of the parameters of potential concern will be lower than or within the range of existing groundwater quality conditions, the anticipated effects on groundwater quality in the Pine Point area are expected to be insignificant.

MVEIRB Request #10

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

c. runoff from the sulphur storage area.

The information need identified by the Review Board is as follows:

Please indicate how Avalon will manage water runoff from the sulphur storage area and how this may affect the water quality Avalon will discharge from the hydromet facility.

Avalon Response #10

Elemental sulphur needed for the Hydrometallurgical Plant will be shipped in a solid form (lump or prill) by train and truck to the plant site located at Pine Point. At the Hydrometallurgical Plant site, the sulphur will be stored under cover on a concrete storage pad. As a result, the sulphur product will not come in contact with water, will not produce water runoff and will not affect the local groundwater quality.

MVEIRB Request #11

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

> *f.* *the tailings management facility (or facilities) supernatant water quality and quantity due to inputs to the facility from points 12a through 12f, as well as due to leachate from the tailings. On this matter, Avalon must give particular attention to uranium, thorium and beryllium levels in supernatant water – in addition to any other radioactive minerals/materials regardless of level of radioactivity, and any other metals or substances of concern. Include analysis of percent water content of tailings.*

The information need identified by the Review Board is as follows:

A single analysis of simulated Hydromet filtrate solution is not adequate to anticipate likely contaminants and concentrations from the Hydrometallurgical Plant Site.

Avalon Response #11

Avalon recognizes that a single simulated Hydrometallurgical Plant solution was used as the basis for determining the likely concentrations of chemical parameters that are anticipated to characterize the hydrometallurgical tailings. However, Avalon is confident that the tailings solution characterization provided will be representative of the worst case scenario of the final anticipated tailings stream and is entirely adequate for the purposes of the assessment conducted in the DAR, based on the conservative approach taken by Avalon.

MVEIRB Request #12

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

See the previously described Terms of Reference.

The information need identified by the Review Board is as follows:

Please provide test results from a more robust investigation into the nature of effects to water quality from all parameters listed in this line item.

Avalon Response #12

With respect, Avalon is of the view that the previously provided responses address this matter and Avalon is confident that the anticipated effects of supernatant infiltration into the Presqu'ile aquifer on groundwater quality in the Pine Point area will be insignificant as predicted in the DAR.

MVEIRB Request #13

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

See the previously described Terms of Reference.

The information need identified by the Review Board is as follows:

For the HMF, beryllium is not considered in the analysis of water quality impacts nor analyzed in the simulated filtrate solution. Please provide this analysis for the HMF tailings as requested in the ToR.

Avalon Response #13

Beryllium was not specifically considered in the analysis of water quality impacts for several reasons. Firstly, as indicated in Avalon's Commitment No.18 in the List of Commitments provided in the DAR, "there will not be any Beryllium produced from the operations."

Secondly, the mineralization in the Nechalacho deposit has no significant beryllium (Be) concentrations. The beryllium content in the Nechalacho ore and host rock is of the same order of magnitude as the average crustal abundance of beryllium and there is no statistical correlation (increase) of beryllium with rare earths or zirconium in the Nechalacho deposit.

Thirdly, as indicated in the Appendix tables to the SGS (2011) report (Pages 79-82 of Attachment 1), the concentrations of beryllium present in the shake flask leach test results for tailings, ore and concentrate were generally measured to be at or below the detection limit of <0.0002 mg/l. This very low concentration is comparable to the concentration of beryllium measured in Thor Lake water, which is also presented in the Appendix tables.

MVEIRB Request #14

The original Terms of Reference (MVEIRB 2011a) for this item was as follows:

6. *Conduct a best-practice risk assessment for the project, exploring the potential for events listed in points 1 through 5. Discuss systems, components, hazards and associated failure modes. The developer will assess likelihood and severity of each risk identified from the points 1-5 [in this section].*

The information need identified by the Review Board is as follows:

A best practice risk assessment is required in this section particularly for the events listed in points 1-5 in this section. This information has not been provided in the DAR. Please provide a risk assessment for the project including likelihood and severity of each potential accident and malfunction event described in points 1-5.

Avalon Response #14

As requested by the Review Board, Avalon has completed a Failure Mode and Effects Analysis (FMEA) or best practices risk assessment for the Project, based on the potential for events listed in Section 9.0 (Accidents and Malfunctions) of the DAR. The analysis is provided as Attachment 3 to this Deficiency Response document.

ATTACHMENTS

Attachment 1: Environmental Characterization of Ore, Concentrate and Tailings From the Nechalacho Rare Earth Element Project – Phase 2. Report prepared by SGS Canada Inc. for Avalon Rare Metals Inc. August 30, 2011.

Attachment 2: Mining of the T Zone, Thor Lake, NWT. Letter from Trace Engineering to Avalon Rare Metals Inc. February 3, 2010.

Attachment 3: Failure Modes and Effects Analysis

Attachment 1

TRACE Engineering
5360 Bunting Ave,
Richmond, BC
V7E 5WI

February 3, 2010

D. Swisher,
Avalon Rare Metals Inc.
330-6165 Hwy. 17
Delta, BC
V4K 5B8

RE: Mining of the T Zone, Thor Lake, NWT

Dear Sir,

During the course of mining of the T Zone, there was little or no water incursion into the mine workings. The summertime period during which the mining was undertaken is, and was, normally dry for the area and there was little or no runoff water entering the workings either.

The decline, nominally at 3 by 4 metres and a 15% grade, was engineered to pick up as many drill holes as possible during its development. All drill holes had been cemented and these were also found to be tight.

The consensus at the time was that essentially all of the water in the workings was introduced by the operations, mostly through drilling of the blast holes.

It is also noteworthy that there was no screening or, to my memory, rock bolting, save for that with strapping, at the brow of the decline. The back stood freely and required little monitoring or scaling.

I paid particular interest to these aspects at the time because the rocks were not dissimilar to those at the TANCO mine and, at the time of my work there, there were several studies underway in the area (WNRE, Pinawa), evaluating underground nuclear waste disposal where water incursion and rock mechanics were of major import.

Yours truly

D.L. Trueman, Ph.D, P.Geo

Attachment 2

An Investigation into

ENVIRONMENTAL CHARACTERISATION OF ORE, CONCENTRATE AND TAILINGS FROM THE NECHALACHO RARE EARTH ELEMENT PROJECT – PHASE 2

prepared for

AVALON RARE METALS INC.

Project 11806-007 – Final Report

August 30, 2011

(Replaces Interim Report of February 28, 2011)

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Executive Summary

SGS was contracted by Avalon Rare Metals Inc. (Avalon) to complete environmental characterisation of ore, concentrate and tailings from the Thor Lake Nechalacho project in the Northwest Territories. The purpose of the environmental test program was to assess the geochemical, acid rock drainage (ARD), contaminant release potential and geotechnical characteristics associated with the Avalon products. Environmental tests were conducted on head, tailings and concentrate samples from the locked cycle test (LCT) flotation project (SGS Project Reference No. 12390-001) and Xstrata Process Support (XPS) pilot plants. Solution samples from the hydrometallurgical test program (SGS Project Reference No. 11806-005), Thor Lake water samples shipped to SGS facilities by Avalon and tap water samples shipped to SGS facilities from XPS and Ortech were also included in the environmental test program. For completeness, summary results of the modal analyses from the mineralogical examinations completed on these samples are also included in this report (SGS Mineralogy Reference No's. MI5004-SEP10, MI5006-SEP10, MI5001-NOV10, MI5042-NOV10 and MI5041-DEC10).

Results of the modal analyses completed during the mineralogical examinations (QEMSCAN®) determined that the Thor Lake head (*Head 1, Head 2, Head 3, PPX Head* and *PP2 Head)* and tailings samples (*F25 Tls, F28 Tls, F29 Tls, F30 Tls, F33 Tls, F36 Tls, F37 Tls, PP1 Tls* and *PP2 Tls*) were comprised primarily of gangue minerals including plagioclase, biotite, quartz, K-feldspar, Fe-oxides and muscovites/clays. Minor to trace amounts of zircon and rare earth element (REE) minerals were also evident. As expected, the concentrate samples (*F25 Conc, F33 Conc, F36 Conc, F37 Conc* and *PP1 Conc*) typically reported considerably lesser levels of gangue minerals and significantly increased amounts of zircon and REE minerals (columbite-(Fe), fergusonite, bastnaesite, synchysite, allanite and monazite). While only trace levels of neutralising carbonates were reported in the tailings samples; increased carbonate concentrations were reported in the head and concentrate samples. Only trace levels of sulphide minerals were reported.

Whole rock and inductively coupled plasma-optical emission spectroscopy/mass spectroscopy (ICP-OES/MS) elemental analyses confirmed the primarily silicate composition of the Nechalacho samples. With the exception of the *MC3* ore composite, the high loss on ignition (LOI) values determined for the head and concentrate samples suggests significant amounts of volatile species (e.g. hydrates, hydroxides and carbonates) are present in these samples. The low LOI values reported for the tailing samples, however; indicate that little of these species remain in the tailings.

While the Nechalacho solids samples (head, tailings and concentrates) typically reported only low levels of radionuclides, increased radionuclide concentrations were reported in the concentrate samples in comparison to the head and tailings samples.

Analysis of the Thor Lake head, tailings and concentrate shake flask extraction leachates, Thor Lake water, XPS and Ortech tap waters, fresh and aged pilot plant tailings decant solutions and simulated hydromet solutions (before and after radium treatment) reported all parameters controlled by the Canadian Metal Mining Effluent Regulations (MMER), including ^{226}Ra, at concentrations well within the designated limits. Acute lethality testing of the initial pilot plant tailings decant solution *(PP1 Tls Decant Day 5)* resulted in the non-lethal designations for both rainbow trout and *Daphnia magna*.

Modified acid base accounting (ABA) test results for the heads and concentrates indicated that these samples are potentially acid neutralising (PAN). Similarly, the very low sulphide concentrations reported for the tailings samples, coupled with the high carbonate (CO_3) NP/AP ratios, indicate that these samples are highly unlikely to generate acidity. The alkaline final pH values reported after aggressive oxidation of the samples during net acid generation (NAG) testing confirmed the non-acid forming nature of these samples.

Analysis of the humidity cell leachates (*F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls, PP2 Tls, Master Conc* and *PP1 Conc*) reported near neutral to slightly alkaline pH values and all MMER controlled parameters well within their respective limits in all test cells. After twenty weeks of leaching, the cumulative sulphide and related CO_3 NP depletion rates determined for all 8 of the humidity cell test samples suggest that the sulphide minerals in these samples are depleting at significantly faster rates than the carbonate minerals.

Particle size distribution analyses indicated that the head samples were comprised primarily of sand sized grains. Only minor fractions of the samples were classified as fines. In comparison, the concentrates and tailings and tailings showed a much finer particle size distribution with the majority of the samples being classified as fines.

Although liquid limits were determined for the *Master Tls, PP1 Tls* and *PP2 Tls* samples, all three samples were found to be non-plastic. This behaviour is typical of cohesionless inorganic silt or rock flour type samples. The low maximum wet and dry densities and midrange optimum moisture contents reported during standard Proctor test completed on the *PP1 Tls* and *PP2 Tls* samples are also characteristic of silt or rock flour type materials. Hydraulic conductivity testing completed on compacted *Master Tls, PP1 Tls* and *PP2 Tls* samples reported semi-pervious hydraulic conductivities corresponding to that which would be expected from very fine sand or silt type soils.

Results of the settling tests indicated that the *PP1 Tls* and *PP2 Tls* will settle fairly quickly in a tailings pond setting. The addition of drainage to the settling tests resulted in significantly improved settling rates and moderate increases to the final % solids reported by the samples.

Introduction

SGS was contracted by Avalon Rare Metals Inc. (Avalon) to complete environmental characterisation of ore, concentrate and tailings from the Thor Lake Nechalacho project in the Northwest Territories. Environmental tests were conducted on products (heads, concentrates and tailings) from the locked cycle test (LCT) flotation program (SGS Project Reference No. 12390-001) and from the Xstrata Process Centre (XPS) pilot plants. Solution samples from the hydrometallurgical test program (SGS Project Reference No. 11806-005), a Thor Lake water sample shipped to SGS facilities by Avalon and tap water samples shipped to SGS facilities from XPS and Ortech were also included in the environmental test program. For completeness, summary results of the modal analyses from the mineralogical examinations completed on these samples are also included in this report (SGS Mineralogy Reference No's. MI5004-SEP10, MI5006-SEP10, MI5001-NOV10, MI5042-NOV10 and MI5041-DEC10).

The test program was designed in consultation with Mr. Bill Mercer (Avalon) and Mr. John Goode (Consulting Metallurgist for Avalon). The purpose of the environmental test program was to assess the geochemical, acid rock drainage (ARD), contaminant release potential and geotechnical characteristics associated with the Avalon products.

The following report, which replaces an Interim Report dated February 28, 2011, provides a summary of the environmental testwork completed and the results thereof.

Barbara A. Bowman
Senior Technologist, Environmental Testing

Robert J. Caldwell
Group Leader, Environmental Testing

Scope of Work

The scope of test work completed on the ore, flotation concentrate, flotation tailings and solution samples included:

- Modal analysis (mineralogical examination) - only the modal analyses are included in this report, complete mineralogy results are covered in separate stand alone mineralogical reports - (SGS Mineralogy Reference No's. MI5004-SEP10, MI5006-SEP10, MI5001-NOV10, MI5042-NOV10 and MI5041-DEC10)).
- Quantitative X-ray diffraction (XRD) analyses.
- Borate fusion X-ray fluorescence (XRF) whole rock analyses.
- Radionuclide analyses of the sample solids.
- Inductively coupled plasma-optical emission spectroscopy/mass spectroscopy (ICP-OES/MS) strong acid digest elemental analyses.
- Shake flask extraction testing (SFE).
- Modified acid base accounting (ABA).
- Net acid generation (NAG) testing.
- Analysis of the lake water, tap water and hydromet filtrate solutions.
- Analysis of the fresh and aged pilot plant tailings decant solutions.
- LC_{50} acute lethality testing of *Daphnia magna* and rainbow trout – tailings decant solutions.
- Particle size distribution (PSD) by sieve and hydrometer (ASTM D 422-63 (2007)).
- Particle size distribution by Malvern laser.
- Atterberg limits (ASTM D 4318-05).
- Standard and drained settling tests.
- Standard Proctor (ASTM D 698-07e1).
- Hydraulic conductivity testing (ASTM D 5084) at standard Proctor effort.

For ease of reference, the individual scope of testwork completed on the Avalon samples is summarised in Table 1.

Table 1: Scope of Work

Sample Identifier	**Modal Analyses**	**XRD Analyses**	**Whole Rock Analyses**	**Radionuclide Analyses**	**ICP**	**Shake Flask Extractions**	**Ageing Test**	**LC_{50} Toxicity Testing**	**Solution Analyses**	**Modified ABA**	**NAG**	**Humidity Cell**	**PSD (sieve, hydrometer +SG)**	**Malvern Laser PSD**	**Atterberg Limits**	**Standard Proctor**	**Hydraulic Conductivity**	**Standard + Drained Settling Tests**
Master Comp 3			X	X	X	X				X	X		X					
Avalon Head Sample 1	X		X	X	X	X				X	X		X					
Avalon Head Sample 2	X		X	X	X	X				X	X		X					
Avalon Head Sample 3	X		X	X	X	X				X	X		X					
XPS PP Comp 2 Head	X		X	X	X	X				X	X		X					
XPS PP Comp 3 Head	X		X	X	X	X				X	X		X					
F25 Comb Tls	X		X	X	X	X				X	X		X					
F28 Comb Tls	X		X	X	X	X				X	X		X					
F29 Comb Tls	X		X	X	X	X				X	X		X					
F30 Comb Tls				X	X													
F33 Comb Tls	X		X	X	X	X				X	X	X	X					
F36 Comb Tls	X		X	X	X	X				X	X	X	X					
F37 Comb Tls	X		X	X	X	X				X	X	X	X					
Master Tls			X	X	X	X				X	X	X	X		X		X	
XPS PP Comp 1 Tls	X		X	X	X	X	X	X		X	X	X	X		X	X	X	X
XPS PP Comp 2 Tls	X		X	X	X	X	X			X	X	X	X		X	X	X	X
Ro Tls Decant (red water solids)		X			X									X				
F25 Mozley Conc	X				X													
F28 Conc Blend				X	X													
F29 Conc Blend				X	X													
F30 Conc Blend				X	X													
F33 Mozley Conc Comp	X		X	X	X	X				X	X		X					
F36 Mozley Conc Comp	X		X	X	X	X				X	X		X					
F37 Mozley Conc Comp	X		X	X	X	X				X	X		X					
Master Conc			X	X	X	X				X	X	X	X					
XPS PP Comp 1 Conc	X		X	X	X	X				X	X	X	X					
Thor Lake Water #4									X									
Thor Lake Water #7									X									
XPS Tap Water 14-JAN-11									X									
Ortech Tap Water									X									
CH-WT1 PLS + Wash									X									
RAR-1 Filtrate									X									

Sample Descriptions, Preparation and Test Methods

The following sections provide brief overviews of the samples received, sample preparation and test methods included in the environmental characterisation program.

1. Sample Descriptions

Descriptions of the various head, flotation concentrates and tailings samples received are summarised in Table 2. The solution samples received are shown in Table 3.

Table 2: Thor Lake Nechalacho Samples Received

Received Sample ID	Reporting Sample ID	Description
Heads		
Master Comp 3	MC3 Head	F25, F28, F29 + F30 Head
Avalon Head Sample 1	Head 1	F33 Head
Avalon Head Sample 2	Head 2	F36 Head
Avalon Head Sample 3	Head 3	F37 Head
XPS PP Comp 2 Head	PPX Head	XPS MPPX
XPS PP Comp 3 Head	PP2 Head	XPS MPP Run 2 Head
Tailings		
F25 Comb Tls	F25 Tls	MC3 Tails
F28 Comb Tls	F28 Tls	MC3 Tails
F29 Comb Tls	F29 Tls	MC3 Tails
F30 Comb Tls	F30 Tls	MC3 Tails
F33 Comb Tls	F33 Tls	Head 1 Tails
F36 Comb Tls	F36 Tls	Head 2 Tails
F37 Comb Tls	F37 Tls	Head 3 Tails
Master Tls	Master Tls	Combined F25, F28, F29 + F30 Tails
XPS PP Comp 1 Tls	PP1 Tls	XPS MPP Run 1 Tails
XPS PP Comp 2 Tls	PP2 Tls	XPS MPP Run 2 Tls (XPS Comp 3 used for MPP2 as per J. Goode)
Concentrates		
F25 Mozley Conc	F25 Conc	MC3 Concentrate
F28 Conc Blend	F28 Conc	MC3 Concentrate
F29 Conc Blend	F29 Conc	MC3 Concentrate
F30 Conc Blend	F30 Conc	MC3 Concentrate
F33 Mozley Conc Comp	F33 Conc	Head 1 Concentrate
F36 Mozley Conc Comp	F36 Conc	Head 2 Concentrate
F37 Mozley Conc Comp	F37 Conc	Head 3 Concentrate
Master Conc	Master Conc	Combined F25, F28, F29 + F30 Concentrates
XPS PP Comp 1 Conc	PP1 Conc	XPS MPP Run 1 Concentrate

Note: Tailings and concentrate samples came from various flotation tests and pilot plant runs.
XPS refers to Xstrata Process Support which did pilot plant flotation work on Avalon material
Note: XPS is Xstrata

Table 3: Solution Samples Received

Received Sample ID	Origin of Sample
Thor Lake Water #4	One of several drums sent to SGS for testwork
Thor Lake Water #7	One of several drums sent to SGS for testwork
XPS Tap Water 14-JAN-11	Sudbury tap water used in testwork at XPS
Ortech Tap Water	Mississauga tap water used to grind ore used in XPS pilot plant
CH-WT1 PLS + Wash	simulated end product from the hydromet program
RAR-1 Filtrate	simulated end product from the hydromet program after Ra removal by addition of $BaCl_2$, $Fe_2(SO_4)_3.5H_2O$, pH adjusted to 7
Avalon Ro Tls (Red Water)	Solution decanted from PP1 Tls
XPS Comp 2 Tls Decant Water (Final Tls Decant)	Solution decanted from PP2 Tls

Note: Thor Lake water collected from below lake surface.

2. Sample Preparation

Upon receipt, the XPS pilot plant tailings samples (*PP1 Tls* and *PP2 Tls*), which were received as very thick pulps, were recombined with enough of their respective solutions to generate slurries that were approximately 30% solids. The reconstituted pilot plant tailings and as-received *PP1 Conc* sample were subsequently mixed for 1 hour at 200 rpm to ensure all solids were thoroughly recombined prior to the extraction and filtration of the solids on #1 Whatman filter papers. Representative portions of the resultant filter cake solids and of the head, tailings and concentrate samples from project 12390-001, which were received as dry solids, were prepared for the proposed geochemical and geotechnical testwork and analyses according to SGS Standard Operating Procedures and the individual test method protocols. The remainder of the tailings pulps were allowed to settle (5 days) prior to the majority of the supernatant being decanted. Aliquots of these day 5 solutions were preserved and submitted for analysis, while the reminder of the decanted solutions were reserved for solution ageing test analyses which were subsequently completed on days 60 and 61.

3. Test Methods

The following sections provide a brief overview of the test methods included in the environmental characterisation program.

3.1. Modal Analysis

QEMSCAN provided the modal estimate of the main mineral species within the samples included in this report.

3.2. Qualitative X-ray Diffraction Analyses

During metallurgical work, it was observed that tailings water from some samples had a reddish hue due to a small amount of suspended solids. A sample of water was filtered and a representative portion of the

Ro Tls Decant (red water solids) sample was submitted for qualitative XRD analyses in order to identify the bulk mineralogy, crystalline species present and the relative proportions of the mineral phases. In this method, x-rays are used to bombard a powdered sample. The x-rays, which penetrate a very thin layer of the sample, are diffracted by lattice planes of minerals. These unique diffraction patterns were used to semi-quantitatively identify the minerals contained within the sample.

3.3. X-ray Fluorescence Whole Rock Analyses

Whole rock analyses were completed on the samples using an XRF method in order to determine the elemental concentrations of the major rock forming constituents. This method quantifies major elements present and reports them as oxides to permit a mass balance assessment against the component of a sample that is amenable to oxidization (loss on ignition).

3.4. Radionuclide Analyses

Representative test charges of the Nechalacho sample solids were analysed for radionuclide content. Radionuclide analyses, which were subcontracted to Becquerel, included ^{226}Ra, ^{228}Ra and ^{210}Pb.

3.5. ICP-OES/MS Strong Acid Digest Elemental Analyses

The samples were digested using an acid mixture of HNO_3, HF, $HClO_4$, and HCl to obtain a near total digest of the parameters being analysed. ICP-OES/MS trace metal scans were performed to provide quantitative analyses of the elemental components of the sample material. Analyses requested included: Cl, F, Ag, Al, As, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Hg, K, Li, Mg, Mn, Mo, Na, Ni, P, Pb, Sb, Se, Si, Sn, Sr, Th, Ti, Tl, U, V, Y, Zn and Zr. The rare earth elements of Ce, Dy, Er, Eu, Ga, Gd, Hf, Ho, La, Lu, Nb, Nd, Pr, Sc, Sm, Ta, Tb, Tm and Yb were also included in the analytical suite. Mercury analyses were completed by cold vapour atomic absorption spectroscopy (CVAAS).

3.6. Shake Flask Extraction Testing

The shake flask extraction is used to determine the mobility of contaminants under the chemical environment dictated by the samples intrinsic properties. Deionised (DI) water leachant was added to the samples at a 3:1 liquid to solid ratio. The samples were rotated end over end at 29 ± 2 rpm for a period of 24 hours prior to being filtered through a 0.45 µm cellulose acetate membrane filter. The resultant filtrates were submitted for radionuclide and dissolved metals analyses utilising the aforementioned analytical suite of parameters.

3.7. Solution Analyses – Lake Water, Tap Water and Hydromet Solutions

ICP-OES/MS elemental analyses were completed as per the aforementioned suite of parameters on the Thor Lake water, XPS and Ortech tap waters and simulated final hydromet filtrate solutions (before and after radium removal by the addition of $BaCl_2$ and $Fe_2(SO_4)_3{\bullet}5H_2O$) to provide quantitative analysis of the total and/or dissolved elemental components and to aid in the identification of elements present at potential environmentally significant concentrations.

3.8. Analysis of the Fresh and Aged Pilot Plant Tailings Decant Solutions

The tailings supernatants, which were initially decanted from the settled tailings slurries, were aged and analysed after defined time periods. The objective of this testing was to identify changes in the sample supernatant over time, and quantify elemental concentrations that may report to surface or ground water systems in a tailings pond setting. Both the fresh and aged solutions were collected and submitted for chemical analysis of the following parameters: pH, TOC, alkalinity, acidity, conductivity, E_H (EMF), TDS, TSS, anions (Cl, F, SO_4, NO_2, NO_3 and PO_4), thiosalts and ammonia (NH_3 and NH_4). Total and dissolved metal analyses and radionuclide analyses were also completed as per the previously noted suite of parameters.

3.9. LC_{50} Acute Lethality Testing of *Daphnia Magna* and Rainbow Trout

Acute lethality testing was completed to determine the concentration of the *PP1 Tls Decant Solution* in which 50% of *Daphnia magna* exposed would die after 48 hours (the LC_{50}). Rainbow trout LC_{50} testing similarly determined the concentration of effluent at which 50% of the trout exposed would die after 96 hours. The test organisms (*Daphnia magna* or rainbow trout) were exposed to the full-strength filtrate solution and at least four geometrically more dilute (for example, 50%, 25%, 12.5%, and 6.3%) concentrations of the effluent. The LC_{50} values were then statistically estimated. Control tests of the dilution water were run parallel to the tests. Testwork was conducted according to the *Daphnia magna* Acute Lethality Toxicity Test Protocol EPS 1/RM/14 and the Acute Lethality of Liquid Effluents to Fish EPS 1/RM/13 protocols from Environment Canada. These tests were subcontracted to Aquatox Testing and Consulting Inc.

3.10. Modified Acid Base Accounting

The modified ABA test provided quantification of the total sulphur, sulphide sulphur, and sulphate concentrations present and the potential acid generation (AP) related to the oxidation of the sulphide sulphur concentration. The test method determined the neutralisation potential (NP) of the sample by initiating a reaction with excess acid and then identified the quantity of acid neutralized by the samples NP by back-titrating to pH 8.3 with NaOH. The balance between the AP and NP assists in defining the potential of the sample to generate acid drainage. In addition, quantification of the extent of carbonate mineral content permitted calculation of the theoretical carbonate NP.

3.11. Net Acid Generation Testing

NAG tests were conducted to determine the balance between the acid consuming and acid producing components of the Thor Lake products. The NAG test initiated a reaction between the sample and concentrated hydrogen peroxide in order to force complete oxidation and reaction of the acidity produced with the neutralising minerals present within the sample. After the reaction ceased, the pH of the solution was measured (NAG pH). The acid remaining after the reaction was titrated with standardized NaOH to pH 4.5 and the net acid generated by the reaction was calculated and expressed in units of kg H_2SO_4 equivalent per tonne. The $NAG_{4.5}$ value is indicative of the contribution from free acid, Al and Fe. Titration from pH 4.5 to pH 7.0 can provide additional information for sample characterisation as, under certain conditions, the $NAG_{7.0}$ is indicative of the presence of metallic ions that consume alkalinity over this pH range, such as Cu and Zn.

3.12. Humidity Cell Testing – ASTM D 5744-96 (2001)

The humidity cell test is used to predict the potential for acidic leachate generation and the primary rates of reaction under aerobic weathering conditions. Following the standard ASTM D5744-96 (2001) method, humidity cell tests were initiated on the tailings and concentrate samples at the as-received particle size in test cells with dimensions of 20.3 cm (8") ID by 10.2 cm (4") height. A perforated disk was located approximately 12.5 mm (1/2") above the cell bottom to support the solid sample. A filter media was placed on the perforated disk to transmit air and to allow leachate to drain and collect in the cell bottom. A valve located at the bottom of the cell allowed leachate to pass into the collection vessel.

A 1000 g dry equivalent weight of sample was loaded into the cell. The first leach, designated as the Week 0 leach, initiated the humidity cell test and established the initial characteristics of the leachate. The first leach was performed by flooding the sample with 1000 mL of DI water for one hour, followed by the collection of leachate for analyses.

Subsequent steps of the humidity cell test involved three stages over a 7-day cycle: (1) dry air (which entered from the side of the test cell and flowed across the sample) continued for 3 days; (2) humid air was passed through the cell in the same manner as the dry air for 3 days; and (3) on the last day of the cycle, DI water was added through the top of the cell and allowed to flood the cell for one hour prior to the leachate being collected. Weekly leachate samples from the humidity cell tests were submitted for general analyses including: pH, acidity, alkalinity, conductivity and sulphate. ICP-OES/MS trace metal scans were initially performed on a weekly basis (Weeks 0 through 5) with subsequent metal scans completed every five weeks thereafter. Radionuclide analyses were completed on the initial Week 0 and the Weeks 5, 10, 15 and 20 leachates.

3.13. Particle Size Distribution Analyses (ASTM D 422-63 (2007))

The Micromeritics Model 1305 multivolume gas pycnometer measured the volume of powdery, granular, porous and irregularly shaped solids in the solids using Boyle's Law. The test used a known weight of solids to quantitatively determine the specific gravity of the solids.

Standard screen sieve sizes (Tyler) were used to determine the particle sizes of the solid tailings particles. The weights of the percent retained and passing on each respective screen size were determined. The test determined the particle size distribution of the plus 200 mesh fraction of the products being investigated.

The particle size distribution for the minus 200 mesh fraction of the products was established using the hydrometer (sedimentation) method. A 50 g (dry equivalent) sample was placed into solution (dispersing agent) with 1 L of distilled water in a standardized glass cylinder. The solution was agitated, and the particles were permitted to settle out of suspension. As settling occurred over time, the average specific gravity of the mixture decreased, causing the height of the suspended hydrometer to drop. Reading of the hydrometer at specific time intervals provided (though established relationships) the weight of the soil remaining in suspension, and the size of the particles that had settled out of solution. The percent finer weight was calculated based on the hydrometer readings, using Stokes Law for spheres falling freely in a fluid of known properties.

3.14. Malvern Laser Particle Size Distribution Analyses

The particle size distribution of the *Ro Tls Decant* (red water solids) was established using the Malvern laser. In this analysis the as-received red water slurry was slowly added to a stirred beaker of distilled water which feeds the analyzer. The analyzer indicated the optimum concentration of solids for analysis, at which point addition of the slurry was ceased. The system pumped the diluted slurry past a lens and laser system, which determined the particle size distribution based on the diffraction of light.

3.15. Atterberg Limits (ASTM D 4318-05)

Testing was completed to determine the liquid limit (LL), plastic limit (PL), and plasticity index (PI) of the minus 0.425 mm (-40 mesh) fraction of the tailings solids. The liquid limit was determined by performing a number of trials in which a moist sample was spread in a brass cup and divided by a grooving tool. The sample was then allowed to flow together, closing the groove, as a result of the impacts from the repeated dropping of the cup in a standardized mechanical device. The plastic limit was determined by rolling a portion of the test sample into a 3-mm diameter thread until the water content of the sample was reduced to the point where the thread crumbled and the sample could no longer be rolled. The plasticity index was then calculated based on the liquid and plastic limit results.

3.16. Standard Proctor (ASTM D 698-07e1)

The objective of this testing was to determine the compaction characteristics of the tailings produced under the standard compaction effort of 600 kN-m/m^3. This test determined the maximum wet and dry densities for the tailings compacted with standard effort and the optimum moisture content that will facilitate compaction to this density.

3.17. Hydraulic Conductivity Testing (ASTM D 5084)

The hydraulic conductivity of the tailings samples were determined by the falling head method using a flexible wall permeameter. The sample was compacted into the standard Proctor mould using the standard compaction effort of 600 kN-m/m^3 and subsequently frozen. The consolidated frozen sample was then removed from the Proctor mould, inserted into a latex membrane, sealed into the flexible wall permeameter and allowed to thaw prior to back pressure saturation under a confining pressure of 2 psi. Once fully saturated, three trials were performed under up-flow conditions. Changes in gradient over time were monitored and the hydraulic conductivity was determined based on Darcy's Law. Corrections for the viscosity of water at ambient temperatures were made and results were expressed as a result at 20°C in units of m/s.

3.18. Standard and Drained Settling Tests

Standard and drained settling tests were conducted to determine if the tailings would settle adequately without flocculant or rakes and to provide an estimate of the settled terminal density. Two litres of pulp were prepared to the desired density and poured into a two litre graduated cylinder (standard settling test). The slurry was then vigorously agitated. A stopwatch was started immediately at the cessation of agitation, and the height of the liquid-solid interface (or mud line) was recorded at given time intervals for a period of 24 hours. The settled pulp and bulk densities were then calculated.

The drained settling test was conducted in the same manner as the standard settling test. This test also utilised two litres of pulp which was poured into a rigid-wall permeameter cell fitted with porous stone and drainage port in the bottom of the permeameter. The height of the liquid-solid interface and drainage volume were recorded at given time intervals and the settled pulp and bulk densities were calculated.

Testwork Summary

Summary results of the Thor Lake environmental testwork are shown in the following sections. Complete analytical test results are included in Appendix A. Analytical certificates of analysis are provided in Appendix B.

1. Modal Analysis

Tables 4 through 7 provide summary results of the modal analyses completed during the mineralogical examination of the Nechalacho samples. Complete mineralogical reports will be supplied to Avalon under separate cover (SGS Mineralogy Reference No's. CALR 12390-001 – MI5004-OCT10, MI5005-OCT10, MI5006-OCT10, CALR 11806-005 – MI5001-NOV10, MI5042-NOV10 and CALR 11806-007 – MI5041-DEC10).

Table 4: Quantitative Modal Abundance – Heads

Mineral	**Head 1**	**Head 2**	**Head 3**	**PPX Head**	**PP2 Head**
Sample Origin	F25, 28, 29 + 30	F33	F36	F37	
	(%)	(%)	(%)	(%)	(%)
	MI5006-OCT10	MI5006-OCT10	MI5006-OCT10	MI5041-OCT10	MI5041-OCT10
Columbite-(Fe)	0.2	0.2	0.6	0.4	0.5
Fergusonite	0.2	0.3	0.3	0.2	0.1
Bastnasite	0.9	1.4	1.2	1.2	0.8
Synchysite	1.0	1.0	0.7	0.5	1.8
Allanite	0.8	1.1	1.4	2.1	1.0
Monazite	0.8	0.4	0.6	0.4	0.3
Other REE	0.0	0.0	0.0	0.0	0.0
Zircon	7.1	8.1	9.0	9.0	8.0
Apatite	0.0	0.0	0.0	0.1	0.0
Quartz	12.9	17.5	14.4	21.7	18.0
Plagioclase	18.8	15.2	19.2	17.6	16.1
K-Feldspar	16.4	11.7	11.8	12.2	14.2
Biotite	17.0	17.1	18.2	19.2	21.6
Muscovites/Clays	6.6	4.5	5.0	3.8	4.5
Chlorite	0.4	0.3	0.6	0.3	0.2
Amphibole	0.4	1.2	0.7	0.2	0.5
Other Silicates	0.5	0.8	0.6	0.5	0.7
Calcite	1.4	1.6	1.4	1.1	0.9
Dolomite	0.8	2.0	0.7	0.2	0.7
Ankerite	2.8	3.6	2.9	1.1	2.5
Other Carbonates	0.0	0.0	0.0	0.0	0.0
Fluorite	0.8	0.6	0.5	0.5	0.2
Fe-Oxides	9.7	11.1	10.0	7.4	7.1
Sulphides	0.1	0.1	0.1	0.1	0.0
Other	0.2	0.1	0.2	0.1	0.0
Total	100.0	100.0	100.0	100.0	100.0

Table 5: Quantitative Modal Abundance – Tailings

Mineral	F25 Tls (%) MI5001-OCT10	F28 Tls (%) MI5001-OCT10	F29 Tls (%) MI5001-OCT10	F30 Tls (%) MI5001-OCT10
Columbite-(Fe)	0.2	0.3	0.4	0.4
Fergusonite	0.1	0.3	0.3	0.3
Bastnasite	0.1	0.1	0.1	0.1
Synchysite	0.1	0.2	0.2	0.2
Allanite	0.5	0.8	0.4	0.7
Monazite	0.1	0.2	0.1	0.1
Other REE	0.0	0.0	0.0	0.0
Zircon	2.2	4.0	3.8	4.2
Apatite	0.0	0.0	0.0	0.0
Quartz	18.0	17.4	18.2	18.0
Plagioclase	16.3	14.0	16.0	14.7
K-Feldspar	12.8	11.4	15.2	13.6
Biotite	16.9	16.3	12.8	16.2
Muscovites/Clays	23.2	23.4	22.3	20.9
Chlorite	0.1	0.0	0.0	0.1
Amphibole	0.1	0.1	0.1	0.0
Other Silicates	0.1	0.2	0.1	0.2
Calcite	0.1	0.2	0.2	0.3
Dolomite	0.0	0.0	0.1	0.1
Ankerite	0.6	0.9	0.8	1.2
Other Carbonates	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0
Fe-Oxides	8.3	10.1	8.7	8.4
Sulphides	0.0	0.0	0.1	0.0
Other	0.1	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0

Table 6: Quantitative Modal Abundance – Tailings

Mineral	F33 Tls (%) MI5001-OCT10	F36 Tls (%) MI5001-OCT10	F37 Tls (%) MI5001-OCT10	PP1 Tls (%) MI5042-NOV10	PP2 Tls (%) MI5041-OCT10
Columbite-(Fe)	0.2	0.2	0.2	0.4	0.4
Fergusonite	0.1	0.1	0.1	0.2	0.2
Bastnasite	0.1	0.1	0.1	0.1	0.1
Synchysite	0.1	0.2	0.1	0.1	0.1
Allanite	0.6	0.8	0.8	0.2	0.4
Monazite	0.0	0.1	0.1	0.1	0.1
Other REE	0.0	0.0	0.0	0.0	0.0
Zircon	1.8	3.4	2.1	3.8	3.5
Apatite	0.0	0.0	0.0	0.0	0.0
Quartz	15.5	20.4	17.5	14.0	16.8
Plagioclase	17.6	14.9	18.3	21.7	19.3
K-Feldspar	14.4	12.4	13.2	16.8	14.2
Biotite	15.0	15.8	15.6	20.3	15.5
Muscovites/Clays	24.0	19.5	19.9	15.6	22.6
Chlorite	0.1	0.1	0.1	0.1	0.1
Amphibole	0.1	0.2	0.1	0.1	0.1
Other Silicates	0.1	0.2	0.2	0.1	0.1
Calcite	0.2	0.2	0.3	0.1	0.1
Dolomite	0.1	0.2	0.1	0.0	0.0
Ankerite	0.6	0.8	0.7	0.4	0.3
Other Carbonates	0.0	0.0	0.0	0.0	0.0
Fluorite	0.0	0.0	0.0	0.0	0.0
Fe-Oxides	9.4	10.4	10.5	5.9	6.1
Sulphides	0.0	0.0	0.0	0.1	0.1
Other	0.0	0.2	0.1	0.1	0.1
Total	100.0	100.0	100.0	100.0	100.0

Table 7: Quantitative Modal Abundance – Concentrates

Mineral	**F25 Conc** (%) MI5004-OCT10	**F33 Conc** (%) MI5001-OCT10	**F36 Conc** (%) MI5001-OCT10	**F37 Conc** (%) MI5001-OCT10	**PP1 Conc** (%) MI5001-OCT10
Columbite (Fe)	1.3	3.1	2.0	2.3	1.5
Fergusonite	1.4	1.7	1.4	1.9	2.3
Bastnasite	4.2	2.8	3.0	4.0	3.5
Synchysite	4.6	3.4	2.3	2.8	5.3
Allanite	2.5	2.3	3.1	2.6	3.7
Monazite	1.2	1.5	1.3	1.8	2.4
Other REE	0.1	0.0	0.0	0.1	0.1
Zircon	38.4	33.3	30.3	35.9	28.8
Apatite	0.3	0.4	0.5	0.3	0.0
Quartz	8.5	7.2	8.8	5.8	5.6
Plagioclase	2.0	2.2	1.7	1.9	2.2
K-Feldspar	1.2	1.3	0.6	0.9	2.1
Biotite	6.8	17.2	14.0	18.6	9.8
Muscovites/Clays	1.2	2.3	2.0	2.4	2.0
Chlorite	0.7	0.5	0.2	0.5	0.6
Amphibole	0.3	0.2	0.8	0.2	0.2
Other Silicates	0.8	0.3	0.5	0.2	0.3
Calcite	2.4	1.5	1.7	1.5	2.3
Dolomite	1.2	1.3	3.0	1.0	1.9
Ankerite	8.1	8.1	9.0	6.9	13.6
Other Carbonates	0.0	0.0	0.0	0.0	0.0
Fluorite	2.2	1.6	0.8	0.9	1.0
Fe-Oxides	10.2	7.6	12.3	6.9	9.9
Sulphides	0.4	0.2	0.2	0.3	0.5
Other	0.2	0.1	0.3	0.3	0.1
Total	100.0	100.0	100.0	100.0	100.0

2. Qualitative X-ray Diffraction Analyses

Summary results of the XRD analyses completed on the *Ro Tls Decant* (red water) solids are presented in Table 8. The detailed XRD test report is included in Appendix C.

Table 8: XRD Summary Results

Sample	**Crystalline Mineral Assemblage (relative proportions based on peak height)** Major (>30% Wt)	Moderate (10% -30% Wt)	Minor (2% -10% Wt)	Trace (<2% Wt)
Ro Tls Decant (red water solids)	-	potassium feldspar, plagioclase	Quartz, mica, hematite, zircon, ferrocolumbite, monetite	*allanite, *monazite, *bastnaestite, *palygorskite, *montmorillonite

**Tentative identification due to low concentrations, diffraction line overlap or poor crystallinity.*

3. X-ray Fluorescence Whole Rock Analyses

Results of the XRF whole rock analyses are presented in Tables 9 through 11 and also included in Appendix A.

Table 9: XRF Whole Rock Analyses Results – Heads

Parameter	Unit	MC3	Head 1	Head 2	Head 3	PPX Head	PP2 Head
Sample Origin		F25, 28, 29 + 30	F33	F36	F37		
SiO_2	%	54.0	54.7	53.6	53.9	54.2	53.8
Al_2O_3	%	10.8	11.3	9.15	10.6	9.42	10.8
Fe_2O_3	%	12.7	11.5	13.3	12.4	13.5	12.6
MgO	%	2.83	2.68	3.34	2.77	3.35	2.79
CaO	%	2.60	2.59	3.08	2.68	2.99	2.58
Na_2O	%	2.94	2.93	2.39	2.88	2.43	2.78
K_2O	%	4.89	5.24	4.44	4.81	4.48	4.86
TiO_2	%	0.05	0.05	0.05	0.04	0.05	0.04
P_2O_5	%	0.11	0.08	0.05	0.12	0.06	0.12
MnO	%	0.19	0.22	0.40	0.19	0.40	0.20
Cr_2O_3	%	< 0.01	< 0.01	< 0.01	< 0.01	0.11	< 0.01
V_2O_5	%	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01
LOI	%	1.14	3.42	4.54	3.42	4.25	3.68
Sum	%	92.2	94.7	94.3	93.9	95.2	94.3
Nb_2O_5	%	0.43	0.39	0.46	0.50	0.46	0.44
ZrO_2	%	3.65	3.14	3.73	3.75	3.57	3.58

Table 10: XRF Whole Rock Analyses Results – Tailings

Parameter	Unit	F25 Tls	F28 Tls	F29 Tls	F33 Tls	F36 Tls	F37 Tls	PP1 Tls	PP2 Tls	Master Tls
SiO_2	%	59.2	63.6	61.5	60.2	60.2	59.8	60.2	61.9	60.9
Al_2O_3	%	11.6	12.0	11.5	12.7	10.9	12.0	13.2	12.8	11.5
Fe_2O_3	%	11.2	9.66	11.5	11.8	12.8	13.0	10.7	10.0	12.0
MgO	%	2.01	1.47	1.67	1.85	2.23	1.82	2.43	1.93	1.86
CaO	%	0.89	0.91	1.08	0.98	1.15	1.00	0.85	0.75	1.11
Na_2O	%	3.23	3.37	3.23	3.49	2.95	3.38	3.35	3.71	3.28
K_2O	%	5.51	5.53	5.35	5.78	5.10	5.35	6.05	5.65	5.42
TiO_2	%	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.04	0.03
P_2O_5	%	0.04	0.04	0.03	0.03	0.01	0.03	0.04	0.04	0.05
MnO	%	0.12	0.11	0.12	0.12	0.16	0.09	0.09	0.08	0.14
Cr_2O_3	%	0.08	0.09	0.10	0.10	0.10	0.10	< 0.01	< 0.01	0.10
V_2O_5	%	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	%	1.82	1.67	1.81	1.74	1.96	1.61	1.54	1.50	1.86
Sum	%	95.6	98.4	97.9	98.8	97.6	98.2	98.5	98.4	98.2
Nb_2O_5	%	0.14	0.16	0.19	0.15	0.18	0.16	0.18	0.22	0.20
ZrO_2	%	0.95	1.01	1.60	0.92	1.55	0.97	1.52	1.45	1.38

Table 11: XRF Whole Rock Analyses Results – Concentrates

Parameter	Unit	F33 Conc	F36 Conc	F37 Conc	Master Conc	PP1 Conc
SiO_2	%	30.6	30.1	29.9	25.8	26.5
Al_2O_3	%	4.13	3.14	4.17	2.92	3.59
Fe_2O_3	%	13.8	17.7	13.7	16.6	13.1
MgO	%	3.62	4.31	3.60	3.08	3.64
CaO	%	8.45	8.50	7.39	9.03	12.1
Na_2O	%	0.56	0.80	0.58	0.41	0.58
K_2O	%	1.93	1.46	1.88	1.32	1.49
TiO_2	%	0.14	0.14	0.18	0.11	0.09
P_2O_5	%	0.80	0.44	0.80	0.66	0.61
MnO	%	0.57	0.98	0.47	0.65	0.84
Cr_2O_3	%	< 0.01	< 0.01	0.02	< 0.01	< 0.01
V_2O_5	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	%	9.62	10.8	8.78	10.8	12.4
Sum	%	74.2	78.3	71.5	71.3	74.9
Nb_2O_5	%	1.69	1.54	1.80	1.88	1.53
ZrO_2	%	16.0	13.0	18.0	17.3	13.5

4. Radionuclide Analyses

Tables 12 through 14 provide results of the radionuclide analyses conducted on the Nechalcho solids.

Table 12: Radionuclide Analyses Results – Heads

Parameter	Unit	MC3	Head 1	Head 2	Head 3	PPX Head	PP2 Head
Sample Origin		F25, 28, 29 + 30	F33	F36	F37		
^{226}Ra	Bq/g	0.32	0.28	0.30	0.36	0.2	0.4
^{210}Pb	Bq/g	0.20	0.16	0.19	0.19	0.2	0.3
^{228}Ra	Bq/g	0.38	0.31	0.28	0.38	0.3	0.4

Table 13: Radionuclide Analyses Results – Tailings

Parameter	Unit	F25 Tls	F28 Tls	F29 Tls	F30 Tls	F33 Tls	F36 Tls	F37 Tls	Master Tls	PP1 Tls	PP2 Tls
^{226}Ra	Bq/g	0.11	0.13	0.16	0.2	0.15	0.15	0.14	0.12	0.17	0.2
^{210}Pb	Bq/g	0.11	0.10	0.13	< 0.3	0.12	0.12	0.10	0.15	0.13	0.2
^{228}Ra	Bq/g	0.12	0.11	0.16	0.1	0.09	0.10	0.11	0.13	0.13	0.2

Table 14: Radionuclide Analyses Results – Concentrates

Parameter	Unit	F25 Conc	F28 Conc	F29 Conc	F30 Conc	F33 Conc	F36 Conc	F37 Conc	Master Conc	PP1 Conc
^{226}Ra	Bq/g	No	1.2	1.2	1.6	1.4	1.2	1.5	1.4	1.2
^{210}Pb	Bq/g	Sample	0.3	0.2	0.3	0.25	0.33	0.30	0.28	0.28
^{228}Ra	Bq/g	Available	1.7	1.6	2.1	1.9	1.2	1.8	1.9	1.8

5. ICP-OES/MS Strong Acid Digest Elemental Analyses

ICP-OES/MS strong acid digest elemental analyses results for the Nechalacho samples (including the solids collected from the *Ro Tls Decant*) are summarised in Tables 15 through 17. Complete results of the elemental analyses are presented in Appendix A.

Table 15: Strong Acid Digest ICP-OES/MS Elemental Analyses Results – Heads

Parameter	Unit	MC3	Head 1	Head 2	Head 3	PPX Head	PP2 Head
Sample Origin		F25, 28, 29 + 30	F33	F36	F37		
F	%	1.04	1.11	0.89	1.05	0.69	0.91
Hg	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Al	µg/g	56000	59000	47000	58000	62000	73000
As	g/t	13	4.8	7.4	4.2	4.4	3.4
Ca	µg/g	18000	17000	21000	19000	22000	19000
Cu	g/t	3.6	4.7	7.9	3.8	2.0	1.7
Fe	µg/g	87000	78000	90000	90000	100000	94000
K	µg/g	39000	41000	35000	40000	43000	47000
Mg	µg/g	17000	16000	20000	18000	22000	19000
Na	µg/g	20000	19000	16000	20000	18000	22000
Ni	g/t	16	13	12	14	6.0	6.7
Pb	g/t	17	14	15	18	10	11
Se	g/t	7.6	6.0	7.2	7.4	13	12
Si	%	27.2	23.8	24.7	22.3	24.2	23.8
Th	g/t	110	91	73	110	61	80
U	g/t	22	19	17	23	12	15
Zn	g/t	140	140	160	130	100	64
Ce	g/t	5700	4300	5200	5100	5700	5600
La	g/t	2500	2100	2500	2500	2500	2700
Nb	%	0.24	0.22	0.26	0.28	0.30	0.30
Nd	g/t	2600	2300	2700	2700	3200	3000
Zr	%	2.4	1.9	2.5	2.4	2.68	2.70

Table 16: Strong Acid Digest ICP-OES/MS Elemental Analyses Results – Tailings

Parameter	Unit	F25 Tls	F28 Tls	F29 Tls	F30 Tls	F33 Tls	F36 Tls	F37 Tls	Master Tls	PP1 Tls	Ro Tls Decant (Red Water Solids)	PP2 Tls
F	%	0.54	0.65	0.49	0.58	0.47	0.52	0.54	0.55	0.57	---	0.50
Hg	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	---	< 0.1
Al	µg/g	65000	64000	60000	73000	68000	55000	63000	62000	67000	74300	86000
As	g/t	3.1	2.5	4.2	4.5	3.0	4.0	2.8	4.4	49	<30	1.8
Ca	µg/g	6400	6300	7300	9000	6500	7600	6900	7700	5800	12500	5500
Cu	g/t	19	14	17	15	21	23	22	18	5.4	27.8	3.0
Fe	µg/g	81000	68000	80000	82000	82000	87000	89000	83000	72000	89900	75000
K	µg/g	46000	44000	42000	43000	46000	39000	42000	43000	47000	56200	54000
Mg	µg/g	13000	9400	10000	12000	12000	13000	11000	12000	14000	28500	13000
Na	µg/g	23000	24000	21000	22000	24000	20000	24000	22000	22000	15500	27000
Ni	g/t	330	270	320	290	340	340	320	330	17	76	8.5
Pb	g/t	8.9	9.2	10	11	9.0	9.4	8.6	9.9	8.1	30	7.0
Se	g/t	1.9	2.6	3.8	5.3	1.8	2.4	2.4	3.2	2.9	<30	2.6
Si	%	26.2	25.2	25.5	22.4	26.1	26.0	25.9	26.3	24.8	---	27.0
Th	g/t	31	31	44	66	29	31	34	40	39	---	39
U	g/t	7.7	8.1	11	11	8.9	9.1	10	9.9	12	<20	9.7
Zn	g/t	74	55	61	77	75	97	71	68	77	174	44
Ce	g/t	1600	2600	1900	2400	1500	1800	1800	1900	1260	---	1500
La	g/t	680	1100	870	1100	660	800	800	850	547	---	600
Nb	%	0.09	0.14	0.13	0.14	0.10	0.11	0.09	0.10	0.12	---	0.14
Nd	g/t	780	1300	970	1200	730	910	880	970	654	---	900
Zr	%	0.74	1.07	1.07	1.20	0.69	1.17	0.73	0.88	1.13	---	1.12

Table 17: Strong Acid Digest ICP-OES/MS Elemental Analyses Results – Concentrates

Parameter	Unit	F25 Conc	F28 Conc	F29 Conc	F30 Conc	F33 Conc	F36 Conc	F37 Conc	Master Conc	PP1 Conc
F	%	2.15	2.66	3.10	2.74	2.96	1.98	2.41	2.80	3.21
Hg	µg/g	< 0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Al	µg/g	15000	20000	19000	15000	21000	16000	22000	15000	18000
As	g/t	160	81	62	100	27	26	20	77	16
Ca	µg/g	61000	60000	71000	59000	56000	56000	50000	61000	81000
Cu	g/t	< 50	17	12	22	21	13	17	16	45
Fe	µg/g	113000	110000	110000	120000	94000	120000	96000	110000	89000
K	µg/g	9900	13000	13000	9900	17000	13000	17000	12000	13000
Mg	µg/g	17000	21000	22000	18000	22000	26000	22000	19000	22000
Na	µg/g	3500	3100	2500	2000	3600	5000	4200	2500	3600
Ni	g/t	91	87	79	89	77	44	48	86	100
Pb	g/t	< 200	48	52	62	52	54	64	63	55
Se	g/t	< 30	32	32	43	25	25	26	31	24
Si	%	13.2	12.7	11.5	10.9	11.5	13.8	11.5	12.0	12.6
Th	g/t	530	45	85	90	210	53	210	3.5	2.2
U	g/t	110	70	66	87	84	65	89	87	67
Zn	g/t	270	260	260	290	260	300	320	270	230
Ce	g/t	26000	24000	26000	30000	23000	22000	24000	27000	26000
La	g/t	11000	11000	12000	13000	10000	9300	10000	12000	11000
Lu	g/t	110	99	93	110	85	87	90	100	77
Nb	%	1.38	1.24	1.11	1.43	1.18	1.01	1.02	1.28	0.82
Nd	g/t	13000	12000	13000	15000	12000	11000	12000	14000	13000
Zr	%	13.5	12.0	10.5	14.1	11.5	9.39	10.6	12.6	8.4

6. Shake Flask Extraction

Results of the 3:1 liquid to solid ratio shake flask extractions are summarised in Tables 18 through 21 and shown in their entirety in Appendix A.

Table 18: Shake Flask Extraction Results – Heads

Parameter	Unit	*MMER	MC3	Head 1	Head 2	Head 3	PPX Head	PP2 Head
Sample Origin			F25, 28, 29 + 30	F33	F36	F37		
Initial pH	units		9.90	9.82	9.87	9.86	9.97	9.86
Final pH	units		9.56	9.50	9.61	9.54	9.46	9.51
Radionuclide Analyses								
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.3	< 0.1	< 0.4	< 0.3	< 0.3	< 0.1
^{210}Pb	Bq/L		0.3	0.1	< 0.1	0.2	0.2	< 0.1
General and Metals Analyses								
pH	units	6.0-9.5	9.27	9.21	8.96	9.33	8.50	8.92
F	mg/L		12.0	12.2	10.3	11.8	0.98	11.0
Cl	mg/L		11	11	11	10	12	11
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0010	0.0010	0.0011	0.0010	0.0013	0.0008
Ca	mg/L		8.09	7.30	7.25	7.99	7.12	6.44
Cu	mg/L	0.30	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0013	0.0009
Fe	mg/L		0.015	0.018	0.010	0.003	0.012	0.014
K	mg/L		27.9	24.4	24.2	28.3	24.0	20.2
Mg	mg/L		3.52	3.00	3.38	3.57	3.31	2.83
Na	mg/L		21.8	25.1	21.8	22.0	22.2	16.8
Ni	mg/L	0.50	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003
Pb	mg/L	0.20	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.00047	0.00072
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		3.36	3.50	4.28	3.46	4.42	2.67
Th	mg/L		0.00223	0.000577	0.000365	0.000066	0.000489	0.000300
U	mg/L		0.000143	0.000327	0.000169	0.000462	0.000160	0.000165
Zn	mg/L	0.50	0.001	0.002	0.002	0.001	0.006	0.003

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 19: Shake Flask Extraction Results – Tailings

Parameter	Unit	*MMER	F25 Tls	F28 Tls	F29 Tls	F33 Tls
Initial pH	units		8.30	8.59	8.62	8.86
Final pH	units		8.44	8.66	8.66	8.91
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.2	< 0.1	< 0.3	< 0.1
^{210}Pb	Bq/L		0.2	< 0.1	< 0.1	< 0.1
General and Metals Analyses						
pH	units	6.0-9.5	7.91	7.87	7.81	7.90
F	mg/L		1.29	1.23	1.39	2.40
Cl	mg/L		1.4	1.7	1.9	2.6
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0024	0.0027	0.0031	0.0079
Ca	mg/L		13.1	12.8	13.0	13.1
Cu	mg/L	0.30	0.0042	0.0020	0.0029	0.0049
Fe	mg/L		0.304	0.081	0.123	0.041
K	mg/L		2.33	3.44	3.47	7.79
Mg	mg/L		2.41	2.20	2.10	2.46
Na	mg/L		6.70	6.75	9.29	9.95
Ni	mg/L	0.50	0.0023	0.0012	0.0016	0.0019
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		7.72	6.44	6.17	5.74
Th	mg/L		0.00280	0.000702	0.00186	0.000354
U	mg/L		0.00132	0.00119	0.00131	0.00410
Zn	mg/L	0.50	0.008	0.006	0.006	0.004

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 20: Shake Flask Extraction Results – Tailings

Parameter	Unit	*MMER	F36 Tls	F37 Tls	Master Tls	PP1 Tls	PP2 Tls
Initial pH	units		8.84	8.92	8.52	9.28	9.08
Final pH	units		8.84	8.95	8.59	8.81	8.82
Radionuclide Analyses							
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.1	< 0.1	< 0.1	< 0.3	< 0.3
^{210}Pb	Bq/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
General and Metals Analyses							
pH	units	6.0-9.5	8.02	8.09	7.81	7.95	8.12
F	mg/L		2.33	2.71	1.40	1.83	4.43
Cl	mg/L		3.3	3.6	1.8	3.6	5.0
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0081	0.0066	0.0032	0.0199	0.0060
Ca	mg/L		13.8	14.1	13.3	21.0	14.5
Cu	mg/L	0.30	0.0063	0.0056	0.0028	0.0010	0.0008
Fe	mg/L		0.079	0.056	0.198	0.041	0.072
K	mg/L		8.52	7.96	2.69	8.76	12.8
Mg	mg/L		2.70	2.50	2.30	3.20	5.31
Na	mg/L		10.3	10.9	9.18	13.4	17.4
Ni	mg/L	0.50	0.0020	0.0015	0.0018	0.0059	0.0015
Se	mg/L		< 0.001	0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		5.85	5.58	7.56	4.72	3.35
Th	mg/L		0.000577	0.000420	0.002330	0.000832	0.000377
U	mg/L		0.00429	0.00514	0.00136	0.00535	0.00535
Zn	mg/L	0.50	0.008	0.010	0.011	0.003	0.010

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 21: Shake Flask Extraction Results – Concentrates

Parameter	Unit	*MMER	F33 Conc	F36 Conc	F37 Conc	Master Conc	PP1 Conc
Initial pH	units		8.92	8.68	8.87	9.10	8.90
Final pH	units		8.93	8.75	8.89	9.02	8.80
Radionuclide Analyses							
^{226}Ra	Bq/L	0.37	< 0.01	0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
^{210}Pb	Bq/L		< 0.1	0.1	< 0.1	< 0.1	< 0.1
General and Metals Analyses							
pH	units	6.0-9.5	7.93	7.61	7.61	7.71	7.78
F	mg/L		0.97	0.90	0.90	1.31	1.08
Cl	mg/L		1.1	1.1	1.0	1.3	2.0
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0113	0.0107	0.0093	0.0047	0.0019
Ca	mg/L		7.20	8.18	7.46	10.1	10.4
Cu	mg/L	0.30	0.0020	0.0008	0.0006	0.0020	0.0006
Fe	mg/L		0.083	0.070	0.031	0.104	0.014
K	mg/L		1.57	4.52	2.75	0.872	1.73
Mg	mg/L		0.855	1.12	0.929	0.914	1.53
Na	mg/L		8.53	7.14	8.13	7.79	4.56
Ni	mg/L	0.50	0.0005	0.0004	< 0.0001	< 0.0001	0.0004
Se	mg/L		< 0.001	< 0.001	< 0.001	0.001	< 0.001
Si	mg/L		3.50	3.29	3.40	3.31	2.65
Th	mg/L		0.000248	0.000169	0.000089	0.000514	0.000039
U	mg/L		0.000180	0.000078	0.000103	0.00105	0.00154
Zn	mg/L	0.50	0.008	0.006	0.005	0.004	0.004

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

7. Solution Analyses – Lake Water, Tap Water and Hydromet Solutions

Results of the Thor Lake and XPS and Ortech tap water analyses are summarised in Table 22. Summary results of the analyses completed on the simulated end product from the hydrometallurgical test program both before and after radium removal are provided in Table 23. Detailed results are available in Appendix A.

Table 22: Solution Analysis Results – Lake and Tap Waters

Parameter	Unit	*MMER	Thor Lake Water # 4		Thor Lake Water # 7		XPS Tap Water 14-JAN-11		Ortech Tap Water	
Radionuclide Analyses										
^{226}Ra	Bq/L	0.37	< 0.01	---	< 0.01	---	< 0.01	---	< 0.01	---
^{228}Ra	Bq/L		< 0.2	---	< 0.2	---	< 0.1	---	< 0.1	---
^{210}Pb	Bq/L		< 0.1	---	< 0.1	---	< 0.1	---	< 0.2	---
General Analyses										
pH	units	6.0-9.5	8.19	---	8.26	---	7.62	---	7.96	---
Alkalinity	mg/L as $CaCO_3$		144	---	142	---	51	---	89	---
EMF	mV		303	---	281	---	686	---	576	---
Conductivity	µS/cm		277	---	280	---	311	---	308	---
TDS	mg/L		186	---	180	---	200	---	186	---
TSS	mg/L	15.00	< 2	---	2	---	< 2	---	< 2	---
Cl	mg/L		3.8	---	3.8	---	48	---	29	---
SO_4	mg/L		0.4	---	0.4	---	20	---	27	---
F	mg/L		1.01	---	1.02	---	0.06	---	0.34	---
TOC	mg/L		12.2	---	13.0	---	2.3	---	1.6	---
Metals Analyses			**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0009	0.0008	0.0008	0.0009	0.0015	0.0017	0.0007	0.0008
Ca	mg/L		32.1	30.5	31.3	30.2	25.6	30.2	35.4	35.4
Cu	mg/L	0.30	< 0.0005	0.0006	< 0.0005	< 0.0005	0.0342	0.0335	0.0025	0.0030
Fe	mg/L		0.019	< 0.002	0.013	0.008	0.008	0.002	0.006	0.003
K	mg/L		1.87	1.81	1.82	1.76	1.37	1.62	1.82	1.83
Mg	mg/L		17.5	16.4	17.1	16.3	5.57	6.60	9.37	9.43
Na	mg/L		5.94	5.55	5.83	5.49	20.3	23.5	16.1	16.2
Ni	mg/L	0.50	0.0006	0.0007	0.0006	0.0008	0.0009	0.0011	0.0008	0.0008
Pb	mg/L	0.20	0.00006	0.00007	0.00007	0.00008	0.00016	0.00005	0.00095	0.00085
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		3.12	2.95	3.03	2.92	7.15	8.40	0.47	0.49
Th	mg/L		0.000115	0.000022	0.000079	0.000023	0.000026	0.000006	0.000027	0.000004
U	mg/L		0.000402	0.000338	0.000373	0.000350	0.000322	0.000345	0.000310	0.000289
Zn	mg/L	0.50	< 0.002	< 0.002	< 0.002	< 0.002	0.204	0.241	0.007	0.006

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 23: Solution Analysis Results – Hydromet Solutions

Parameter	Unit	*MMER	CH-WT1 PLS +Wash Simulated Hydromet Tls Filtrate	RAR-1 Filtrate Hydromet Tls Filtrate after Ra Removal
Radionuclide Analyses				
^{226}Ra	Bq/L	0.37	0.10	< 0.01
^{228}Ra	Bq/L		< 0.2	< 0.4
^{210}Pb	Bq/L		< 0.1	0.1
General Analyses				
pH	units	6.0-9.5	7.73	7.46
Alkalinity	mg/L as $CaCO_3$		118	82
EMF	mV		214	---
Conductivity	µS/cm		13400	13300
TDS	mg/L		16800	---
TSS	mg/L	15.00	---	---
Cl	mg/L		55	---
SO_4	mg/L		11000	12000
F	mg/L		1.82	---
TOC	mg/L		53.9	---
NH_3+NH_4	as N mg/L		91.7	---
Metals Analyses			**Diss**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001
As	mg/L	0.50	0.0022	0.0024
Ca	mg/L		393	387
Cu	mg/L	0.30	0.0226	0.0470
Fe	mg/L		0.150	0.138
K	mg/L		86.8	87.8
Li	mg/L		2.18	2.22
Mg	mg/L		1530	1550
Mn	mg/L		6.15	6.33
Na	mg/L		1580	1470
Ni	mg/L	0.50	0.0701	0.0726
Pb	mg/L	0.20	0.00052	0.00075
Se	mg/L		0.005	0.008
Si	mg/L		2.47	2.55
Sr	mg/L		11.2	11.0
Th	mg/L		0.002945	0.000690
U	mg/L		0.0239	0.0167
Zn	mg/L	0.50	< 0.002	0.030

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

8. Analysis of the Fresh and Aged Tailings Decant Solutions

Tables 24 and 25 provide summary results of the ICP-OES/MS analyses completed on the fresh and aged tailings decant solutions. Results are presented in their entirety in Appendix A.

Table 24: ICP-OES/MS Fresh and Aged Decant Solution Results – PP1 Tls

Parameter	Unit	*MMER	PP1 Tls Decant Day 5		PP1 Tls Decant Day 60	
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	---	0.02	---
^{228}Ra	Bq/L		0.3	---	< 0.3	---
^{210}Pb	Bq/L		< 0.1	---	< 0.1	---
General Analyses						
pH	units	6.0-9.5	8.20	---	8.16	---
Alkalinity	mg/L as $CaCO_3$		119	---	126	---
EMF	mV		284	---	207	---
Conductivity	µS/cm		617	---	662	---
TDS	mg/L		400	---	406	---
TSS	mg/L	15.00	14	---	< 2	---
Cl	mg/L		44	---	44	---
SO_4	mg/L		100	---	110	---
F	mg/L		4.43	---	4.46	---
TOC	mg/L		12.2	---	7.2	---
Metals Analyses			**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0022	0.0025	0.0019	0.0019
Ca	mg/L		43.7	40.0	41.2	40.9
Cu	mg/L	0.30	0.0023	0.0024	0.0012	0.0027
Fe	mg/L		0.570	0.025	0.025	< 0.002
K	mg/L		28.8	27.0	26.4	26.4
Mg	mg/L		9.14	8.15	8.56	8.43
Mn	mg/L		0.0788	0.0488	0.00808	0.00140
Na	mg/L		70.4	66.0	66.5	66.5
Ni	mg/L	0.50	0.0070	0.0066	0.0048	0.0046
Pb	mg/L	0.20	0.00060	0.00033	0.00051	0.00011
Se	mg/L		< 0.001	0.001	< 0.001	< 0.001
Si	mg/L		8.10	6.24	6.31	6.23
Th	mg/L		0.000694	0.000082	0.000385	0.000084
U	mg/L		0.00880	0.00836	0.00865	0.00863
Y	mg/L		0.00877	0.000376	0.000174	0.000091
Zn	mg/L	0.50	0.007	0.004	0.003	< 0.002

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 25: ICP-OES/MS Fresh and Aged Decant Solution Results – PP2 Tls

Parameter	Unit	*MMER	PP2 Tls Decant Day 5		PP2 Tls Decant Day 61	
Radionuclide Analyses						
^{226}Ra	Bq/L	0.37	< 0.01	---	< 0.01	---
^{228}Ra	Bq/L		< 0.4	---	< 0.1	---
^{210}Pb	Bq/L		0.1	---	0.1	---
General Analyses						
pH	units	6.0-9.5	8.41	---	8.39	---
Alkalinity	mg/L as $CaCO_3$		148	---	154	---
EMF	mV		178	---	190	---
Conductivity	µS/cm		603	---	576	---
TDS	mg/L		354	---	371	---
TSS	mg/L	15.00	2	---	5	---
Cl	mg/L		63	---	68	---
SO_4	mg/L		29	---	31	---
F	mg/L		9.53	---	9.19	---
TOC	mg/L		17.1	---	11.0	---
Metals			**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0047	0.0048	0.0049	0.0049
Ca	mg/L		21.8	22.1	22.1	21.5
Cu	mg/L	0.30	0.0007	0.0027	0.0018	0.0018
Fe	mg/L		0.706	0.020	0.041	0.003
K	mg/L		37.0	36.8	39.6	38.4
Mg	mg/L		12.3	12.3	12.4	12.0
Mn	mg/L		0.0317	0.0240	0.0217	0.0216
Na	mg/L		74.5	74.8	77.3	73.5
Ni	mg/L	0.50	0.0068	0.0065	0.0061	0.0060
Pb	mg/L	0.20	0.00026	0.00011	0.00029	0.00008
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		8.19	4.70	4.88	4.63
Th	mg/L		0.00140	0.000193	0.000020	< 0.000004
U	mg/L		0.00784	0.00742	0.00698	0.00685
Y	mg/L		0.00436	0.000464	0.000512	0.000231
Zn	mg/L	0.50	0.002	0.003	< 0.002	< 0.002

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

9. LC_{50} Acute Lethality Testing of *Daphnia Magna* and Rainbow Trout

Summary results of the LC_{50} acute lethality tests are presented in Table 26. Complete toxicity test reports are provided in Appendix D.

Table 26: LC_{50} Acute Lethality Test Results

Sample Identifier	Unit	LC_{50} Acute Lethality of Effluents to Daphnia Magna 48-h LC_{50}	LC_{50} Acute Lethality of Effluents to Rainbow Trout 96-h LC_{50}
PP1 Tls Decant Day 5	%	> 100%	> 100%

10. Modified Acid Base Accounting and Net Acid Generation Testing

Summary results of the ABA and NAG tests completed on the Nechalacho samples are provided in 27 through 29. Detailed test results are shown in Appendix A.

Table 27: Modified Acid Base Accounting and Net Acid Generation Test Results – Heads

Parameter	**Unit**	**MC3**	**Head 1**	**Head 2**	**Head 3**	**PPX Head**	**PP2 Head**
Sample Origin		F25, 28, 29 + 30	F33	F36	F37		
Paste pH	units	9.12	9.54	9.58	9.57	9.59	9.51
Fizz Rate	---	3	3	3	3	3	3
NP[1]	t $CaCO_3$/1000 t	44.2	42.4	67.4	45.1	67.6	47.7
AP	t $CaCO_3$/1000 t	0.31	0.31	0.31	0.31	0.31	0.31
Net NP	t $CaCO_3$/1000 t	43.9	42.1	67.1	44.8	67.3	47.4
NP/AP	ratio	143	137	217	145	218	154
S	%	0.021	0.016	0.023	0.019	< 0.005	< 0.005
SO_4	%	0.02	0.02	0.02	0.02	< 0.01	< 0.01
Sulphide	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C	%	0.690	0.655	0.992	0.713	0.930	0.680
Carbonate	%	1.97	1.98	3.30	2.26	3.21	2.08
CO_3 NP[2]	t $CaCO_3$/1000 t	32.7	32.9	54.8	37.5	53.3	34.5
CO_3 Net NP	t $CaCO_3$/1000 t	32.4	32.6	54.5	37.2	53.0	34.2
CO_3 NP/AP	ratio	105	106	177	121	172	111
Classification	based on ABA NP[1]	PAN	PAN	PAN	PAN	PAN	PAN
Classification	based on CO_3 NP[2]	PAN	PAN	PAN	PAN	PAN	PAN
Final pH	units	10.88	10.65	10.63	10.90	10.76	10.84
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0	0

[1] measured in ABA test
[2] theoretical, based on CO_3 content alone
Green highlighting indicates Net NP values less than 20.
Orange highlighting indicates NP/AP ratios less than 3.
PAG - Potentially Acid Generating based on interpretation of ABA test data alone.
PAN - Potentially Acid Neutralising based on interpretation of ABA test data alone.
uncertain - acid generation potential is uncertain based on interpretation of ABA test data alone.

Table 28: Modified Acid Base Accounting and Net Acid Generation Test Results – Tailings

Parameter	Unit	F25 Tls	F28 Tls	F29 Tls	F33 Tls	F36 Tls	F37 Tls	Master Tls	PP1 Tls	PP2 Tls
Paste pH	units	9.40	9.40	8.90	9.37	9.38	9.41	9.30	9.32	8.92
Fizz Rate	---	2	2	2	2	2	2	2	1	2
NP[1]	t $CaCO_3$/1000 t	19.2	20.0	22.8	20.3	25.8	21.3	22.4	18.3	16.7
AP	t $CaCO_3$/1000 t	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Net NP	t $CaCO_3$/1000 t	18.9	19.7	22.5	20.0	25.5	21.0	22.1	18.0	16.4
NP/AP	ratio	61.9	64.5	73.5	65.5	83.2	68.7	72.3	59.0	53.9
S	%	0.007	< 0.005	0.006	0.008	0.006	0.006	0.006	0.007	< 0.005
SO_4	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulphide	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C	%	0.344	0.321	0.377	0.312	0.406	0.316	0.405	0.214	0.196
Carbonate	%	0.608	0.599	0.699	0.604	0.903	0.622	0.810	0.515	0.469
CO_3 NP[2]	t $CaCO_3$/1000 t	10.1	9.9	11.6	10.0	15.0	10.3	13.4	8.5	7.8
CO_3 Net NP	t $CaCO_3$/1000 t	9.8	9.6	11.3	9.7	14.7	10.0	13.1	8.2	7.5
CO_3 NP/AP	ratio	32.6	32.1	37.4	32.3	48.4	33.3	43.4	27.577	25.114
Classification	based on ABA NP[1]	uncertain	uncertain	PAN	uncertain	PAN	PAN	PAN	uncertain	uncertain
Classification	based on CO_3 NP[2]	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain	uncertain
Sample weight	g	1.50	1.49	1.52	1.54	1.53	1.51	1.50	1.49	1.55
Final pH	units	10.39	10.41	10.50	10.39	10.42	10.51	10.40	9.76	10.21
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0	0	0	0	0

[1] measured in ABA test
[2] theoretical, based on CO_3 content alone
Green highlighting indicates Net NP values less than 20.
Orange highlighting indicates NP/AP ratios less than 3.
PAG - Potentially Acid Generating based on interpretation of ABA test data alone.
PAN - Potentially Acid Neutralising based on interpretation of ABA test data alone.
uncertain - acid generation potential is uncertain based on interpretation of ABA test data alone.

Table 29: Modified Acid Base Accounting and Net Acid Generation Test Results – Concentrates

Parameter	Unit	F33 Conc	F36 Conc	F37 Conc	Master Conc	PP1 Conc
Paste pH	units	9.10	9.21	9.17	9.29	8.96
Fizz Rate	---	3	3	3	3	3
NP[1]	t $CaCO_3$/1000 t	110	172	106	139	188
AP	t $CaCO_3$/1000 t	2.94	1.89	4.05	3.26	2.62
Net NP	t $CaCO_3$/1000 t	107	170	102	136	186
NP/AP	ratio	37.4	91.0	26.2	42.8	71.9
S	%	0.116	0.078	0.135	0.118	0.098
SO_4	%	0.02	0.02	< 0.01	0.01	0.01
Sulphide	%	0.09	0.06	0.13	0.10	0.08
C	%	2.02	2.64	1.93	2.86	3.08
Carbonate	%	5.36	8.50	4.81	7.03	9.59
CO_3 NP[2]	t $CaCO_3$/1000 t	89.0	141	79.8	117	159
CO_3 Net NP	t $CaCO_3$/1000 t	86.0	139	75.8	113	157
CO_3 NP/AP	ratio	30.3	74.7	19.7	35.8	60.8
Classification	based on ABA NP[1]	PAN	PAN	PAN	PAN	PAN
Classification	based on CO_3 NP[2]	PAN	PAN	PAN	PAN	PAN
Final pH	units	10.50	10.34	10.84	10.61	9.40
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0

[1] measured in ABA test
[2] theoretical, based on CO_3 content alone
Green highlighting indicates Net NP values less than 20.
Orange highlighting indicates NP/AP ratios less than 3.
PAG - Potentially Acid Generating based on interpretation of ABA test data alone.
PAN - Potentially Acid Neutralising based on interpretation of ABA test data alone.
uncertain - acid generation potential is uncertain based on interpretation of ABA test data alone.

11. Humidity Cell Testing – ASTM D 544-96 (2001)

Results of pH, conductivity, acidity, alkalinity and sulphate analyses, and sulphate production, NP consumption and cumulative depletion rates calculated for the *F33 Tls, F36 Tls, F37 Tls, Master Tls, PP 1 Tls, PP2 Tls, Master Conc* and *PP1 Conc* humidity cell test leachates are summarised in Tables 30, 32, 34, 36, 38, 40, 42 and 44, respectively . Summary results of the dissolved metal concentrations in the *F33 Tls, F36 Tls, F37 Tls, Master Tls, PP 1 Tls, PP2 Tls, Master Conc* and *PP1 Conc* leachates, as compared to the Canadian Metal Mining Effluent Regulation (MMER) limits, are presented in Tables 31, 33, 35, 37, 39, 41, 43 and 45, respectively. Complete humidity cell test reports are provided in Appendix E. Humidity cell certificates of analysis are included in Appendix F.

Table 30: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – F33 Tls

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
	units	$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.37	<2	15	41	2.0	1.7	0.72	1.80	0.01	0.02
1	7.51	<2	16	45	2.9	2.6	1.80	2.69	0.02	0.04
2	7.51	<2	13	41	2.8	2.6	2.89	2.74	0.04	0.07
3	7.52	<2	12	33	1.6	1.4	3.47	1.45	0.04	0.09
4	7.68	<2	16	44	2.6	2.3	4.45	2.44	0.05	0.11
5	7.62	<2	26	54	1.7	1.4	5.02	1.42	0.06	0.13
6	8.11	<2	91	98	1.5	1.3	5.56	1.35	0.07	0.14
7	7.96	<2	73	155	0.8	0.7	5.84	0.72	0.07	0.15
8	7.80	<2	31	61	0.7	0.6	6.11	0.67	0.08	0.15
9	7.53	<2	24	51	0.4	0.4	6.27	0.39	0.08	0.16
10	7.32	<2	15	34	0.3	0.3	6.38	0.29	0.08	0.16
11	7.48	<2	15	28	0.4	0.4	6.53	0.38	0.08	0.16
12	8.06	<2	71	157	2.7	2.3	7.49	2.39	0.09	0.19
13	8.06	<2	68	141	0.6	0.5	7.71	0.55	0.09	0.19
14	8.00	<2	66	101	1.0	0.9	8.08	0.93	0.10	0.20
15	7.94	<2	62	114	1.0	0.9	8.45	0.92	0.10	0.21
16	7.94	<2	59	96	0.6	0.5	8.67	0.55	0.11	0.22
17	8.02	<2	57	88	0.6	0.5	8.89	0.55	0.11	0.22
18	7.96	<2	61	122	0.6	0.6	9.13	0.61	0.11	0.23
19	7.91	<2	60	108	0.5	0.5	9.32	0.48	0.11	0.23
20	7.74	<2	71	138	1.1	0.5	9.52	0.50	0.12	0.24

Table 31: Humidity Cell Test – Dissolved Metals Concentrations – F33 Tls

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	< 0.01	0.02	< 0.01	< 0.01
^{228}Ra	Bq/L		0.4	---	---	---	---	< 0.4	< 0.1	< 0.1	< 0.8
^{210}Pb	Bq/L		< 0.1	---	---	---	---	0.2	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.37	7.51	7.51	7.52	7.68	7.62	7.32	7.94	7.74
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0006	0.0005	0.0006	0.0007	0.0008	0.0006	0.0006	0.0062	0.0040
Ca	mg/L		3.34	3.92	3.49	3.51	3.68	4.83	3.89	16.8	21.5
Cu	mg/L	0.30	0.0005	0.0007	0.0012	< 0.0005	< 0.0005	0.0006	< 0.0005	0.0008	0.0007
Fe	mg/L		0.016	0.007	0.004	0.006	0.009	0.027	0.250	0.012	0.020
K	mg/L		1.50	1.94	1.85	1.45	1.65	1.29	1.53	6.84	6.30
Mg	mg/L		0.490	0.818	0.720	0.481	0.587	0.584	0.774	3.39	3.97
Na	mg/L		2.20	3.19	2.88	1.78	2.30	1.86	0.50	1.68	1.03
Ni	mg/L	0.50	0.0008	0.0010	0.0012	0.0004	0.0005	0.0004	0.0006	0.0009	0.0011
Pb	mg/L	0.20	0.00005	< 0.00002	< 0.00002	0.00002	< 0.00002	0.00032	0.00011	0.00005	0.00004
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Th	mg/L		0.000128	0.000005	< 0.000004	0.000026	0.000012	0.000035	0.000079	0.000011	0.000038
U	mg/L		0.00168	0.00262	0.00221	0.000958	0.00132	0.000869	0.000701	0.00267	0.00236
Zn	mg/L	0.50	0.003	< 0.001	0.001	< 0.001	< 0.001	< 0.001	0.003	< 0.001	0.002

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 32: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – F36 Tls

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
	units	$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.47	<2	21	55	2.4	2.1	0.70	2.20	0.01	0.01
1	7.82	<2	40	94	4.9	4.8	2.29	4.96	0.03	0.05
2	7.99	<2	37	94	4.9	4.8	3.88	4.97	0.05	0.08
3	7.56	2	13	39	2.0	1.9	4.51	1.97	0.05	0.09
4	7.40	<2	14	40	2.4	2.2	5.26	2.33	0.06	0.11
5	6.94	<2	9	26	1.3	1.2	5.65	1.23	0.07	0.12
6	6.91	<2	7	20	1.1	1.0	5.99	1.05	0.07	0.12
7	7.33	<2	13	39	2.5	2.3	6.77	2.44	0.08	0.14
8	7.27	<2	9	27	1.7	1.6	7.30	1.65	0.09	0.15
9	7.44	<2	15	44	2.7	2.5	8.14	2.62	0.10	0.17
10	7.26	<2	13	40	2.2	2.1	8.82	2.15	0.11	0.18
11	7.38	<2	12	28	1.8	1.7	9.38	1.73	0.11	0.20
12	6.91	<2	10	20	1.3	1.3	9.79	1.31	0.12	0.20
13	7.14	<2	11	29	1.2	1.1	10.17	1.16	0.12	0.21
14	7.17	<2	10	27	1.2	1.1	10.54	1.17	0.13	0.22
15	7.11	<2	10	25	1.2	1.1	10.91	1.18	0.13	0.23
16	7.04	<2	9	20	1.0	0.9	11.23	0.98	0.14	0.23
17	7.34	<2	10	21	1.0	0.9	11.54	0.99	0.14	0.24
18	7.20	<2	8	24	1.0	0.9	11.85	0.96	0.14	0.25
19	7.37	<2	11	29	1.1	1.0	12.20	1.09	0.15	0.25
20	7.17	<2	11	25	0.9	0.9	12.49	0.90	0.15	0.26

Table 33: Humidity Cell Test – Dissolved Metals Concentrations – F36 Tls

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	0.04	< 0.02	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.7	---	---	---	---	0.3	0.1	< 0.1	< 1
^{210}Pb	Bq/L		< 0.1	---	---	---	---	< 0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.47	7.82	7.99	7.56	7.40	6.94	7.26	7.11	7.17
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0006	0.0006	0.0009	0.0005	0.0005	0.0003	0.0007	0.0007	0.0008
Ca	mg/L		4.45	9.32	9.78	3.18	3.72	2.21	3.27	2.70	2.83
Cu	mg/L	0.30	0.0007	0.0010	0.0011	< 0.0005	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005
Fe	mg/L		0.010	0.007	0.007	< 0.002	0.003	0.008	0.147	< 0.002	< 0.002
K	mg/L		2.06	3.45	3.81	1.80	1.99	1.09	2.09	1.75	1.67
Mg	mg/L		0.787	1.81	1.86	0.644	0.743	0.413	0.670	0.520	0.604
Na	mg/L		3.07	5.48	5.60	2.21	2.60	1.41	1.87	1.18	1.03
Ni	mg/L	0.50	0.0010	0.0020	0.0019	0.0006	0.0007	0.0004	0.0007	0.0003	0.0003
Pb	mg/L	0.20	0.00003	< 0.00002	< 0.00002	0.00002	< 0.00002	0.00027	0.00008	< 0.00002	< 0.00002
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001
Th	mg/L		0.000109	0.000004	< 0.000004	0.000012	< 0.000004	0.000013	0.000043	< 0.000004	0.000007
U	mg/L		0.00272	0.00652	0.00626	0.00197	0.00217	0.000864	0.00131	0.000715	0.000751
Zn	mg/L	0.50	< 0.001	< 0.001	0.001	0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 34: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – F37 Tls

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cumulative $S^=$	NP Consumption	C Cum NP Depl	Cum CO_3 NP Depl
		$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.80	<2	28	69	2.7	2.3	0.75	2.36	0.01	0.02
1	7.68	<2	24	59	3.2	3.1	1.80	3.27	0.03	0.05
2	7.60	<2	15	44	2.4	2.4	2.59	2.46	0.04	0.08
3	7.54	<2	12	37	2.1	2.0	3.24	2.03	0.05	0.10
4	7.35	<2	11	35	2.0	1.9	3.87	1.98	0.06	0.12
5	7.19	<2	12	32	1.3	1.2	4.26	1.22	0.06	0.13
6	7.13	<2	8	25	1.3	1.2	4.68	1.29	0.07	0.14
7	7.30	<2	11	32	2.0	1.9	5.30	1.93	0.08	0.16
8	7.24	<2	10	31	2.0	1.9	5.92	1.96	0.09	0.18
9	7.23	<2	10	28	1.7	1.6	6.46	1.67	0.09	0.20
10	6.95	<2	10	29	1.6	1.5	6.96	1.56	0.10	0.21
11	7.32	<2	10	23	1.6	1.5	7.46	1.58	0.11	0.23
12	6.97	<2	10	20	1.4	1.3	7.90	1.38	0.12	0.24
13	7.02	<2	9	26	1.3	1.2	8.31	1.26	0.12	0.25
14	7.25	<2	9	24	1.3	1.2	8.71	1.26	0.13	0.26
15	7.00	<2	8	20	1.3	1.2	9.13	1.29	0.13	0.28
16	7.02	<2	9	23	1.4	1.3	9.56	1.36	0.14	0.29
17	7.27	<2	8	20	1.2	1.1	9.94	1.18	0.15	0.30
18	7.10	<2	3	22	1.1	1.0	10.28	1.07	0.15	0.31
19	7.23	<2	8	22	1.0	0.9	10.60	0.99	0.16	0.32
20	7.09	<2	8	50	1.0	1.0	10.91	0.99	0.16	0.33

Table 35: Humidity Cell Test – Dissolved Metals Concentrations – F37 Tls

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	0.03	0.02	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.5	---	---	---	---	< 0.2	< 0.1	0.2	< 0.8
^{210}Pb	Bq/L		< 0.1	---	---	---	---	0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.80	7.68	7.60	7.54	7.35	*7.19	6.95	7.00	7.09
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0009	0.0007	0.0005	0.0005	0.0004	0.0003	0.0004	0.0004	0.0002
Ca	mg/L		18.5	5.49	4.18	3.03	3.30	3.40	2.91	2.43	2.24
Cu	mg/L	0.30	0.0010	0.0009	0.0007	0.0006	< 0.0005	< 0.0005	0.0008	< 0.0005	< 0.0005
Fe	mg/L		< 0.002	0.009	0.004	< 0.002	< 0.002	0.010	0.373	0.004	0.002
K	mg/L		4.69	2.34	1.88	1.56	1.48	1.03	1.23	1.06	0.860
Mg	mg/L		5.30	0.928	0.699	0.496	0.524	0.419	0.558	0.393	0.378
Na	mg/L		16.9	3.95	2.90	2.21	2.14	1.58	1.29	1.06	0.86
Ni	mg/L	0.50	0.0010	0.0009	0.0007	0.0005	0.0005	0.0003	0.0008	0.0002	0.0002
Pb	mg/L	0.20	0.00004	< 0.00002	0.00003	< 0.00002	< 0.00002	0.00061	0.00018	< 0.00002	< 0.00002
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000092	< 0.000004	< 0.000004	0.000011	< 0.000004	0.000013	0.000117	< 0.000004	< 0.000004
U	mg/L		0.00369	0.00386	0.00235	0.00149	0.00143	0.000769	0.000837	0.000558	0.000404
Zn	mg/L	0.50	0.001	< 0.001	0.002	0.002	< 0.001	< 0.001	0.003	< 0.001	< 0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 36: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – Master TIs

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
		$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.67	<2	29	75	3.0	2.5	0.83	2.59	0.01	0.02
1	7.53	<2	25	65	3.0	2.7	1.73	2.80	0.02	0.04
2	8.15	<2	62	153	9.2	8.4	4.52	8.72	0.06	0.11
3	7.49	<2	12	33	1.0	0.9	4.83	0.98	0.07	0.11
4	7.16	<2	9	22	0.7	0.6	5.04	0.66	0.07	0.12
5	6.87	<2	7	18	0.5	0.4	5.19	0.45	0.07	0.12
6	6.84	<2	6	15	0.6	0.5	5.36	0.55	0.07	0.13
7	7.11	<2	8	22	0.9	0.8	5.63	0.83	0.08	0.13
8	7.14	<2	9	21	0.9	0.8	5.90	0.86	0.08	0.14
9	7.12	<2	9	24	0.8	0.7	6.15	0.78	0.09	0.14
10	7.08	<2	10	26	0.9	0.8	6.43	0.87	0.09	0.15
11	7.05	<2	7	15	0.8	0.7	6.67	0.75	0.09	0.16
12	6.89	<2	8	15	0.7	0.6	6.88	0.66	0.10	0.16
13	6.90	<2	6	12	0.6	0.5	7.06	0.55	0.10	0.16
14	6.87	<2	6	16	0.6	0.5	7.23	0.55	0.10	0.17
15	6.86	<2	6	14	0.7	0.6	7.44	0.65	0.10	0.17
16	6.88	<2	6	14	0.7	0.6	7.65	0.64	0.11	0.18
17	7.05	<2	7	15	0.6	0.5	7.82	0.55	0.11	0.18
18	6.96	<2	8	20	0.6	0.6	8.01	0.58	0.11	0.19
19	7.15	<2	8	18	0.6	0.6	8.20	0.58	0.11	0.19
20	7.07	<2	8	22	0.6	0.6	8.38	0.58	0.12	0.20

Table 37: Humidity Cell Test – Dissolved Metals Concentrations – Master TIs

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	< 0.01	< 0.01	0.01	< 0.01
^{228}Ra	Bq/L		0.5	---	---	---	---	< 0.1	< 0.1	< 0.1	< 0.3
^{210}Pb	Bq/L		< 0.1	---	---	---	---	0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.67	7.53	8.15	7.49	7.16	6.87	7.08	6.86	7.07
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0005	0.0003	0.0009	< 0.0002	< 0.0002	< 0.0002	0.0002	0.0002	< 0.0002
Ca	mg/L		6.83	6.81	21.4	4.10	2.80	2.01	2.80	1.82	2.35
Cu	mg/L	0.30	0.0009	0.0007	0.0027	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fe	mg/L		0.004	0.004	0.005	< 0.002	0.007	0.009	0.031	0.005	< 0.002
K	mg/L		1.61	1.20	2.84	0.607	0.466	0.310	0.496	0.36	0.376
Mg	mg/L		1.24	1.05	3.16	0.483	0.362	0.248	0.403	0.272	0.373
Na	mg/L		4.42	3.41	9.19	1.22	0.89	0.64	0.81	0.54	0.56
Ni	mg/L	0.50	0.0011	0.0010	0.0040	0.0007	0.0004	0.0002	0.0002	0.0002	0.0001
Pb	mg/L	0.20	0.00005	< 0.00002	0.00004	< 0.00002	< 0.00002	0.00037	0.00006	< 0.00002	0.00003
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000172	< 0.000004	< 0.000004	0.000024	< 0.000004	0.000008	0.000016	< 0.000004	< 0.000004
U	mg/L		0.00474	0.00426	0.0116	0.00129	0.000815	0.000903	0.000770	0.000364	0.00037
Zn	mg/L	0.50	< 0.001	< 0.001	0.003	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 38: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – PP1 Tls

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
		$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.72	<2	27	95	11	9.1	3.02	9.43	0.05	0.11
1	7.79	<2	25	79	11	10.8	6.60	11.21	0.11	0.24
2	7.63	<2	15	55	6.5	6.3	8.72	6.60	0.15	0.32
3	7.56	<2	13	44	5.0	4.8	10.32	5.01	0.18	0.38
4	7.19	<2	10	36	4.5	4.3	11.75	4.47	0.20	0.43
5	6.94	<2	8	30	3.6	3.3	12.84	3.42	0.22	0.47
6	6.89	<2	7	26	3.1	3.0	13.84	3.10	0.24	0.51
7	7.19	<2	9	31	4.1	3.8	15.11	3.99	0.26	0.56
8	7.11	<2	8	30	3.9	3.7	16.35	3.86	0.28	0.60
9	7.07	<2	8	27	3.4	3.2	17.42	3.34	0.30	0.64
10	6.86	<2	8	28	3.2	3.0	18.43	3.16	0.31	0.68
11	7.18	<2	9	23	3.0	2.9	19.38	2.98	0.33	0.71
12	6.92	<2	8	27	2.9	2.8	20.31	2.88	0.35	0.75
13	6.99	<2	8	18	2.6	2.4	21.12	2.55	0.36	0.78
14	7.11	<2	8	23	2.4	2.3	21.87	2.35	0.37	0.80
15	6.98	<2	7	20	2.3	2.2	22.61	2.29	0.39	0.83
16	7.00	<2	7	19	2.3	2.2	23.33	2.25	0.40	0.86
17	7.19	<2	7	18	2.1	2.0	23.99	2.06	0.41	0.88
18	7.20	<2	8	23	2.2	2.1	24.67	2.14	0.42	0.91
19	7.17	<2	8	20	2	1.9	25.30	1.97	0.43	0.93
20	7.03	<2	8	26	1.8	1.7	25.88	1.81	0.44	0.95

Table 39: Humidity Cell Test – Dissolved Metals Concentrations – PP1 Tls

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	0.01	---	---	---	---	0.07	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.6	---	---	---	---	< 0.1	< 0.1	0.2	< 0.2
^{210}Pb	Bq/L		< 0.1	---	---	---	---	0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.72	7.79	7.63	7.56	7.19	6.94	6.86	6.98	7.03
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0005	0.0003	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
Ca	mg/L		6.85	7.61	5.47	4.05	3.30	2.92	2.31	2.20	2.09
Cu	mg/L	0.30	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fe	mg/L		0.038	0.037	0.016	0.010	0.004	0.017	0.077	0.002	0.009
K	mg/L		4.22	3.71	2.30	2.18	1.86	1.49	1.41	1.31	1.11
Mg	mg/L		1.17	1.31	0.840	0.627	0.553	0.469	0.413	0.391	0.405
Na	mg/L		5.35	5.55	3.16	2.25	1.98	1.72	1.27	1.11	0.95
Ni	mg/L	0.50	0.0008	0.0005	0.0004	0.0003	0.0002	0.0002	0.0002	0.0001	0.0001
Pb	mg/L	0.20	0.00009	0.00002	< 0.00002	< 0.00002	< 0.00002	0.00061	0.00003	< 0.00002	< 0.00002
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000088	0.000017	< 0.000004	0.000025	< 0.000004	0.000013	0.000052	< 0.000004	0.000006
U	mg/L		0.00215	0.00208	0.00121	0.000901	0.000669	0.000592	0.000469	0.000380	0.000388
Zn	mg/L	0.50	0.003	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 40: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – PP2 Tls

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
	units	$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.69	<2	34	85	2.5	2.1	0.71	2.23	0.01	0.03
1	7.88	<2	25	65	2.4	2.4	1.50	2.46	0.03	0.06
2	7.93	<2	36	103	5.4	5.3	3.26	5.51	0.06	0.13
3	7.80	<2	27	82	3.1	3.1	4.28	3.18	0.08	0.17
4	7.37	<2	11	28	1.2	1.1	4.66	1.18	0.09	0.19
5	6.99	<2	9	27	1.3	1.2	5.07	1.27	0.09	0.20
6	7.35	<2	10	24	1.7	1.6	5.60	1.66	0.10	0.22
7	7.05	<2	9	20	1.6	1.5	6.10	1.56	0.11	0.24
8	7.14	<2	9	4	1.7	1.6	6.62	1.64	0.12	0.27
9	7.24	<2	10	29	1.9	1.8	7.22	1.87	0.14	0.29
10	7.00	<2	9	27	1.9	1.8	7.81	1.84	0.15	0.31
11	7.30	<2	10	30	2.3	2.1	8.52	2.22	0.16	0.34
12	7.57	<2	13	40	3.2	3.0	9.51	3.09	0.18	0.38
13	7.14	<2	9	32	2.3	2.1	10.22	2.22	0.19	0.41
14	7.29	<2	10	25	2.4	2.3	10.98	2.38	0.21	0.44
15	7.18	<2	9	23	2.1	2.0	11.64	2.06	0.22	0.47
16	7.25	<2	7	28	2.4	2.3	12.39	2.35	0.23	0.50
17	7.48	<2	11	32	2.3	2.1	13.10	2.23	0.25	0.52
18	7.39	<2	10	23	2.4	2.3	13.86	2.38	0.26	0.56
19	7.35	<2	9	26	2.3	2.2	14.60	2.30	0.27	0.58
20	7.13	<2	9	26	2.1	2.0	15.26	2.07	0.29	0.61

Table 41: Humidity Cell Test – Dissolved Metals Concentrations – PP2 Tls

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	< 0.02	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.1	---	---	---	---	< 0.1	0.3	< 0.1	< 0.6
^{210}Pb	Bq/L		0.1	---	---	---	---	0.1	< 0.1	0.1	0.2
pH	units	6.0-9.5	7.69	*7.88	7.93	7.80	7.37	6.99	7.00	7.18	7.13
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0004	0.0005	0.0009	0.0004	< 0.0002	< 0.0002	< 0.0002	< 0.0002	0.0003
Ca	mg/L		4.38	3.95	5.15	4.59	2.28	1.82	2.10	2.02	1.89
Cu	mg/L	0.30	0.0012	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fe	mg/L		0.055	0.040	0.021	0.019	0.009	0.579	0.011	0.011	0.008
K	mg/L		5.92	4.42	8.19	4.06	1.99	2.04	1.90	1.61	1.52
Mg	mg/L		1.03	1.10	1.80	1.26	0.534	0.664	0.520	0.547	0.537
Na	mg/L		5.66	4.82	8.82	3.88	1.54	1.39	1.38	1.21	0.95
Ni	mg/L	0.50	0.0008	0.0004	0.0062	0.0029	0.0032	0.0007	0.0001	0.0001	0.0002
Pb	mg/L	0.20	0.00057	0.00003	0.00003	0.00002	0.00005	0.00017	<0.00002	<0.00002	0.00004
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000079	0.000066	0.000008	0.000009	< 0.000004	0.000297	< 0.000004	0.000009	< 0.000004
U	mg/L		0.000852	0.000875	0.00155	0.000959	0.000349	0.000419	0.000320	0.000288	0.000216
Zn	mg/L	0.50	0.006	< 0.001	< 0.001	< 0.001	< 0.001	0.003	<0.001	<0.001	<0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 42: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – Master Conc

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
		$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	7.22	<2	11	33	2.0	1.8	0.06	1.83	0.00	0.00
1	7.64	<2	21	55	1.9	1.8	0.12	1.89	0.00	0.00
2	7.56	<2	13	47	2.5	2.1	0.19	2.22	0.00	0.01
3	7.44	<2	12	39	1.6	1.4	0.24	1.48	0.01	0.01
4	7.69	<2	27	50	2.7	2.6	0.32	2.73	0.01	0.01
5	7.86	<2	59	160	11	9.1	0.63	9.45	0.01	0.02
6	7.84	<2	51	111	1.5	1.3	0.67	1.31	0.02	0.02
7	8.05	<2	58	112	1.7	1.4	0.72	1.48	0.02	0.02
8	8.01	<2	49	103	1.6	1.5	0.77	1.53	0.02	0.02
9	7.83	<2	44	99	1.8	1.6	0.82	1.62	0.02	0.02
10	7.88	<2	46	99	1.5	1.4	0.87	1.50	0.02	0.02
11	8.12	<2	44	75	1.4	1.3	0.91	1.33	0.02	0.02
12	7.75	<2	45	67	1.6	1.4	0.95	1.43	0.02	0.03
13	7.97	<2	46	67	1.4	1.2	0.99	1.25	0.02	0.03
14	8.03	<2	47	98	1.0	0.9	1.02	0.91	0.02	0.03
15	7.71	<2	45	84	1.8	1.6	1.08	1.69	0.02	0.03
16	7.97	<2	44	81	1.4	1.2	1.12	1.26	0.03	0.03
17	8.07	<2	48	75	1.2	1.0	1.15	1.07	0.03	0.03
18	7.79	<2	42	86	1.4	1.3	1.19	1.36	0.03	0.03
19	8.00	<2	38	66	0.6	0.6	1.21	0.58	0.03	0.03
20	7.86	<2	45	78	1.7	1.7	1.27	1.76	0.03	0.03

Table 43: Humidity Cell Test – Dissolved Metals Concentrations – Master Conc

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	0.05	---	---	---	---	0.11	< 0.01	0.01	< 0.01
^{228}Ra	Bq/L		< 0.5	---	---	---	---	< 0.2	< 0.1	0.2	< 0.4
^{210}Pb	Bq/L		< 0.1	---	---	---	---	0.2	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.22	7.64	7.56	7.44	7.69	7.86	7.88	7.71	7.86
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0002	0.0002	0.0005	0.0004	0.0005	0.0059	0.0032	0.0018	0.0012
Ca	mg/L		3.01	2.82	3.41	2.97	5.04	22.1	15.6	15.1	16.3
Cu	mg/L	0.30	0.0006	< 0.0005	< 0.0005	0.0007	0.0006	0.0030	0.0006	< 0.0005	< 0.0005
Fe	mg/L		0.007	0.008	0.010	0.005	0.003	0.046	0.077	0.002	< 0.002
K	mg/L		0.255	0.210	0.199	0.162	0.306	1.28	1.18	1.25	1.16
Mg	mg/L		0.233	0.263	0.298	0.224	0.443	2.23	1.41	1.48	1.73
Na	mg/L		2.15	2.04	2.18	1.56	2.78	18.4	1.77	0.65	0.38
Ni	mg/L	0.50	0.0002	0.0002	0.0002	0.0005	0.0002	0.0008	0.0003	0.0004	0.0006
Pb	mg/L	0.20	0.00009	0.00003	0.00004	0.00006	< 0.00002	0.00046	0.00013	< 0.00002	0.00004
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000222	< 0.000004	< 0.000004	0.000033	0.000010	0.000067	0.000060	< 0.000004	0.000029
U	mg/L		0.00226	0.00248	0.00331	0.00232	0.00476	0.01860	0.00376	0.00229	0.00236
Zn	mg/L	0.50	< 0.001	< 0.001	< 0.001	0.002	0.002	0.001	0.002	< 0.001	< 0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

Table 44: Humidity Cell Test – Weekly Leachate Results and Cumulative Depletion Rates – PP1 Conc

Week	pH	Acidity	Alkalinity	Conductivity	SO_4	SO_4 Prod Rate	Cum $S^=$ Depl	NP Consumption	Cum NP Depl	Cum CO_3 NP Depl
	units	$CaCO_3$ eq. mg/L	$CaCO_3$ eq. mg/L	µS/cm	mg/L	g/t/wk	%	$CaCO_3$, g/t/wk	%	%
0	8.01	<2	80	264	22	19.1	0.80	19.91	0.01	0.01
1	8.11	<2	58	126	1.9	1.8	0.87	1.85	0.01	0.01
2	8.13	<2	44	96	1.8	1.7	0.94	1.76	0.01	0.01
3	8.13	<2	46	97	1.7	1.6	1.01	1.71	0.01	0.02
4	8.01	<2	42	91	2.0	2.0	1.09	2.07	0.01	0.02
5	7.77	<2	44	96	2.2	2.0	1.18	2.10	0.02	0.02
6	7.26	<2	13	30	0.5	0.5	1.20	0.48	0.02	0.02
7	7.33	<2	12	26	0.4	0.4	1.21	0.40	0.02	0.02
8	7.52	<2	11	26	0.5	0.5	1.23	0.51	0.02	0.02
9	7.34	<2	9	20	0.5	0.5	1.25	0.47	0.02	0.02
10	6.90	<2	9	22	0.6	0.6	1.27	0.59	0.02	0.02
11	7.28	<2	9	19	0.7	0.7	1.30	0.69	0.02	0.02
12	6.97	<2	10	17	0.8	0.8	1.33	0.80	0.02	0.02
13	6.98	<2	9	15	0.7	0.7	1.36	0.68	0.02	0.02
14	7.12	<2	9	21	0.7	0.7	1.39	0.68	0.02	0.02
15	7.35	<2	14	28	0.9	0.9	1.42	0.89	0.02	0.02
16	7.11	<2	9	5	1.0	0.9	1.46	0.98	0.02	0.02
17	7.31	<2	9	16	0.8	0.8	1.49	0.79	0.02	0.02
18	7.25	<2	9	22	1	0.9	1.53	0.97	0.02	0.02
19	7.28	<2	9	19	0.9	0.9	1.57	0.89	0.02	0.02
20	7.34	<2	13	19	0.8	0.8	1.60	0.80	0.02	0.03

Table 45: Humidity Cell Test – Dissolved Metals Concentrations – PP1 Conc

Parameter	Units	*MMER	0	1	2	3	4	5	10	15	20
^{226}Ra	Bq/L	0.37	< 0.01	---	---	---	---	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.3	---	---	---	---	0.4	< 0.1	0.1	< 0.4
^{210}Pb	Bq/L		< 0.1	---	---	---	---	< 0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	8.01	8.11	8.13	8.13	8.01	7.77	6.90	7.35	7.34
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
As	mg/L	0.50	0.0033	0.0028	0.0027	0.0026	0.0022	0.0021	< 0.0002	< 0.0002	< 0.0002
Ca	mg/L		5.43	11.1	12.5	12.1	12.0	16.3	3.91	3.29	3.06
Cu	mg/L	0.30	0.0019	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005	< 0.0005
Fe	mg/L		0.011	< 0.002	< 0.002	< 0.002	< 0.002	< 0.002	0.188	< 0.002	0.002
K	mg/L		2.56	2.32	2.50	2.44	2.32	2.47	0.445	0.441	0.401
Mg	mg/L		0.968	2.38	2.42	2.05	1.87	2.41	0.395	0.328	0.326
Na	mg/L		4.05	4.02	2.45	1.54	1.14	1.13	0.08	0.10	0.10
Ni	mg/L	0.50	0.0095	0.0034	0.0026	0.0018	0.0015	0.0017	0.0007	0.0006	0.0006
Pb	mg/L	0.20	0.00006	< 0.00002	< 0.00002	0.00003	< 0.00002	0.00012	0.00015	< 0.00002	< 0.00002
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Th	mg/L		0.000088	< 0.000004	< 0.000004	0.000008	< 0.000004	0.000005	0.000393	< 0.000004	< 0.000004
U	mg/L		0.0147	0.00599	0.00505	0.00460	0.00447	0.00454	0.000558	0.000460	0.000379
Zn	mg/L	0.50	0.003	0.002	< 0.001	0.001	< 0.001	< 0.001	0.002	< 0.001	< 0.001

**Department of Justice Canada. 2002. Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.*

12. Particle Size Distribution Analyses (ASTM D 422-63 (2007)) and Malvern Laser

Specific gravity results for the Nechalacho samples are provided in Table 46. Summary results of the PSD (sieve and hydrometer analyses) completed on the samples are presented in Tables 47 through 50. Results of the Malvern PSD analyses are shown in Table 51. Detailed test reports are included in Appendix G.

Table 46: Specific Gravity Determinations

Sample Identifier (Heads)	Specific Gravity	Sample Identifier (Tails)	Specific Gravity	Sample Identifier (Concentrates)	Specific Gravity
MC3 (F25, 28, 29 + 30)	2.92	F25 Tls	2.81	F33 Conc	3.54
Head 1 (F33)	2.89	F28 Tls	2.76	F36 Conc	3.49
Head 2 (F36)	2.96	F29 Tls	2.82	F37 Conc	3.53
Head 3 (F37)	2.93	F33 Tls	2.82	Master Conc	3.67
PPX Head	2.97	F36 Tls	2.86	PP1 Conc	3.47
PP2 Head	2.91	F37 Tls	2.86	---	---
---	---	Master Tls	2.83	---	---
---	---	PP1 Tls	2.84	---	---
---	---	PP2 Tls	2.82	---	---

Table 47: Particle Size Distribution Results (ASTM D 422-63 (2007)) – Heads

MC3 F25, 28, 29 +30		Head 1 F33		Head 2 F36		Head 3 F37		PPX Head		PP2 Head	
Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)
4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0	4.750	99.9	4.750	100.0
2.000	74.1	2.000	61.5	2.000	68.2	2.000	66.7	2.000	63.6	2.000	70.5
0.850	43.6	0.850	32.2	0.850	41.1	0.850	37.6	0.850	32.9	0.850	37.8
0.425	30.9	0.425	23.1	0.425	29.0	0.425	26.8	0.425	24.8	0.425	29.3
0.212	23.2	0.212	17.9	0.212	21.3	0.212	20.5	0.212	17.1	0.212	21.0
0.150	19.1	0.150	15.2	0.150	18.4	0.150	17.2	0.150	15.2	0.150	18.8
0.075	16.4	0.075	13.4	0.075	15.2	0.075	13.8	0.075	12.1	0.075	15.2
0.045	13.8	0.046	9.9	0.045	8.0	0.045	11.6	0.044	11.8	0.045	13.4
0.032	11.3	0.033	8.9	0.032	6.3	0.032	9.9	0.032	9.6	0.032	11.6
0.023	10.0	0.023	8.3	0.023	5.7	0.023	9.4	0.023	9.1	0.023	10.5
0.016	8.8	0.016	7.3	0.016	5.7	0.016	7.7	0.016	8.6	0.016	9.3
0.012	8.8	0.012	5.7	0.012	5.1	0.012	6.6	0.012	7.0	0.012	8.1
0.008	7.5	0.009	5.2	0.008	4.5	0.008	6.6	0.008	6.4	0.008	7.0
0.006	6.3	0.006	4.7	0.006	3.4	0.006	5.5	0.006	5.4	0.006	5.8
0.004	5.0	0.004	4.2	0.004	2.3	0.004	5.0	0.004	5.4	0.004	4.7
0.001	2.5	0.001	2.6	0.001	1.1	0.001	2.2	0.001	3.2	0.001	3.5

Table 48: Particle Size Distribution Results (ASTM D 422-63 (2007)) – Tailings

F25 Tls		F28 Tls		F29 Tls		F33 Tls	
Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)
4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0
2.000	100.0	2.000	100.0	2.000	100.0	2.000	100.0
0.850	100.0	0.850	100.0	0.850	100.0	0.850	100.0
0.425	100.0	0.425	99.9	0.425	100.0	0.425	99.9
0.212	99.9	0.212	99.8	0.212	99.9	0.212	99.9
0.150	99.9	0.150	99.7	0.150	99.9	0.150	99.8
0.075	98.8	0.075	97.2	0.075	97.9	0.075	98.5
0.038	62.2	0.038	67.8	0.043	39.0	0.038	66.7
0.029	49.8	0.029	53.1	0.031	32.5	0.029	52.8
0.021	42.6	0.022	41.2	0.023	26.0	0.021	44.5
0.016	32.9	0.016	33.0	0.016	22.3	0.015	36.1
0.012	25.8	0.012	26.6	0.012	18.6	0.011	29.6
0.008	19.5	0.008	21.1	0.008	16.7	0.008	23.2
0.006	16.0	0.006	16.5	0.006	13.0	0.006	17.6
0.004	11.5	0.004	12.8	0.004	11.1	0.004	13.0
0.001	3.6	0.001	5.5	0.001	4.6	0.001	5.6

Table 49: Particle Size Distribution Results (ASTM D 422-63 (2007)) – Tailings

F36 Tls		F37 Tls		Master Tls		PP1 Tls		PP2 Tls	
Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)
4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0
2.000	100.0	2.000	100.0	2.000	100.0	2.000	100.0	2.000	100.0
0.850	100.0	0.850	100.0	0.850	100.0	0.850	100.0	0.850	100.0
0.425	100.0	0.425	100.0	0.425	100.0	0.425	100.0	0.425	100.0
0.212	100.0	0.212	100.0	0.212	100.0	0.212	100.0	0.212	100.0
0.150	100.0	0.150	100.0	0.150	99.8	0.150	100.0	0.150	100.0
0.075	98.1	0.075	98.3	0.075	98.2	0.075	99.1	0.075	99.4
0.039	59.6	0.037	64.7	0.039	61.9	0.040	60.7	0.039	56.9
0.029	46.0	0.028	50.4	0.029	49.2	0.029	50.0	0.029	46.5
0.021	37.0	0.021	41.4	0.021	40.1	0.021	43.8	0.021	39.6
0.016	29.8	0.015	32.4	0.016	32.8	0.015	37.5	0.016	32.8
0.012	23.5	0.011	27.0	0.012	27.3	0.012	32.1	0.012	27.6
0.008	19.0	0.008	21.6	0.008	21.9	0.008	26.8	0.008	24.1
0.006	15.3	0.006	16.2	0.006	16.4	0.006	22.3	0.006	19.0
0.004	11.7	0.004	12.6	0.004	12.7	0.004	17.9	0.004	16.4
0.001	3.6	0.001	5.4	0.001	4.6	0.001	7.1	0.001	6.9

Table 50: Particle Size Distribution Results (ASTM D 422-63 (2007)) – Concentrates

F33 Conc		F36 Conc		F37 Conc		Master Conc		PP1 Conc	
Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)	Particle Size e (mm)	Weight Passing (%)	Particle Size (mm)	Weight Passing (%)
4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0	4.750	100.0
2.000	100.0	2.000	100.0	2.000	100.0	2.000	100.0	2.000	100.0
0.850	100.0	0.850	100.0	0.850	100.0	0.850	100.0	0.850	100.0
0.425	100.0	0.425	100.0	0.425	100.0	0.425	100.0	0.425	100.0
0.212	100.0	0.212	100.0	0.212	100.0	0.212	100.0	0.212	100.0
0.150	99.9	0.150	99.9	0.150	100.0	0.150	100.0	0.150	100.0
0.075	99.0	0.075	99.0	0.075	99.6	0.075	99.3	0.075	99.3
0.033	50.7	0.033	56.2	0.032	58.4	0.032	48.7	0.033	51.5
0.025	36.0	0.025	40.1	0.024	42.6	0.025	34.1	0.026	35.4
0.019	24.5	0.019	28.9	0.018	31.5	0.018	22.7	0.019	27.3
0.014	14.7	0.014	17.6	0.014	18.9	0.013	13.0	0.014	16.1
0.010	8.2	0.010	9.6	0.010	10.3	0.010	5.7	0.010	10.5
0.007	3.3	0.007	4.8	0.007	5.5	0.007	2.4	0.007	5.6
0.005	1.6	0.005	3.2	0.005	3.2	0.005	1.6	0.005	3.2
0.004	0.8	0.004	1.6	0.004	1.6	0.004	0.8	0.004	2.4
0.001	0.8	0.001	1.6	0.001	1.6	0.001	0.8	0.001	1.6

Table 51: Malvern Particle Size Distribution Results – Red Water

Size µm	Volume Under %	Size µm	Volume Under %	Size µm	Volume Under %
0.138	1.19	0.832	50.93	5.012	95.79
0.158	5.44	0.955	54.12	5.754	96.30
0.182	11.83	1.096	57.63	6.607	96.71
0.209	18.95	1.259	61.75	7.586	97.11
0.240	25.35	1.445	66.51	8.710	97.55
0.275	30.09	1.660	71.65	10.000	98.02
0.316	33.05	1.905	76.82	11.482	98.51
0.363	34.89	2.188	81.67	13.183	98.98
0.417	36.52	2.512	85.91	15.136	99.38
0.479	38.56	2.884	89.35	17.378	99.71
0.550	41.25	3.311	91.96	19.953	99.89
0.631	44.37	3.802	93.80	22.909	99.97
0.724	47.70	4.365	95.02	26.303	100.00

13. Atterberg Limits (ASTM D 4318-05)

Results of the Atterberg limit tests completed on the *Master Tls, PP1 Tls* and *PP2 Tls* samples are summarised in Table 52. Complete test reports are provided in Appendix G.

Table 52: Atterberg Limit Test Results

Parameter	Master Tls	PP1 Tls	PP2 Tls
Liquid Limit (% moisture)	24	22	21
Plastic Limit	*NP	NP	*NP
Plasticity Index	*NP	NP	*NP

**NP= Not plastic*

14. Standard Proctor (ASTM D 698-07e1)

Table 53 shows summary results of the standard Proctor tests completed on the XPS PP samples *(PP1 Tls* and *PP2 Tls*). Standard Proctor test reports are shown in Appendix G.

Table 53: Standard Proctor Test Results

Parameter	PP1 Tls	PP2 Tls
Max. Wet Density (g/cm^3)	2.055	2.028
Max. Dry Density (g/cm^3)	1.785	1.760
Optimum Moisture Content (%)	15.1	15.2

15. Hydraulic Conductivity Testing

Summary results of the hydraulic conductivity tests completed on the compacted tailings solids (*Master Tl, PP1 Tls* and *PP2 Tls*) are provided in Table 54. Complete test reports are included in Appendix G.

Table 54: Hydraulic Conductivity Test Results

Parameter	Unit	Master Tls	PP1 Tls	PP2 Tls
Average Hydraulic Conductivity	m/sec	$5.16E^{-07}$	$7.18E^{-08}$	$1.98E^{-07}$

16. Standard and Drained Settling Tests

Summary results of the standard and drained settling tests completed on the XPS PP samples *(PP1 Tls* and *PP2 Tls*) are shown in Table 55. Detailed test reports are provided in Appendix G.

Table 55: Standard and Drained Settling Test Results

Parameter	Standard Settling Test PP1 Tls	Drained Settling Test PP1 Tls	Standard Settling Test PP2 Tls	Drained Settling Test PP2 Tls
Dry solid SG	2.84	2.84	2.82	2.82
Feed pulp density (g/L)	1279	1292	1267	1289
Feed percent solids (%)	33.7	34.9	32.6	34.7
Total settling time (min)	8588	8553	8576	8531
Final percent solids (%)	59.6	67.2	57.4	65.7
Final mudline (mL)	887	756	906	785
Final settled density (g/L)	1629	1771	1589	1736

Discussion

Results of the modal analyses completed during the mineralogical examination (QEMSCAN®) determined that the Thor Lake head samples tested (*Head 1, Head 2, Head 3, PPX Head* and *PP2 Head*) were comprised primarily of gangue minerals including plagioclase, biotite, quartz, K-feldspar, Fe-oxides and muscovites/clays. Minor amounts of zircon (7.1 to 9.0%) and trace levels (≤2%) of rare earth element (REE) minerals including columbite-(Fe), fergusonite, bastnaesite, synchysite, allanite and monazite were also evident in the head samples. Minor to moderate concentrations of neutralising carbonates (2.5 to 7.2%) were observed. Ankerite was the dominant carbonate mineral, typically followed by calcite and dolomite. Only trace levels of sulphide minerals (≤0.1%) were reported in the head samples.

As expected, modal analyses of the Thor Lake tailings samples (*F25 Tls, F28 Tls, F29 Tls, F30 Tls, F33 Tls, F36 Tls, F37 Tls, PP1 Tls* and *PP2 Tls*) reported increased amounts of gangue minerals (plagioclase, biotite, quartz, K-feldspar and muscovites/clays) and lesser levels of zircon (1.8 to 4.2%) and REE (<0.5%) minerals than the head samples from which they were derived. Only trace levels of carbonate (0.9 to 1.6%) and sulphide (≤0.1%) minerals were observed in the tailings samples.

The concentrate samples (*F25 Conc, F33 Conc, F36 Conc, F37 Conc* and *PP1 Conc*) typically reported considerably lesser levels of gangue minerals (plagioclase, biotite, quartz, K-feldspar, Fe-oxides and muscovites/clays) than the ore samples. Major amounts of zircon (30 to 39%) and significantly increased levels of REE minerals (1.2 to 5.3%) were evident in the concentrates. Increased levels of carbonate minerals (10 to 18%) were also observed in the concentrates. Again only trace levels of sulphide minerals (0.2 to 0.5%) were reported. Results of the modal analyses are illustrated graphically in Figure1 below.

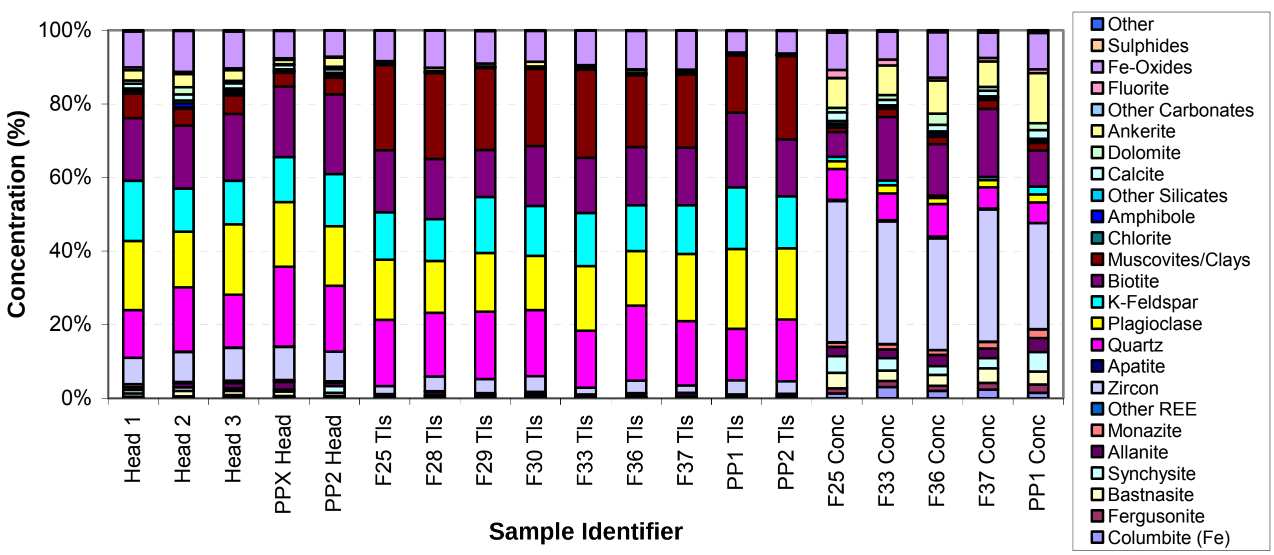


Figure 1: Modal Abundance Results

Because the *Ro Tls Decant* (solution from the XPS PP1 that was separated from the tailings solids at the Xstrata facility) contained large amounts of extremely fine suspended particulate matter ("red water") in solution, to better understand the system the suspended particle content of the sample was submitted for qualitative XRD, basic ICP metals and Malvern particle size distribution analyses. It should be noted that, once the red water (*Ro Tls Decant*) was blended with the tailings, the "red water" clarified and slowly settled out of solution (over a 3-4 day period). Qualitative XRD analyses conducted on the *Ro Tls Decant* solids determined that this sample was comprised predominantly of potassium feldspar and plagioclase with minor amounts of quartz, mica, hematite, zircon, ferrocolumbite and monazite.

Whole rock analyses confirmed that the head and tailings samples tested were comprised primarily of SiO_2 (54 to 64 %) with moderate amounts of Fe_2O_3 (10 to 14%) and Al_2O_3 (9.2 to 13%) and minor amounts of K_2O (4.4 to 6.1%) and Na_2O (2.4 to 3.7%). Minor concentrations of ZrO_2 (3.1 to 3.8%) and trace concentration of Nb_2O_5 (0.4 to 0.5%) were also evident in the head samples. As expected, only trace levels of ZrO_2 and Nb_2O were reported in the tailings samples. The lesser levels of MgO (1.5 to 2.4%) and CaO (0.8 to 1.2%) observed in the tailings samples in comparison to the ore composite samples (MgO 2.7 to 3.4% and CaO 2.6 to 3.1%) were consistent with the modal analysis for these samples.

In comparison to the aforementioned samples, whole rock analyses of the concentrates indicated significantly lesser concentrations of SiO_2 (20 to 31%), Al_2O_3 (9.2 to 13%), K_2O (1.3 to 1.9%) and Na_2O (<1%) and significantly increased concentrations of Fe_2O_3 (13 to 18%), CaO (7.4 to 12%), MgO (3.1 to 4.3%), ZrO_2 (13 to 18%) and Nb_2O_5 (1.5 to 1.9%). Again the increased CaO and MgO contents reported for the concentrates are consistent with the modal analysis for these samples.

With the exception of the *MC3* head sample, the high loss on ignition (LOI) values (3.5 to 12%) determined for the head and concentrate samples suggests significant amounts of volatile species (e.g. hydrates, hydroxides and carbonates) are present in these samples. The low LOI values (≤2.0%) reported for the tailings samples, however; indicate that little of these species remain in the tailings. The poor recovery sums reported for the whole rock analyses, especially for the concentrate and head samples, are due to the considerable REE and Zr content of the samples. Comparative results of the whole rock analyses are shown in Figure 2.

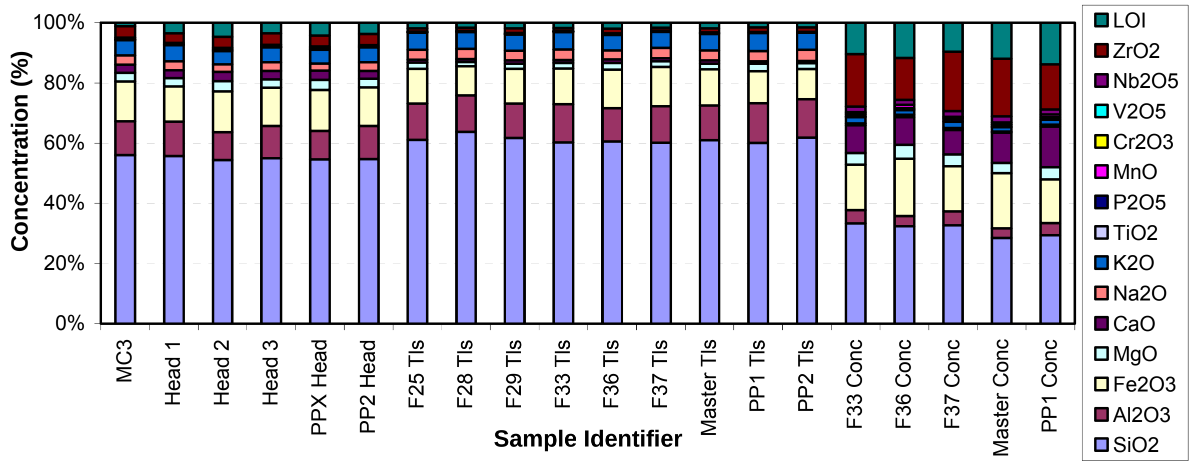


Figure 2: XRF Whole Rock Results

As expected, analysis of the Thor Lake solids typically reported increased levels of radionuclides in the concentrate samples in comparison to the ore samples, while tailings showed lower levels of radionuclides. Results of the radionuclide analyses are illustrated in Figure 3

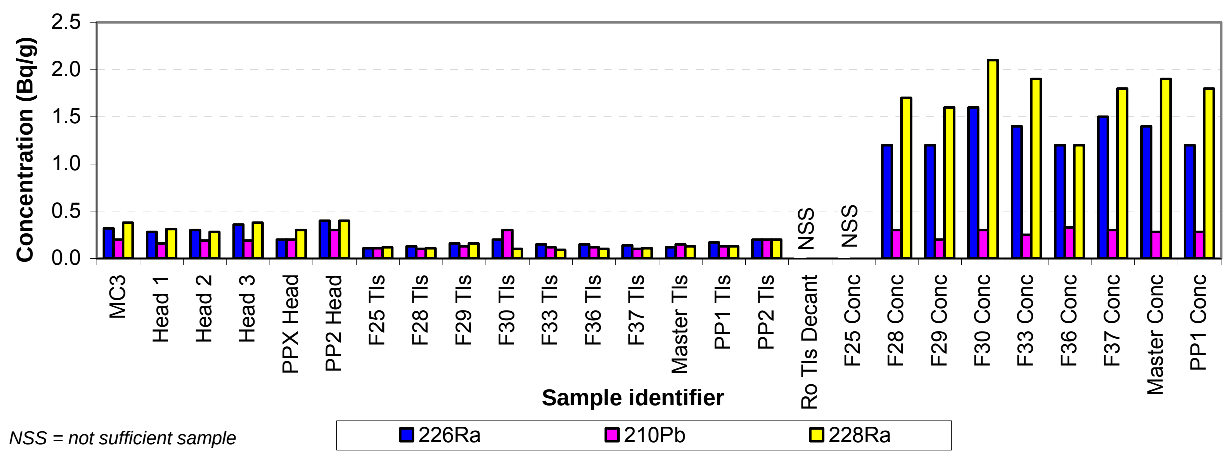


Figure 3: Radionuclide Analysis Results

ICP-OES/MS strong acid digest elemental analysis of the Thor Lake samples typically reported significant amounts of Si, Al, Ca, F, Fe, K, Mg and Na. Noteworthy levels of Ce, La, Nb, Nd and Zr were also evident in the concentrates and, in the case of Zr, in the heads.

As expected, the concentrates typically reported lesser concentrations of Si (11 to 14%) and Al (1.5 to 2.2%) and increased levels of Ca, Zr, Ce, La, Nb and Nd. In comparison, the head and tailings samples generally reported increased levels of Si (22 to 27%) and Al (4.7 to 8.6%) and considerably lesser concentrations of Ca, Zr, Ce, La, Nb and Nd. The *Ro Tls Decant* sample ("red water" solids) typically reported increased levels of Ba, Ca, Cu, Li, Mn, Pb, Y and Zn (one order of magnitude) and double the amount of Mg observed in the other tailings samples.

It should be noted that, as per instructions from John Goode and Avalon, ICP analyses were initially submitted to the Minerals analytical department through the hydrometallurgical department, rather than being submitted to environmental analytical. Because Minerals deals with the increased metal concentrations typical of metallurgical process samples, the final detection limits achieved for numerous parameters (e.g. Hg, Ag, Bi, Cd, Co, Cu, Pb, Sb, Se, Sn and Tl) were unsuitable for the environmental test program. To achieve the environmental detection limits required the samples were resubmitted for environmental ICP analyses. Due to a lack of sample mass, the environmental ICP reassay analyses could not be completed on the *F25 Conc* and *Ro Tls Decant* samples. Comparative results of the ICP elemental analyses and of the zirconium and REE analyses are provided in Figures 4 and 5, respectively. The significant components of the samples are illustrated in Figures 6 through 8.

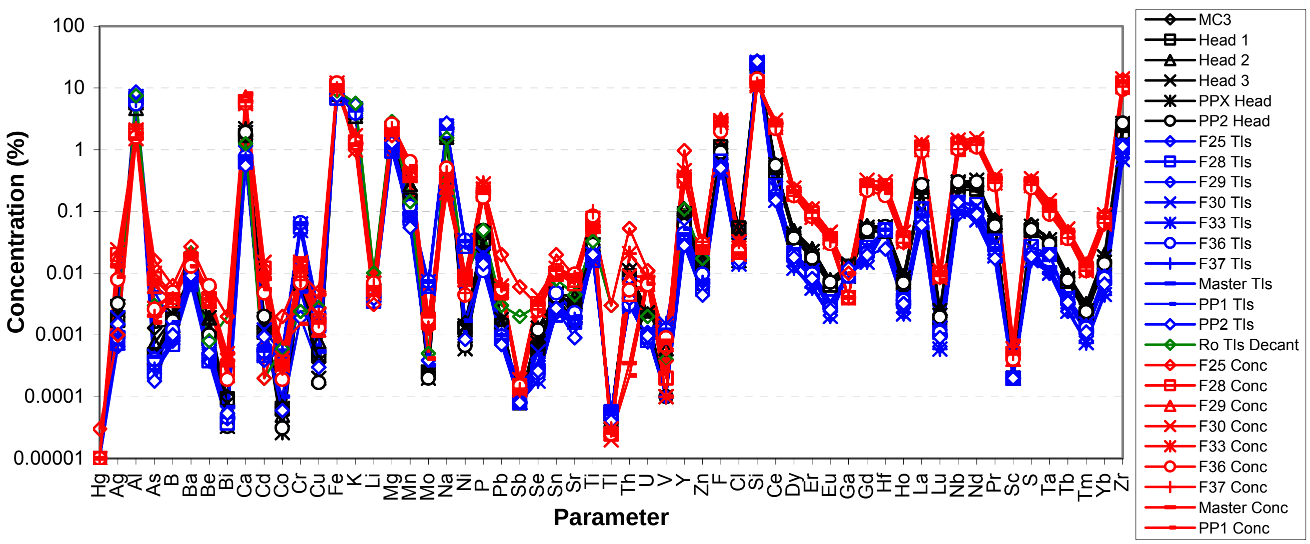


Figure 4: ICP-OES/MS Elemental Analyses Results

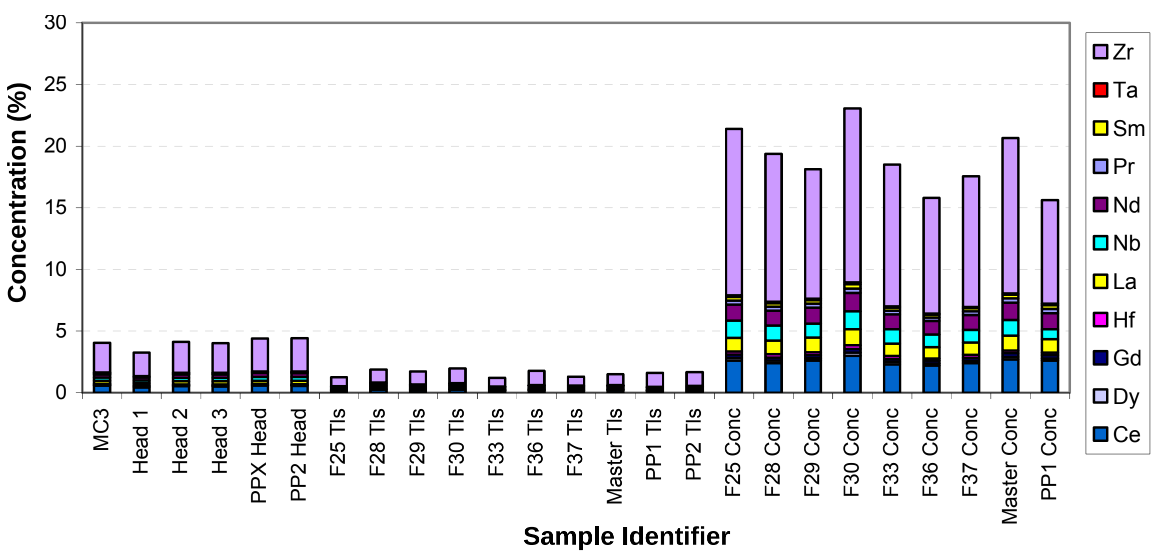


Figure 5: Comparison of Zirconium and REE Significant Components

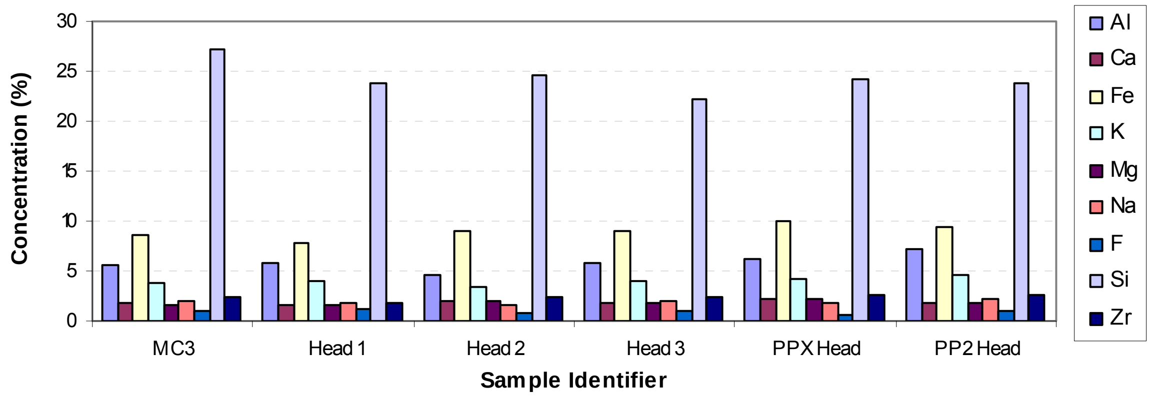


Figure 6: Comparison of the ICP Elemental Significant Components – Heads

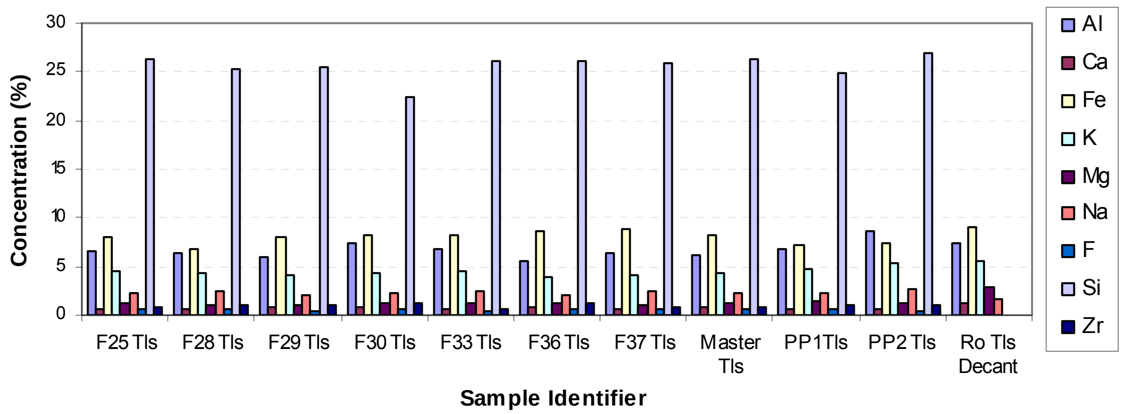


Figure 7: Comparison of the ICP Elemental Significant Components – Tailings

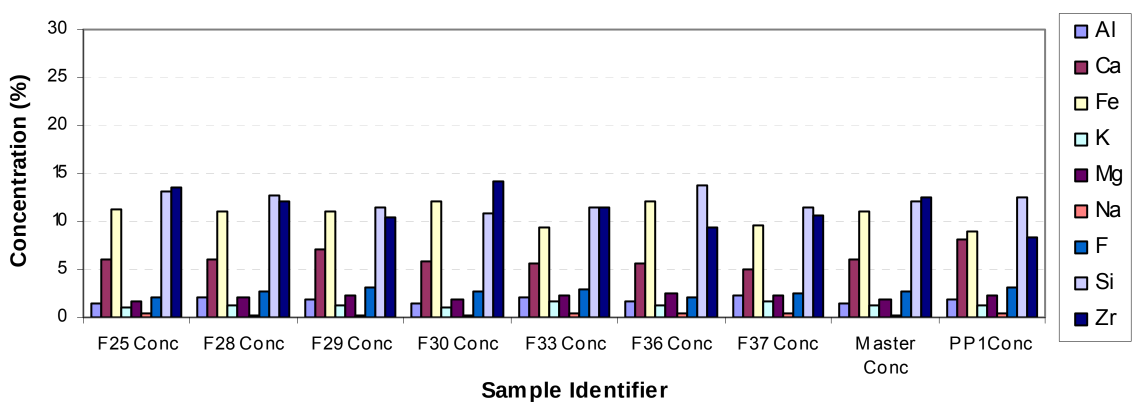


Figure 8: Comparison of the ICP Elemental Significant Components – Concentrates

Analysis of the Thor Lake shake flask extraction leachates reported all controlled parameters at concentrations well within the Canadian Metal Mining Regulation (MMER) limits. Radionuclide levels (^{226}Ra, ^{228}Ra and ^{210}Pb) of the shake flask leachates typically remained below the analytical detection limits.

Although the head samples (*MC3, Head 1, Head 2, Head 3, PPX Head* and *PP2 Head*) reported alkaline initial and final slurry pH values in excess of the MMER upper limit (9.5), separation of the DI leachant from the solids resulted in alkaline final pH values within the specified limits. Near neutral to slightly alkaline final pH values (7.61 to 8.12) were reported for the concentrate and tailings samples. Significant amounts of Cl (1.0 to 12 mg/L), F (0.90 to 12 mg/L), Ca (6.4 to21 mg/L), K (0.87 to 28 mg/L), Mg (0.96 to 5.3 mg/L), Na (4.6 to 25 mg/L) and Si (2.7 to 7.7 mg/L) were evident in all of the Thor Lake leachates.

The head samples typically reported concentrations of Cl, F and K one order of magnitude greater than those determined for the concentrate and tailings samples. Increased levels of Na (one order of magnitude) were also evident in the head and the *F36, F37, PP1* and *PP2* tailings leachates. Increased Ca was observed in the tailings samples. Figure 9 graphically illustrates the results of the shake flask extractions.

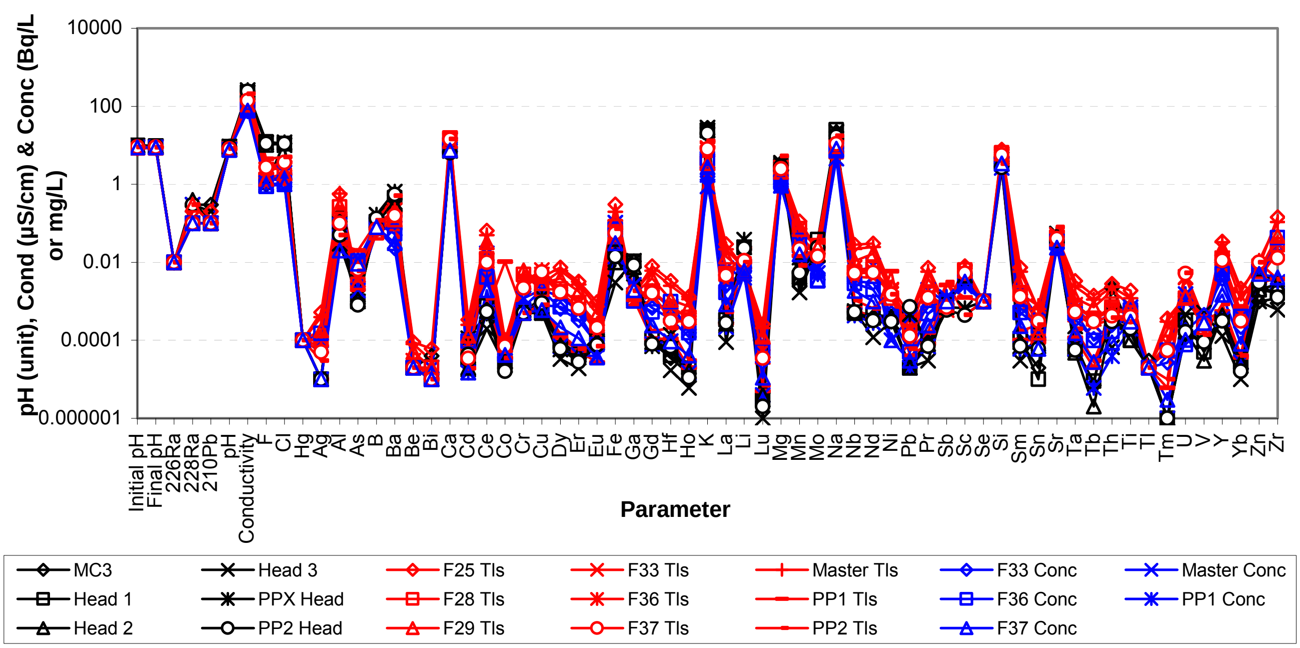


Figure 9: Shake Flask Extraction Test Results

As expected, analysis of the *Thor Lake Water* (*#4* and *#7*), *XPS Tap Water* and *Ortech Tap Water* samples reported all MMER controlled parameters within the specified limits. Near neutral to moderately alkaline pH values (≥7.62) and significant levels of TDS and corresponding conductivity measurements were observed in both the lake and tap water solutions. Radionuclide levels in the lake and tap water samples were below the analytical detection limits.

Increased levels of alkalinity, F, TOC and Mg (one order of magnitude) were observed in the *Thor Lake Water* samples, while increased levels of Cl, Na (one order of magnitude) and SO_4 (2 orders of magnitude were evident in the tap water samples (XPS and Ortech). The *XPS Tap Water* sample also reported unusually high levels of P and Zn for a tap water sample (one and 2 orders of magnitude higher, respectively, than the lake water and *Ortech Tap Water* samples).

Overall both the lake water and tap water solutions showed significant levels of alkalinity (51 to 44 mg/L), TOC (1.6 to 13 mg/L), Cl (3.8 to 48 mg/L), Ca (26 to 35 mg/L), K (1.4 to 1.9 mg/L), Mg (5.6 to 18 mg/L), Na (2.6 to 24 mg/L). While significant concentrations of Si (2.9 to 8.4 mg/L) were observed in the lake water and *XPS Tap Water* samples, only low level Si was evident in the *Ortech Tap Water* sample.

Analysis of the simulated hydromet filtrate solutions (*CH-WT1 PLS* and *RAR-1*) again reported all parameters controlled by the MMER within the designated limits. Near neutral pH values (≥7.46) and very high levels of TDS and corresponding conductivity measurements were observed in both the initial solution (*CH-WT1 PLS+WASH*) and in the solution after radium removal by addition of $BaCl_2$ and $Fe^2(SO_4)_3*5H_2O$ (*RAR-1 Filtrate*). With the exception of ^{226}Ra in the *CH-WT1 PLS* solution, radionuclide analyses completed on the hydromet filtrate solution were typically below the analytical detection limits.

In general both the hydromet filtrate solutions showed very high levels of SO_4 (11,000 to 12,000 mg/L), Ca (387 to 393 mg/L), Mg (1530 to 1550 mg/L), Na (1470 to 1580 mg/L). Significant levels of alkalinity (82 to 118 mg/L), K (87 to 88 mg/L), Li (2.2 mg/L for both samples), Mn (6.2 to 6.3 mg/L), Si (2.5 to 2.6 mg/L) and Sr (11 mg/L for both samples) were also observed. Increased levels of Cl (55 mg/L), F (1.8 mg/L), TOC (54 mg/L) and ammonia (92 mg/L) were also reported in the *CH-WT1 PLS* filtrate solution. The cause of the increased zirconium and REE concentrations observed in the hydromet solution after radium removal (*RAR-1 Filtrate*) is unknown.

Results of the lake and tap water analyses and of the hydromet solution analyses are illustrated in Figures 10 and 11, respectively.

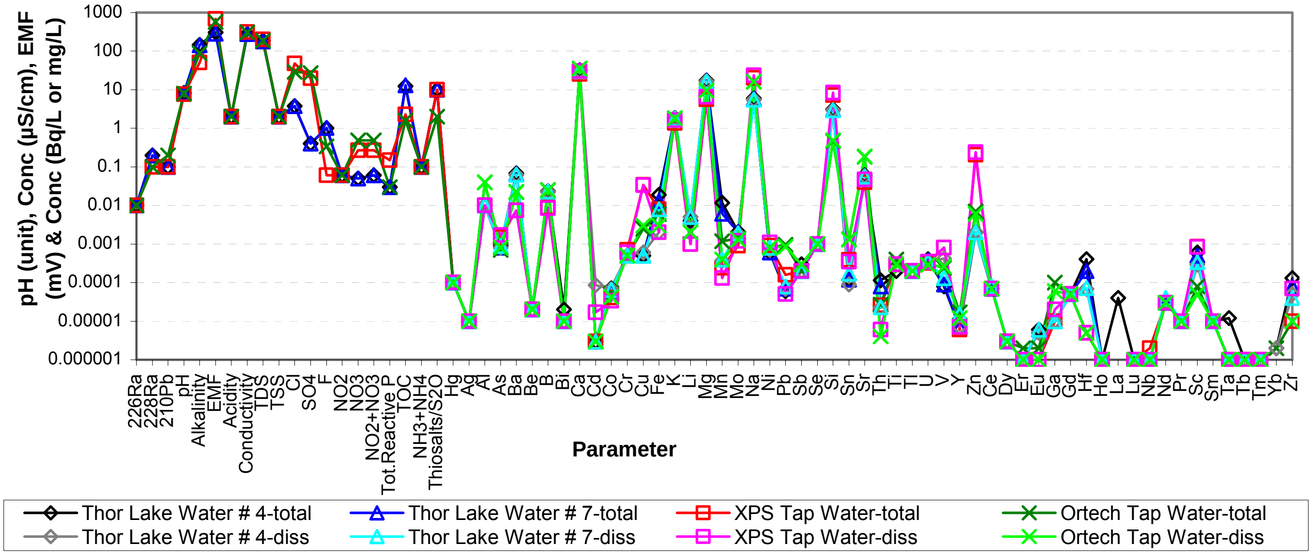


Figure 10: Thor Lake and XPS & Ortech Tap Water Solution Analyses

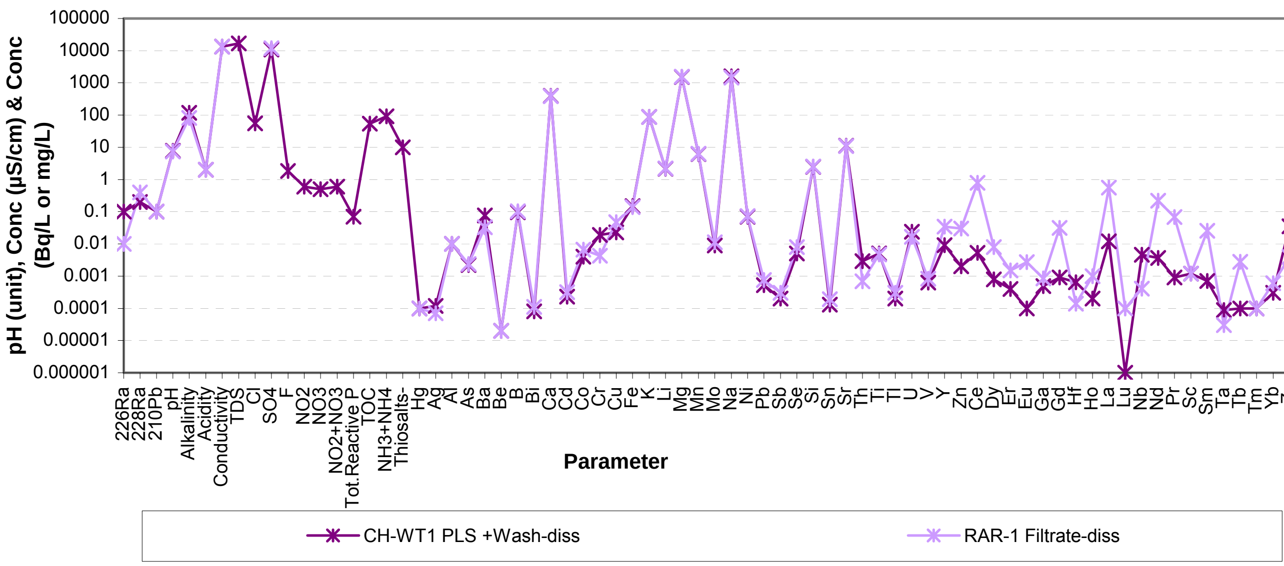


Figure 11: Hydromet Filtrate Solution Analyses

Because of the high level of suspended solids in the fresh *PP1* and *PP2* tailings pulps, these samples were allowed to settle for 5 days prior to decantation of the tailings solution. Analysis of the fresh and aged tailings solutions (*PP1 Tls Decant Day 5* and *Day 60* and *PP2 Tls Decant Day 5* and *Day 61*) reported all controlled parameter at concentrations well within the designated MMER limits. Moderately alkaline pH values (≥8.16) and high levels of TDS and corresponding conductivity measurements were observed in both the fresh and aged solutions. Radionuclide levels in the solutions typically remained at, or below the analytical detection limits. Significantly lesser levels of SO_4 (one order of magnitude) were evident in the *PP2 Tls* solutions in comparison to the *PP1 Tls* solutions.

Overall the fresh and aged *PP1* and *PP2* tailings solutions showed significant levels of alkalinity (119 to 148 mg/L), TOC (7.2 to 17 mg/L), F (4.4 to 9.3 mg/L), Cl (44 to 63 mg/L), SO_4 (29 to 110 mg/L), Ca (22 to 44 mg/L), K (26 to 37 mg/L), Mg (8.2 to 12 mg/L), Na (66 to 75 mg/L) and Si (4.7 to 8.2 mg/L). Dissolved metals analyses indicated that the majority of the Al, Fe and REE metals in solution in the Day 5 decant solutions were due to suspended solids. Over the 60 and 61 day ageing test period's significant decreases were observed in the concentrations of most metals in the tailings solutions. Results of the fresh and aged solution analyses are illustrated graphically in Figure 12.

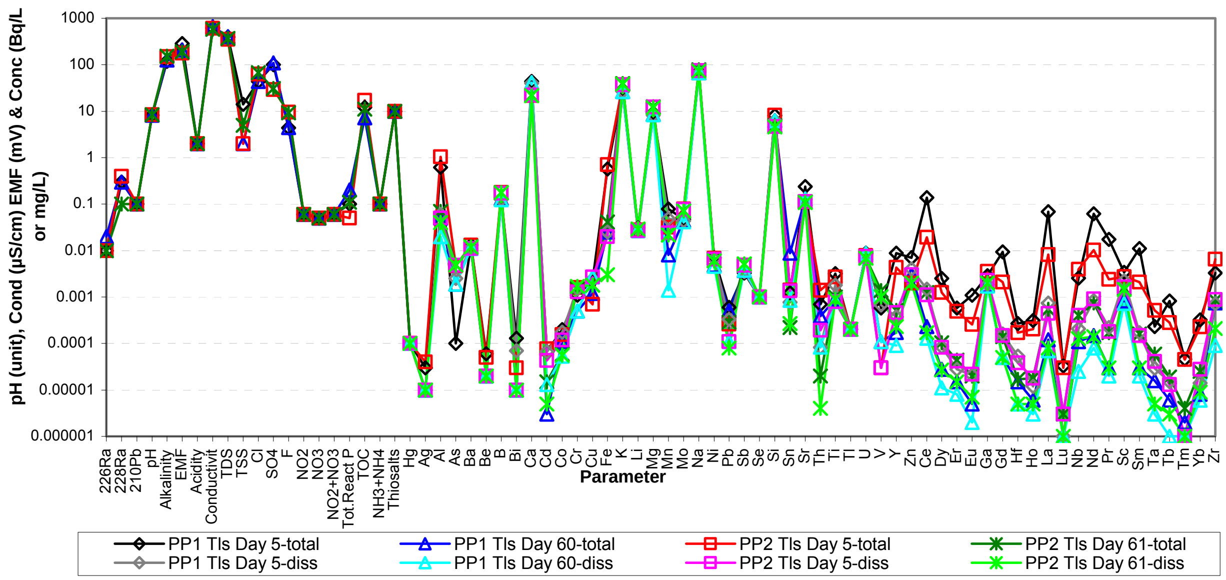
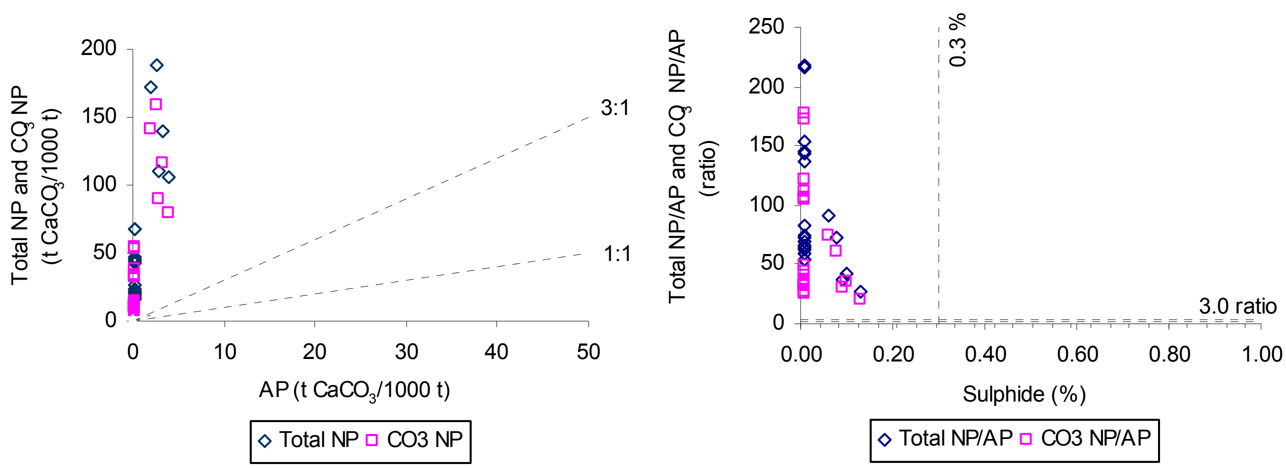


Figure 12: ICP-OES/MS Fresh and Aged Tailings Decant Solution Analyses

LC_{50} acute lethality testing of the *PP1 Tls Decant Day 5* solution resulted in non-lethal designations for both *Daphnia magna* and rainbow trout. Both the daphnia and the trout tests reported 100% survival rates in the full strength effluent (100% effluent concentration) resulting in LC_{50} values of >100%.

ABA test results for the head (*MC3, Head 1, Head 2, Head 3, PPX Head* and *PP2 Head*) and concentrate samples (*Master Conc, F33 Conc, F36 Conc, F37 Conc* and *PP1 Conc*) reported alkaline paste pH values (>8.96) and fizz rates (3) suggesting the presence of available reactive alkaline minerals. Determination of the carbonate (CO_3) content of these samples also indicated that ≥72% of the total NP reported for these samples is related to fast reacting carbonate minerals. The resultant CO_3 NP values (32.7 to 159 t $CaCO_3$/1000 t), coupled with the relatively low sulphide contents (<0.01 to 0.10%) and significant CO_3 NP/AP ratios (19.7 to 172), clearly illustrate the neutralisation capacity of these samples and indicate the potential for acid neutralisation. The non-acid forming nature of these samples was corroborated by the NAG test results which reported no net acidity generated and alkaline final pH values (≥9.40) after aggressive oxidation of the samples.

The tailings samples (*F25 Tls, F28 Tls, F29 Tls, Master Tls, F33 Tls, F36 Tls, F37 Tls, PP1 Tls* and *PP2 Tls*) samples reported lesser total NP values than the head and concentrate samples. Carbonate analyses also indicated that much of this total NP (40% to 53%) was from less reactive sources. Since carbonate minerals are typically the only minerals that can react at fast enough rates to counteract acidities released by sulphide mineral oxidation; the resultant CO_3 Net NP values less than 20 t $CaCO_3$/1000 t (7.5 to 14.7 t $CaCO_3$/1000 t) reported for the tailings samples indicate increased uncertainty with regards to the availability and reactivity of this NP. Nonetheless, the very low sulphide contents (<0.01%) and large CO_3 NP/AP ratios (25 to 48) indicate that these samples are highly unlikely to generate acidity. The alkaline final pH values (≥9.76) reported after aggressive oxidation of the tailings samples during NAG testing confirmed the highly unlikely acid generation potential determined by the ABA test method. Results of the total and CO_3 NP versus AP and of the total and CO_3 NP/AP ratios versus sulphide are presented in Figure 13.



Note: Samples reporting NP to AP ratios greater than 3 indicate low potential for acid generation (non-acid generating). Samples reporting NP to AP ratios of less than 3 but greater than 1 indicate uncertain potential for acid generation. Samples reporting NP to AP ratios less than 1 indicate potential for acid generation.

Figure 13: Modified Acid Base Accounting Results

Near neutral to slightly alkaline pH values and low to moderate levels of alkalinity were maintained in the tailings (*F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls* and *PP2 Tls*) and concentrate (*Master Conc* and *PP2 Conc*) humidity cell leachates. Only minimal concentrations of SO_4 were released into the weekly leachates. ICP-OES/MS analyses of the humidity cell leachates reported all MMER controlled parameters well within their respective limits in all test cells. Comparisons of the weekly pH values, conductivity levels and SO_4 concentrations reported in the *F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls* and *PP2 Tls* leachates are illustrated in Figure 14. Results for the *Master Conc* and *PP1 Conc* leachates are shown in Figure 15.

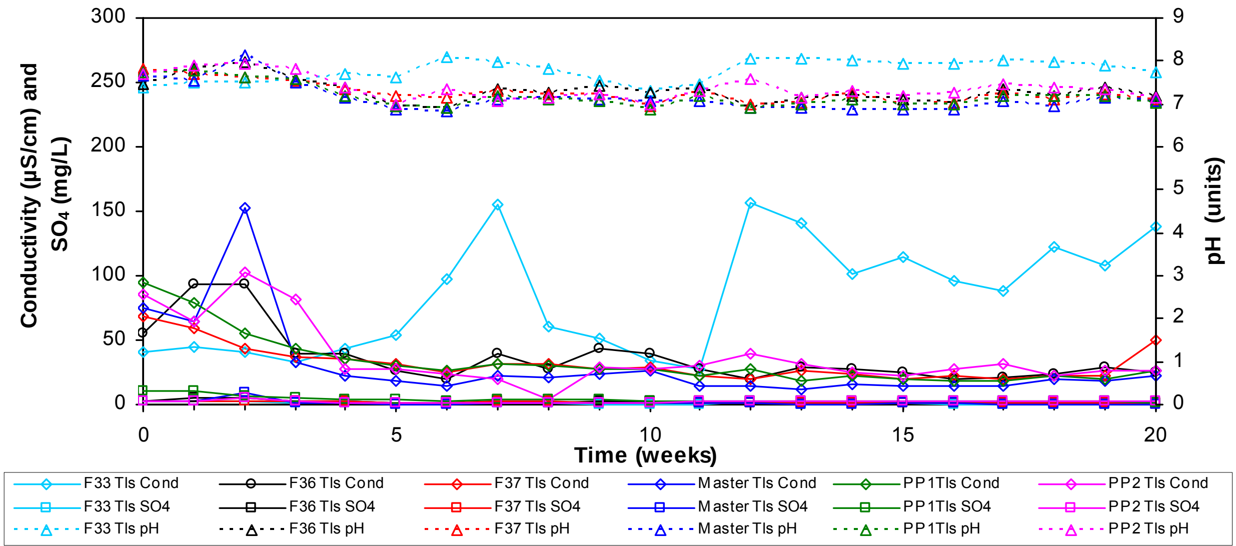


Figure 14: Humidity Cell Test – pH Values, Conductivity and Sulphate Concentrations – F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls and PP2 Tls

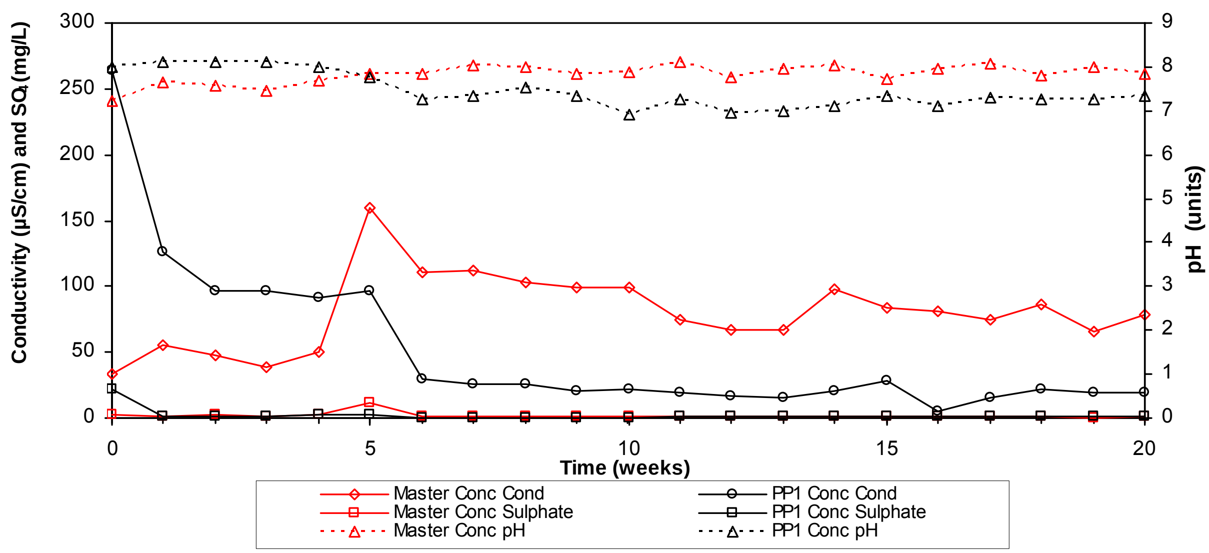
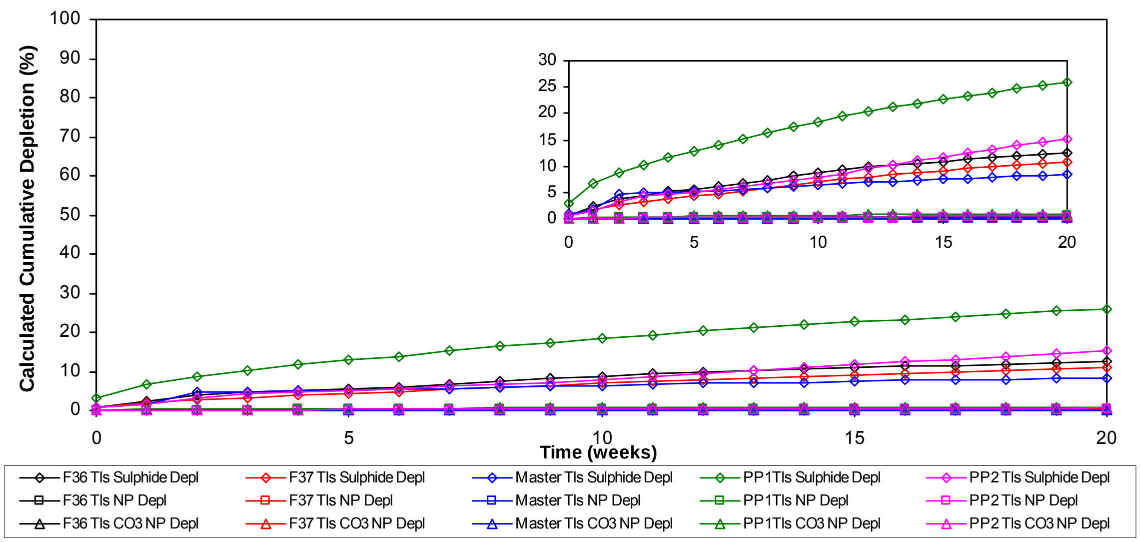


Figure 15: Humidity Cell Test – pH Values, Conductivity and Sulphate Concentrations – Master Conc and PP1 Conc

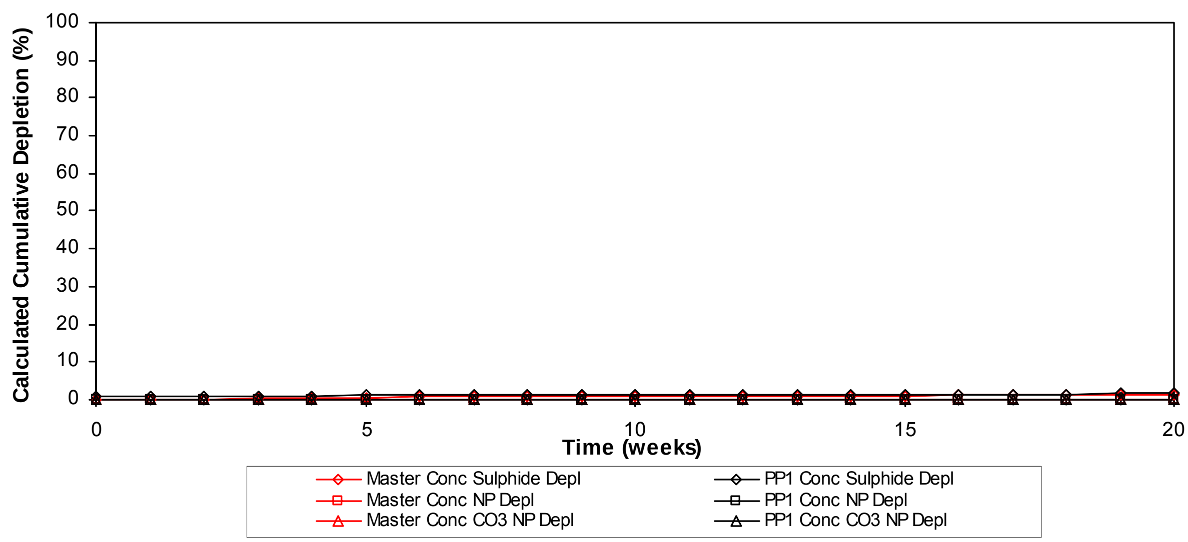
After twenty weeks of leaching, the cumulative sulphide depletion rates (1.27 to 26%) and related CO_3 NP depletions (0.03 to 0.95%) determined for the entire suite of Nechalacho tailings and concentrate samples (*F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls, PP2 Tls, Master Conc* and *PP1 Conc*) suggest that the sulphide minerals in these samples are depleting at significantly faster rates than the carbonate minerals. This indicates that, if the current depletion rates continue, these samples may be expected to retain excess CO_3 NP carbonate available upon exhaustion of the sulphide content contained within the samples. Depletion rates for the tailings samples (*F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls* and

PP2 Tls) are shown in Figure 16 below. Depletion rates for the concentrate samples (*Master Conc* and *PP2 Conc*) are illustrated in Figure 17.



Note: Inset graph y-axis reduced to 30% for ease of viewing.

Figure 16: Humidity Cell Test – Depletion Rates – F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls and PP2 Tls



Note: Inset graph y-axis reduced to 10% for ease of viewing.

Figure 17: Humidity Cell Test – Depletion Rates – Master Conc and PP1 Conc

Specific gravities of 2.91 to 2.97 were determined for the head sample solids (*MC3, Head 1, Head 2, Head 3, PPX Head* and *PP2 Head)*. As expected, the ASTM D 422 particle size distribution analyses (sieve and hydrometer) completed on the crushed head samples classified these samples as primarily sand sized material (≥85%). Of this sand sized material, the majority would be classified as coarse to medium grained sand. Only 12 to 15% of the head samples fractured into fine grained particles (<200 mesh or 0.075 mm) with only 2 to 5% of this fine grained material reporting as clay size particles (<0.002 mm).

Lower specific gravities (2.76 to 2.86) were determined for the tailing samples (*F25 Tls, F28 Tls, F29 Tls, F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls* and *PP2 Tls*). In comparison to the head samples, sieve and hydrometer analyses completed on the tailings samples reported very fine particle size distribution characteristics with approximately 98% of the samples passing the 200 mesh sieve (0.075 mm). Of this fine grained material, approximately 88% comprised of silt size grains. The remaining approximately 10% of the tailings samples fell into the clay size range.

As would be expected, the concentrate samples (*F33 Conc, F36 Conc, F37 Conc, Master Conc* and *PP1 Conc*) reported increased specific gravities (3.47 to 3.67). PSD analyses completed on the concentrates also showed a very fine particle size distribution with only approximately 1% of the samples being classified as fine sand sized material and approximately 99% of the samples passing the 200 mesh sieve (0.075 mm). This fine grained material was typically comprised of silt size grains (~97%) with only a minor fraction falling into the clay size range (~2%).

Malvern laser particle size analysis completed on the Ro Tls Decant (red water) reported a much finer particle size distribution than the tailings samples. In comparison to the tailings, 100% of the “red water” solids fell into the clay/silt size range. Of this extremely fine grained material, approximately 18% was comprised of silt size grains while the remaining 82% of the sample was comprised of clay sized grain (<0.002 mm). Comparative results of the particle size analyses are presented graphically in Figures 18 and 19.

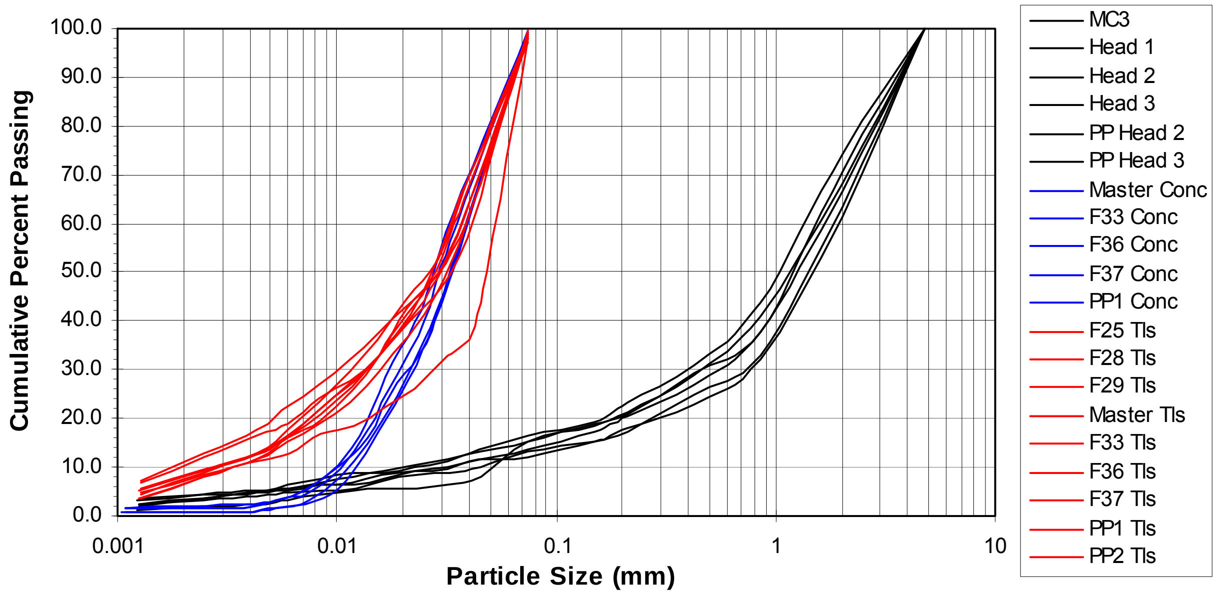


Figure 18: Particle Size Distribution Results

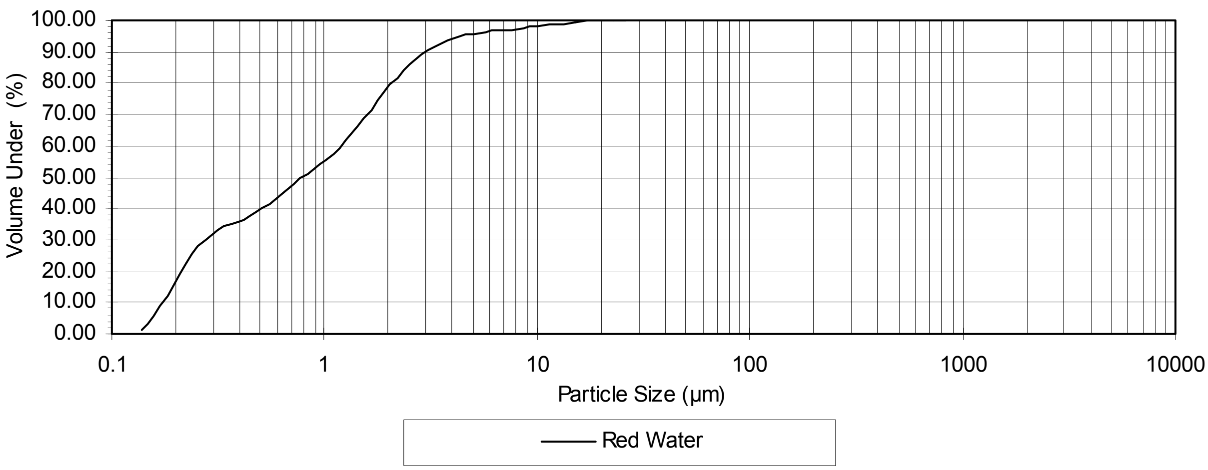


Figure 19: Malvern Particle Size Distribution Results – Red Water

Atterberg limits testing reported liquid limits (LL) of 21 to 24 (% moisture) for the *Master Tls, PP1 Tls* and *PP2 Tls* samples. The tailings samples; however, could not be rolled into a 1/8″ thread at any moisture content. Therefore, as per the ASTM D 4318-05 method, the Avalon tailings samples were determined to be non-plastic. This behaviour is typical of cohesionless inorganic silt or rock flour type samples.

Results of the standard Proctor tests completed on the *PP1 Tls* and *PP2 Tls* samples reported very similar maximum wet (2.055 and 2.028 g/cm^3, respectively) and dry (1.785 and 1.760 g/cm^3) densities and a typically silt like optimum moisture content (15.1 and 15.2%). These are compaction characteristics that would typically be expected from a silt or rock flour type material. Results of the standard Proctor tests are illustrated in Figure 20.

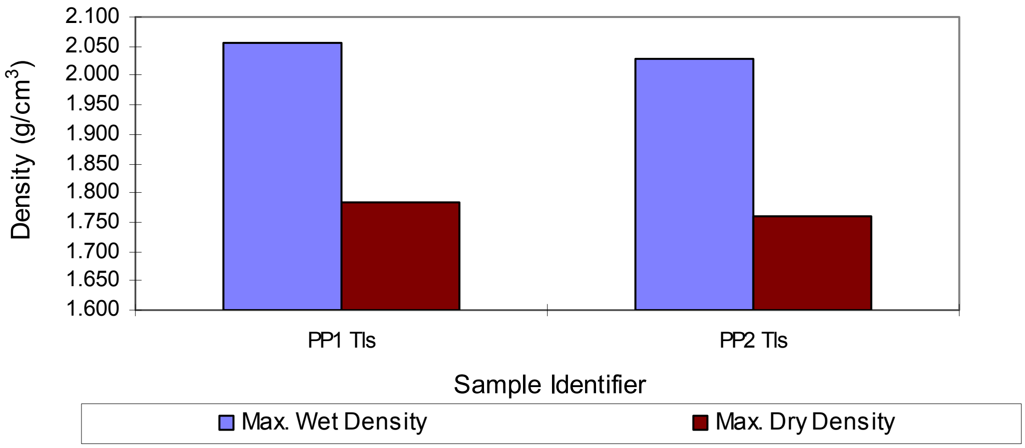


Figure 20: Standard Proctor Test Results

Hydraulic conductivity testing was completed on the *Master Tls, PP1 Tls* and *PP2 Tls* samples after they were combined with approximately 13.5% water (by weight) and wet compacted with an effort of 600 kN-m/m^3 into a 4" diameter mould. The compacted tailings reported semi-pervious hydraulic conductivities ranging from 7.15E^{-08} to 6.19E^{-07} m/s (average hydraulic conductivities of 5.16E^{-07}, 7.18E^{-08} and 1.98E^{-07} m/s for the *Master Tls, PP1 Tls* and *PP2 Tls* samples, respectively). In general terms, these hydraulic conductivities correspond to that which would be expected from very fine sand or silt type soils. Due to the much faster flow of water through the *Master Tls* and *PP2 Tls* samples (1½ to 2 minutes and 4½ to 5½ minutes, respectively) in comparison to the *PP1 Tls* (approximately 13 minutes), the *Master Tls* and *PP2 Tls* hydraulic conductivity tests were both recompacted and retested using fresh test charges. The 2nd conductivity tests; however, reported very similar results to the 1st round of testing on these samples. Results of the hydraulic conductivity test are shown in Figures 21 through 23.

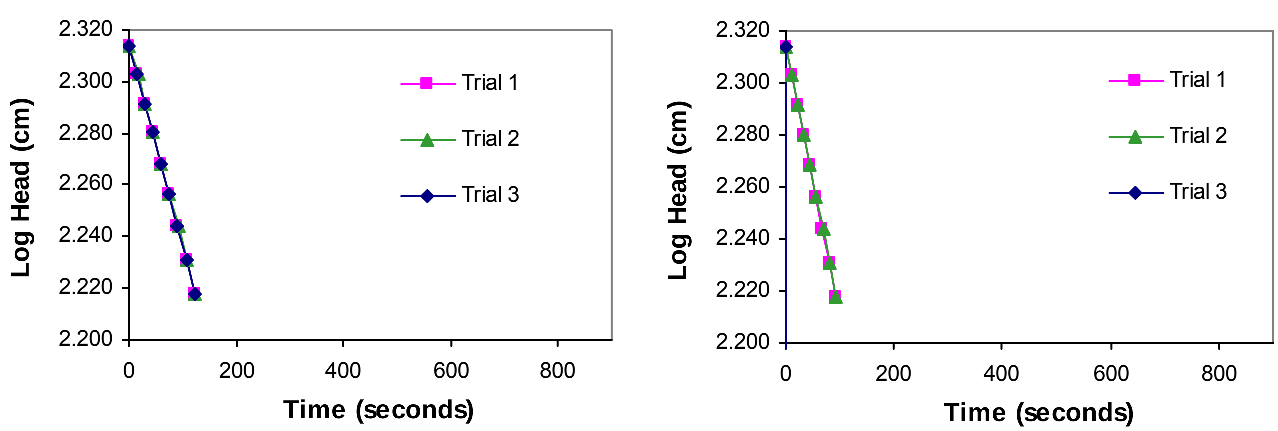


Figure 21: Hydraulic Conductivity Test Results – Master Tls

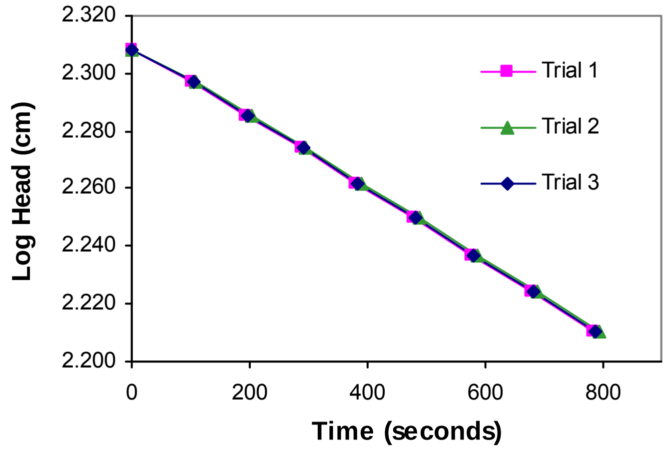


Figure 22: Hydraulic Conductivity Test Results – PP1 Tls

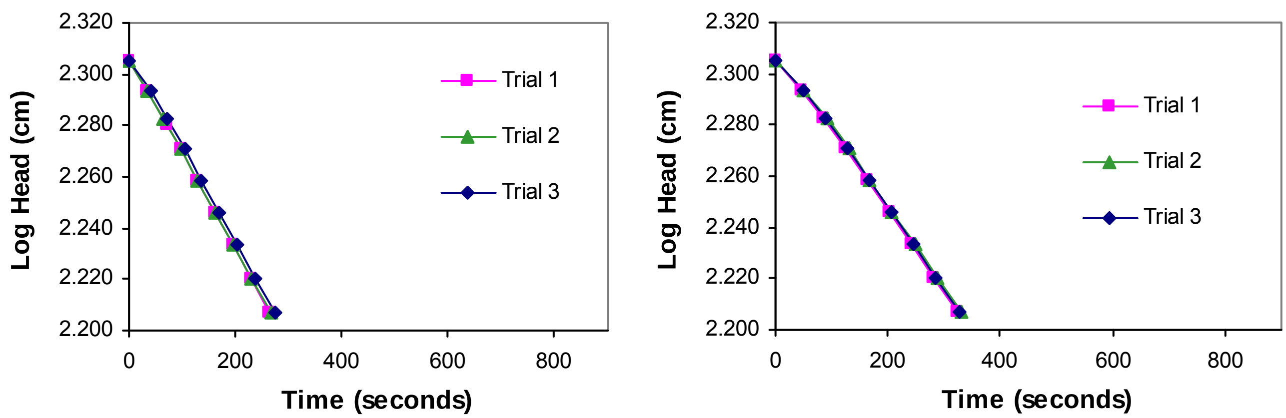
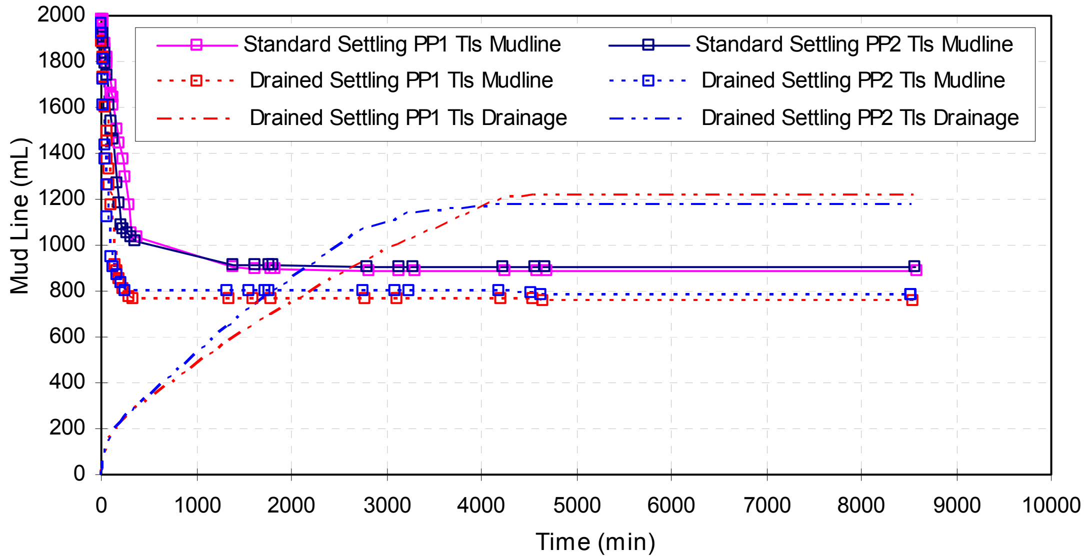


Figure 23: Hydraulic Conductivity Test Results – PP2 Tls

Results of the settling tests indicated that the *PP1 Tls* and *PP2 Tls* will settle fairly quickly in a tailings pond setting. The standard settling test samples generally settled out of solution in 5 hours and terminal density was achieved shortly thereafter (approximately 10 hrs). The addition of drainage to the settling tests resulted in significantly improved the settling rate (terminal density reached in approximately 5 hrs) and moderate increases to the final % solids reported by the samples (increases of 7 to 8%). Figure 24 graphically illustrates the time vs. mudline measurements while Figure 25 illustrates the initial and final results of the settling tests.



Note: "mudline" refers to the liquid/solid interface

Figure 24: Standard and Drained Settling Test Results – Time vs. Mudline

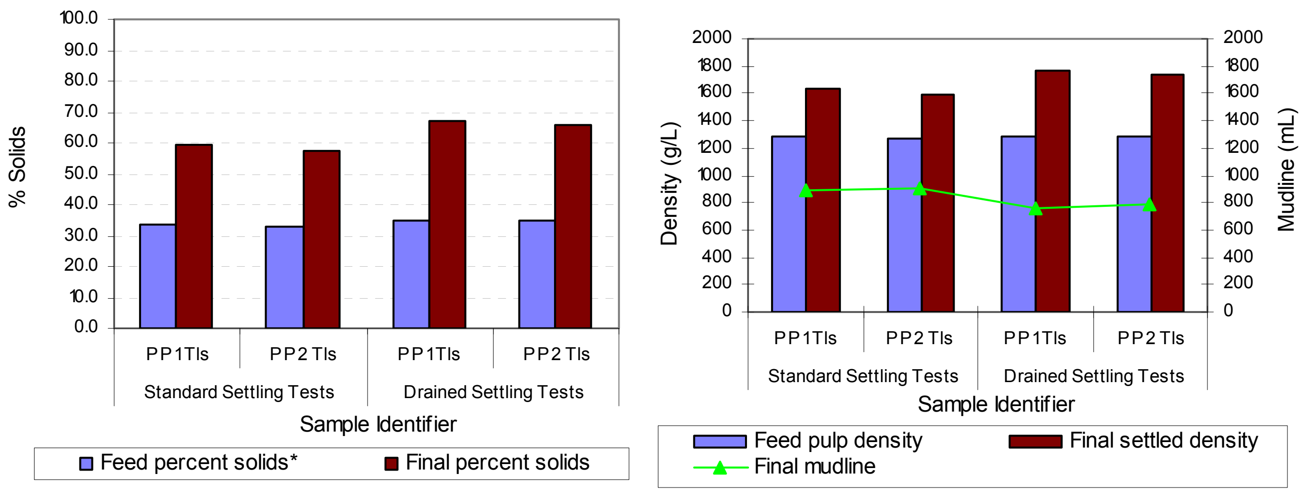


Figure 25: Standard and Drained Settling Test Results – Feed % Solids vs. Final % Solids & Feed Pulp Density vs. Final Settled Density

Conclusions

This report has been provided to Avalon to summarise results of the testwork completed on the Thor Lake Nechalacho samples. In conclusion:

- Modal analyses determined that the Thor Lake samples tested were predominantly comprised of gangue silicate minerals with minor to moderate amounts of Fe-oxides.
- Increased carbonate concentrations were reported in the head and concentrate samples in comparison to the tailings samples.
- Only trace levels of sulphide minerals were reported during the modal analyses completed on the samples (head, tailings and concentrates).
- Whole rock and ICP-OES/MS elemental analyses confirmed the primarily silicate composition of the samples.
- The high loss on ignition values determined for the head and concentrate samples suggested the presence of significant amounts of volatile species, while the low LOI values reported for the tailing samples indicate that little of these species remain in the tailings.
- The low whole rock recoveries reported for the concentrate and head samples, are expected to result directly from the considerable REE content of the samples.
- The Nechalacho head, tailings and concentrate sample solids typically reported only low levels of radionuclides.
- Analysis of the shake flask extraction leachates, fresh and aged pilot plant tailings decant solutions and simulated hydromet solutions (before and after radium treatment) reported all controlled parameters, including ^{226}Ra, at concentrations well within the MMER limits.
- Toxicity testing determined that the *PP1 Tls Decant Day 5* solution was non-lethal to both *Daphnia magna* and rainbow trout.
- Modified ABA testing indicated, and NAG testing confirmed, that the Thor Lake head, tailings and concentrate samples tested were either potentially acid neutralising or highly unlikely to generate acidity.
- Depletion rates calculated for the humidity cell test samples (*F33 Tls, F36 Tls, F37 Tls, Master Tls, PP1 Tls, PP2 Tls, Master Conc* and *PP1 Conc*) suggest that the sulphide minerals in these samples are depleting at significantly faster rates than the carbonate minerals.
- Analysis of the humidity cell leachates reported all World Bank controlled parameters well within the designated limits.
- Particle size distribution analyses indicated that the head samples were comprised primarily of sand sized grains, while the tailings and concentrate samples were comprised primarily of fines (silt and clay sized material).
- Atterberg limit testing indicated that the tailings samples tested (*Master Tls, PP1 Tls* and *PP2 Tls*) were non-plastic.
- The *PP1 Tls* and *PP2 Tls* samples reported compaction characteristics that would typically be expected from a silt or rock flour type material.
- Hydraulic conductivity testing of the *Master Tls, PP1 Tls* and *PP2 Tls* samples reported semi-pervious hydraulic conductivities also corresponding to that which would be expected from very fine sand or silt type materials.
- The addition of drainage to the *PP1 Tls* and *PP2 Tls* settling tests resulted in an improved settling rates and moderate increases to the final settled density of the samples.

References

Department of Justice Canada. 2002. *Metal Mining Effluent Regulations, Fisheries Act SOR-2002-222.* Updated 2004. Available Online: http://laws.justice.gc.ca/en/F-14/SOR-2002-222/119716.html

Appendix A – Analytical Summary Tables

Whole Rock Analysis

		Head Samples					
Parameter	**Unit**	**Master Comp 3**	**Avalon Head Sample 1**	**Avalon Head Sample 2**	**Avalon Head Sample 3**	**XPS PP Comp 2 Head**	**XPS PP Comp 3 Head**
Sample Origin		**F25, 28, 29 + 30**	**F33**	**F36**	**F37**	**MPPX**	**MPP Run 2**
LIMS		11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	10356-DEC10	10356-DEC10
SiO_2	%	54.0	54.7	53.6	53.9	54.2	53.8
Al_2O_3	%	10.8	11.3	9.15	10.6	9.42	10.8
Fe_2O_3	%	12.7	11.5	13.3	12.4	13.5	12.6
MgO	%	2.83	2.68	3.34	2.77	3.35	2.79
CaO	%	2.60	2.59	3.08	2.68	2.99	2.58
Na_2O	%	2.94	2.93	2.39	2.88	2.43	2.78
K_2O	%	4.89	5.24	4.44	4.81	4.48	4.86
TiO_2	%	0.05	0.05	0.05	0.04	0.05	0.04
P_2O_5	%	0.11	0.08	0.05	0.12	0.06	0.12
MnO	%	0.19	0.22	0.40	0.19	0.40	0.20
Cr_2O_3	%	< 0.01	< 0.01	< 0.01	< 0.01	0.11	< 0.01
V_2O_5	%	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01
LOI	%	1.14	3.42	4.54	3.42	4.25	3.68
Sum	%	92.2	94.7	94.3	93.9	95.2	94.3
Nb_2O_5	%	0.43	0.39	0.46	0.50	0.46	0.44
ZrO_2	%	3.65	3.14	3.73	3.75	3.57	3.58

Whole Rock Analy

		Tailings Samples								
Parameter	**Unit**	**F25 Comb Tls**	**F28 Comb Tls**	**F29 Comb Tls**	**F33 Comb Tls**	**F36 Comb Tls**	**F37 Comb Tls**	**Master Tls**	**XPS PP Comp 1 Tls**	**XPS PP Comp 2 Tls**
Sample Origin								**F25, 28, 29 + 30**	**MPP Run 1**	**MPP Run 2**
LIMS		11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	11612-NOV10	10329-DEC10
SiO_2	%	59.2	63.6	61.5	60.2	60.2	59.8	60.9	60.2	61.9
Al_2O_3	%	11.6	12.0	11.5	12.7	10.9	12.0	11.5	13.2	12.8
Fe_2O_3	%	11.2	9.66	11.5	11.8	12.8	13.0	12.0	10.7	10.0
MgO	%	2.01	1.47	1.67	1.85	2.23	1.82	1.86	2.43	1.93
CaO	%	0.89	0.91	1.08	0.98	1.15	1.00	1.11	0.85	0.75
Na_2O	%	3.23	3.37	3.23	3.49	2.95	3.38	3.28	3.35	3.71
K_2O	%	5.51	5.53	5.35	5.78	5.10	5.35	5.42	6.05	5.65
TiO_2	%	0.03	0.03	0.03	0.02	0.03	0.03	0.03	0.03	0.04
P_2O_5	%	0.04	0.04	0.03	0.03	0.01	0.03	0.05	0.04	0.04
MnO	%	0.12	0.11	0.12	0.12	0.16	0.09	0.14	0.09	0.08
Cr_2O_3	%	0.08	0.09	0.10	0.10	0.10	0.10	0.10	< 0.01	< 0.01
V_2O_5	%	< 0.01	< 0.01	< 0.01	< 0.01	0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	%	1.82	1.67	1.81	1.74	1.96	1.61	1.86	1.54	1.50
Sum	%	95.6	98.4	97.9	98.8	97.6	98.2	98.2	98.5	98.4
Nb_2O_5	%	0.14	0.16	0.19	0.15	0.18	0.16	0.20	0.18	0.22
ZrO_2	%	0.95	1.01	1.60	0.92	1.55	0.97	1.38	1.52	1.45

Whole Rock Analy

Parameter	Unit	Concentrate Samples				
		F33 Mozley Conc Comp	F36 Mozley Conc Comp	F37 Mozley Conc Comp	Master Conc	XPS PP Comp 1 Conc
Sample Origin					**F25, 28, 29 + 30**	**MPP Run 1**
LIMS		11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10	11294-NOV10
SiO_2	%	30.6	30.1	29.9	25.8	26.5
Al_2O_3	%	4.13	3.14	4.17	2.92	3.59
Fe_2O_3	%	13.8	17.7	13.7	16.6	13.1
MgO	%	3.62	4.31	3.60	3.08	3.64
CaO	%	8.45	8.50	7.39	9.03	12.1
Na_2O	%	0.56	0.80	0.58	0.41	0.58
K_2O	%	1.93	1.46	1.88	1.32	1.49
TiO_2	%	0.14	0.14	0.18	0.11	0.09
P_2O_5	%	0.80	0.44	0.80	0.66	0.61
MnO	%	0.57	0.98	0.47	0.65	0.84
Cr_2O_3	%	< 0.01	< 0.01	0.02	< 0.01	< 0.01
V_2O_5	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
LOI	%	9.62	10.8	8.78	10.8	12.4
Sum	%	74.2	78.3	71.5	71.3	74.9
Nb_2O_5	%	1.69	1.54	1.80	1.88	1.53
ZrO_2	%	16.0	13.0	18.0	17.3	13.5

Radionuclide and ICP-OES/MS Elemental Analyses

Parameter	Unit	Head Samples					
		Master Comp 3	**Avalon Head Sample 1**	**Avalon Head Sample 2**	**Avalon Head Sample 3**	**XPS PP Comp 2 Head**	**XPS PP Comp 3 Head**
Sample Origin		**F25, 28, 29 + 30**	**F33**	**F36**	**F37**	**XPS MPPX**	**MPP Run 2**
Batch #		T10-01609.0	T10-01609.0	T10-01609.0	T10-01609.0	T10-01853.0	T10-01853.0
^{226}Ra	Bq/g	0.32	0.28	0.30	0.36	0.2	0.4
^{210}Pb	Bq/g	0.20	0.16	0.19	0.19	0.2	0.3
^{228}Ra	Bq/g	0.38	0.31	0.28	0.38	0.3	0.4
LIMS #		11622-NOV10	11622-NOV10	11622-NOV10	11622-NOV10	10359-DEC10	10359-DEC10
Hg	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ag	g/t	23	17	18	25	29	32
Al	µg/g	56000	59000	47000	58000	62000	73000
As	g/t	13	4.8	7.4	4.2	4.4	3.4
B	g/t	15	18	19	14	22	17
Ba	g/t	110	95	89	120	93	110
Be	g/t	11	8.5	19	8.7	19	10
Bi	g/t	1.0	0.92	0.67	0.60	0.33	0.33
Ca	µg/g	18000	17000	21000	19000	22000	19000
Cd	g/t	14	11	12	16	18	20
Co	g/t	0.68	0.63	0.50	0.65	0.26	0.31
Cr	g/t	79	75	86	69	83	82
Cu	g/t	3.6	4.7	7.9	3.8	2.0	1.7
Fe	µg/g	87000	78000	90000	90000	100000	94000
K	µg/g	39000	41000	35000	40000	43000	47000
Li	g/t	52	51	65	52	69	53
Mg	µg/g	17000	16000	20000	18000	22000	19000
Mn	g/t	1300	1500	2700	1400	2800	1300
Mo	g/t	2.5	2.5	2.9	2.0	2.5	2.0
Na	µg/g	20000	19000	16000	20000	18000	22000
Ni	g/t	16	13	12	14	6.0	6.7
P	µg/g	400	340	180	440	190	490
Pb	g/t	17	14	15	18	10	11
Sb	g/t	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se	g/t	7.6	6.0	7.2	7.4	13	12
Sn	g/t	42	36	45	43	46	42
Sr	g/t	32	31	42	34	21	16
Ti	µg/g	260	230	250	290	280	290
Tl	g/t	0.52	0.52	0.47	0.52	0.29	0.32
Th	g/t	110	91	73	110	61	80
U	g/t	22	19	17	23	12	15
V	g/t	< 1	10	6	12	< 1	< 1
Y	g/t	1100	790	1100	920	720	590
Zn	g/t	140	140	160	130	100	64
LIMS		02281-NOV10	03121-SEP10 + 02284-NOV10	03121-SEP10 + 02284-NOV10	03121-SEP10 + 02284-NOV10	02850-DEC10	02850-DEC10
F	%	1.04	1.11	0.89	1.05	0.69	0.91
Cl	g/t	360	540	536	499	159	170
Si	%	27.2	23.8	24.7	22.3	24.2	23.8
Ce	g/t	5700	4300	5200	5100	5700	5600
Dy	g/t	420	380	490	420	437	371
Er	g/t	180	170	250	190	227	176
Eu	g/t	74	64	78	76	71.6	71.4
Ga	%	0.010	0.013	0.013	0.014	0.009	0.010
Gd	g/t	570	480	590	560	501	500
Hf	%	0.06	0.047	0.057	0.056	0.06	0.06
Ho	g/t	72	66	92	73	83.5	69.8
La	g/t	2500	2100	2500	2500	2500	2700
Lu	g/t	21	17	27	21	24.9	19.4
Nb	%	0.24	0.22	0.26	0.28	0.30	0.30
Nd	g/t	2600	2300	2700	2700	3200	3000
Pr	g/t	740	570	680	660	595	584
Sc	g/t	2	< 2	< 2	< 2	< 2	< 2
Sm	g/t	610	490	610	580	504	508
Ta	%	0.03	0.029	0.036	0.035	0.03	0.03
Tb	g/t	86	73	94	83	81.1	77.3
Tm	g/t	24	22	32	25	31.1	23.7
Yb	g/t	150	130	200	150	184	142
Zr	%	2.4	1.9	2.5	2.4	2.68	2.70

All samples from project 12390-001

Radionuclide and ICP-OE

Parameter	Unit	Tailings Samples F25 Comb Tls	F28 Comb Tls	F29 Comb Tls	F30 Comb Tls	F33 Comb Tls	F36 Comb Tls	F37 Comb Tls
Sample Origin								
Batch #		T10-01609.0	T10-01609.0	T10-01609.0	T10-01852.0	T10-01609.0	T10-01609.0	T10-01609.0
^{226}Ra	Bq/g	0.11	0.13	0.16	0.2	0.15	0.15	0.14
^{210}Pb	Bq/g	0.11	0.10	0.13	< 0.3	0.12	0.12	0.10
^{228}Ra	Bq/g	0.12	0.11	0.16	0.1	0.09	0.10	0.11
LIMS #		11622-NOV10	11622-NOV10	11622-NOV10	10271-DEC10	11622-NOV10	11622-NOV10	11622-NOV10
Hg	µg/g	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ag	g/t	6.5	7.3	11	19	7.4	9.1	8.9
Al	µg/g	65000	64000	60000	73000	68000	55000	63000
As	g/t	3.1	2.5	4.2	4.5	3.0	4.0	2.8
B	g/t	8	7	9	9	13	12	8
Ba	g/t	73	65	72	70	83	80	85
Be	g/t	3.8	3.8	5.2	4.9	4.5	7.3	4.2
Bi	g/t	0.46	0.37	0.44	0.56	0.55	0.46	0.47
Ca	µg/g	6400	6300	7300	9000	6500	7600	6900
Cd	g/t	3.9	4.6	6.8	12	4.6	5.4	5.4
Co	g/t	5.6	4.9	5.3	4.8	5.6	5.6	5.3
Cr	g/t	640	560	640	490	630	660	600
Cu	g/t	19	14	17	15	21	23	22
Fe	µg/g	81000	68000	80000	82000	82000	87000	89000
K	µg/g	46000	44000	42000	43000	46000	39000	42000
Li	g/t	48	35	40	45	44	49	35
Mg	µg/g	13000	9400	10000	12000	12000	13000	11000
Mn	g/t	860	760	890	920	870	1200	680
Mo	g/t	73	61	72	57	74	74	70
Na	µg/g	23000	24000	21000	22000	24000	20000	24000
Ni	g/t	330	270	320	290	340	340	320
P	µg/g	170	130	180	203	130	110	170
Pb	g/t	8.9	9.2	10	11	9.0	9.4	8.6
Sb	g/t	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8	< 0.8
Se	g/t	1.9	2.6	3.8	5.3	1.8	2.4	2.4
Sn	g/t	23	21	26	26	25	48	25
Sr	g/t	16	16	18	19	20	23	18
Ti	µg/g	190	160	180	204	170	200	180
Tl	g/t	0.59	0.57	0.56	0.56	0.56	0.51	0.50
Th	g/t	31	31	44	66	29	31	34
U	g/t	7.7	8.1	11	11	8.9	9.1	10
V	g/t	10	10	9	15	13	12	15
Y	g/t	310	310	440	590	310	440	330
Zn	g/t	74	55	61	77	75	97	71
LIMS		03108-OCT10	03108-OCT10	03108-OCT10	03108-OCT10	03108-OCT10	03108-OCT10	03108-OCT10
F	%	0.54	0.65	0.49	0.58	0.47	0.52	0.54
Cl	g/t	185	179	151	312	140	151	185
Si	%	26.2	25.2	25.5	22.4	26.1	26.0	25.9
Ce	g/t	1600	2600	1900	2400	1500	1800	1800
Dy	g/t	130	200	200	210	120	190	130
Er	g/t	60	98	100	110	57	98	58
Eu	g/t	21	34	28	34	20	27	24
Ga	%	0.010	0.009	0.009	0.010	0.010	0.009	0.010
Gd	g/t	160	260	240	260	150	210	180
Hf	%	< 0.05	0.05	< 0.05	< 0.05	< 0.05	< 0.05	< 0.05
Ho	g/t	23	37	37	40	22	36	23
La	g/t	680	1100	870	1100	660	800	800
Lu	g/t	6.5	11	12	13	5.9	11	5.9
Nb	%	0.09	0.14	0.13	0.14	0.10	0.11	0.09
Nd	g/t	780	1300	970	1200	730	910	880
Pr	g/t	200	330	240	310	190	240	230
Sc	g/t	< 2	< 2	< 2	< 2	< 2	< 2	< 2
Sm	g/t	170	270	220	260	160	200	180
Ta	%	0.01	0.02	0.02	0.01	0.01	0.02	< 0.01
Tb	g/t	24	39	37	40	24	34	27
Tm	g/t	8.0	13	14	15	7.5	13	7.4
Yb	g/t	49	82	89	93	45	82	44
Zr	%	0.74	1.07	1.07	1.20	0.69	1.17	0.73

All samples from project 12390-0(

Radionuclide and ICP-OE

Parameter	Unit	Tailings Samples Master Tls	XPS PP Comp 1 Tls	Ro Tail Decant	XPS PP Comp 2 Tls
Sample Origin		**F25, 28, 29 + 30**	**MPP Run 1**	**MPP1 Red Water Solids**	**MPP Run 2**
Batch #		T10-01609.0	T10-01722.0	---	T10-01854.0
^{226}Ra	Bq/g	0.12	0.17	---	0.2
^{210}Pb	Bq/g	0.15	0.13	---	0.2
^{228}Ra	Bq/g	0.13	0.13	---	0.2
LIMS #		11622-NOV10	11615-NOV10	02222-JAN11	10332-DEC10
Hg	µg/g	< 0.1	< 0.1	---	< 0.1
Ag	g/t	9.8	11	< 10	15
Al	µg/g	62000	67000	74300	86000
As	g/t	4.4	49	< 30	1.8
B	g/t	9	16	---	10
Ba	g/t	73	94	211	91
Be	g/t	4.9	4.8	8.0	5.1
Bi	g/t	0.47	0.67	< 20	0.54
Ca	µg/g	7700	5800	12500	5500
Cd	g/t	6.0	6.6	< 2	9.3
Co	g/t	5.5	1.0	< 6	0.60
Cr	g/t	640	51	24	19
Cu	g/t	18	5.4	27.8	3.0
Fe	µg/g	83000	72000	89900	75000
K	µg/g	43000	47000	56200	54000
Li	g/t	44	51	101	39
Mg	µg/g	12000	14000	28500	13000
Mn	g/t	950	670	1430	550
Mo	g/t	73	3.2	< 5	3.9
Na	µg/g	22000	22000	15500	27000
Ni	g/t	330	17	76	8.5
P	µg/g	170	130	494	140
Pb	g/t	9.9	8.1	30	7.0
Sb	g/t	< 0.8	1.7	< 20	< 0.8
Se	g/t	3.2	2.9	< 30	2.6
Sn	g/t	26	29	< 80	27
Sr	g/t	19	20	44.5	9.03
Ti	µg/g	200	200	328	200
Tl	g/t	0.57	0.58	< 30	0.40
Th	g/t	40	39	---	39
U	g/t	9.9	12	< 20	9.7
V	g/t	12	< 1	< 4	< 1
Y	g/t	420	520	1080	280
Zn	g/t	68	77	174	44
LIMS		03108-OCT10	03020-NOV10 + 02814-DEC10		02784-DEC10
F	%	0.55	0.57	---	0.50
Cl	g/t	157	151	---	162
Si	%	26.3	24.8	---	27.0
Ce	g/t	1900	1260	---	1500
Dy	g/t	170	186	---	180
Er	g/t	83	89.5	---	82.3
Eu	g/t	27	24.3	---	25.4
Ga	%	0.010	0.010	---	0.012
Gd	g/t	210	190	---	198
Hf	%	< 0.05	0.03	---	0.02
Ho	g/t	31	35.0	---	32.1
La	g/t	850	547	---	600
Lu	g/t	9.6	10.1	---	9.10
Nb	%	0.10	0.12	---	0.14
Nd	g/t	970	654	---	900
Pr	g/t	250	157	---	173
Sc	g/t	< 2	< 2	---	< 2
Sm	g/t	210	169	---	186
Ta	%	< 0.01	0.01	---	0.02
Tb	g/t	32	33.8	---	33.7
Tm	g/t	11	12.2	---	11.1
Yb	g/t	71	73.2	---	66.7
Zr	%	0.88	1.13	---	1.12

All samples from project 12390-0

Radionuclide and ICP-OE

Parameter	Unit	Concentrate Samples					
		F25 Mozley Conc	F28 Conc Comp	F29 Conc Comp	F30 Conc Comp	F33 Mozley Conc Comp	F36 Mozley Conc Comp
Sample Origin							
Batch #		---	T10-01852.0	T10-01852.0	T10-01852.0	T10-01609.0	T10-01609.0
^{226}Ra	Bq/g	No Sample	1.2	1.2	1.6	1.4	1.2
^{210}Pb	Bq/g	Available	0.3	0.2	0.3	0.25	0.33
^{228}Ra	Bq/g	---	1.7	1.6	2.1	1.9	1.2
LIMS #		03282-SEP10	10271-DEC10	10271-DEC10	10271-DEC10	11622-NOV10	11622-NOV10
Hg	µg/g	< 0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Ag	g/t	< 10	200	180	240	110	78
Al	µg/g	15000	20000	19000	15000	21000	16000
As	g/t	160	81	62	100	27	26
B	g/t	63	40	36	44	43	49
Ba	g/t	270	170	160	210	170	130
Be	g/t	63	38	35	45	38	63
Bi	g/t	< 20	2.7	2.2	5.0	3.9	1.9
Ca	µg/g	61000	60000	71000	59000	56000	56000
Cd	g/t	< 2	120	110	150	64	48
Co	g/t	< 20	3.6	3.4	4.2	3.2	1.9
Cr	g/t	100	140	130	150	110	70
Cu	g/t	< 50	17	12	22	21	13
Fe	µg/g	113000	110000	110000	120000	94000	120000
K	µg/g	9900	13000	13000	9900	17000	13000
Li	g/t	31	54	58	48	70	70
Mg	µg/g	17000	21000	22000	18000	22000	26000
Mn	g/t	3800	4100	4600	4000	3800	6400
Mo	g/t	13	17	16	18	16	18
Na	µg/g	3500	3100	2500	2000	3600	5000
Ni	g/t	91	87	79	89	77	44
P	µg/g	2600	1900	2200	2300	2800	1700
Pb	g/t	< 200	48	52	62	52	54
Sb	g/t	< 60	1.5	1.4	1.9	1.3	1.5
Se	g/t	< 30	32	32	43	25	25
Sn	g/t	< 200	100	97	120	100	110
Sr	g/t	89	67	77	80	86	96
Ti	µg/g	690	600	570	640	710	840
Tl	g/t	< 30	0.25	0.25	0.20	0.30	0.25
Th	g/t	530	45	85	90	210	53
U	g/t	110	70	66	87	84	65
V	g/t	6	2	7	3	< 1	9
Y	g/t	9700	3100	4200	4600	3600	3600
Zn	g/t	270	260	260	290	260	300
LIMS		03282-SEP10 + 03087-OCT10	02474-OCT10 + 03088-OCT10	02474-OCT10 + 03088-OCT10	02474-OCT10 + 03088-OCT10	03108-OCT10	03108-OCT10
F	%	2.15	2.66	3.10	2.74	2.96	1.98
Cl	g/t	288	219	253	202	325	224
Si	%	13.2	12.7	11.5	10.9	11.5	13.8
Ce	g/t	26000	24000	26000	30000	23000	22000
Dy	g/t	2300	2000	1900	2400	1900	1800
Er	g/t	1100	940	910	1100	800	820
Eu	g/t	410	360	370	460	320	300
Ga	%	0.010	< 0.004	< 0.004	< 0.004	0.004	< 0.004
Gd	g/t	2800	2600	2600	3200	2400	2200
Hf	%	0.25	0.26	0.23	0.30	0.24	0.18
Ho	g/t	430	370	360	460	320	320
La	g/t	11000	11000	12000	13000	10000	9300
Lu	g/t	110	99	93	110	85	87
Nb	%	1.38	1.24	1.11	1.43	1.18	1.01
Nd	g/t	13000	12000	13000	15000	12000	11000
Pr	g/t	3300	3100	3300	3700	2900	2700
Sc	g/t	6	5	4	6	4	4
Sm	g/t	3100	2800	2900	3400	2600	2400
Ta	%	0.13	0.12	0.11	0.15	0.11	0.09
Tb	g/t	470	410	410	520	380	360
Tm	g/t	140	120	120	150	110	110
Yb	g/t	860	750	720	880	630	650
Zr	%	13.5	12.0	10.5	14.1	11.5	9.39

All samples from project 12390-0

Radionuclide and ICP-OE

Parameter	Unit	F37 Mozley Conc Comp	Concentrate Samples Master Conc	XPS PP Comp 1 Conc
Sample Origin			**F25, F28, F29 + F30**	**MPP Run 1**
Batch #		T10-01609.0	T10-01609.0	T10-01609.0
^{226}Ra	Bq/g	1.5	1.4	1.2
^{210}Pb	Bq/g	0.30	0.28	0.28
^{228}Ra	Bq/g	1.8	1.9	1.8
LIMS #		11622-NOV10	11622-NOV10	11622-NOV10
Hg	µg/g	< 0.1	< 0.1	< 0.1
Ag	g/t	130	130	87
Al	µg/g	22000	15000	18000
As	g/t	20	77	16
B	g/t	39	45	38
Ba	g/t	210	190	130
Be	g/t	39	47	40
Bi	g/t	3.1	3.8	5.0
Ca	µg/g	50000	61000	81000
Cd	g/t	80	80	55
Co	g/t	2.9	3.8	7.3
Cr	g/t	77	160	15
Cu	g/t	17	16	45
Fe	µg/g	96000	110000	89000
K	µg/g	17000	12000	13000
Li	g/t	62	59	51
Mg	µg/g	22000	19000	22000
Mn	g/t	3000	4700	5400
Mo	g/t	13	20	4.1
Na	µg/g	4200	2500	3600
Ni	g/t	48	86	100
P	µg/g	2900	2000	2200
Pb	g/t	64	63	55
Sb	g/t	1.3	1.3	1.2
Se	g/t	26	31	24
Sn	g/t	110	120	92
Sr	g/t	85	92	97
Ti	µg/g	990	570	470
Tl	g/t	0.29	0.26	0.24
Th	g/t	210	3.5	2.2
U	g/t	89	87	67
V	g/t	< 1	8	< 1
Y	g/t	3600	4000	3200
Zn	g/t	320	270	230
LIMS		03108-OCT10	02474-OCT10	02281-NOV10
F	%	2.41	2.80	3.21
Cl	g/t	326	207	184
Si	%	11.5	12.0	12.6
Ce	g/t	24000	27000	26000
Dy	g/t	1800	2100	1800
Er	g/t	770	1000	730
Eu	g/t	340	400	330
Ga	%	< 0.004	< 0.004	0.010
Gd	g/t	2500	2800	2600
Hf	%	0.25	0.24	0.20
Ho	g/t	310	400	290
La	g/t	10000	12000	11000
Lu	g/t	90	100	77
Nb	%	1.02	1.28	0.82
Nd	g/t	12000	14000	13000
Pr	g/t	2900	3300	3500
Sc	g/t	5	5	8
Sm	g/t	2700	3100	2900
Ta	%	0.10	0.11	0.12
Tb	g/t	370	460	370
Tm	g/t	110	130	96
Yb	g/t	650	790	570
Zr	%	10.6	12.6	8.4

All samples from project 12390-0

Modified Acid Base Accounting

Parameter	Unit	Head Samples Master Comp 3	Avalon Head Sample 1	Avalon Head Sample 2	Avalon Head Sample 3	XPS PP Comp 2 Head	XPS PP Comp 3 Head
Sample Origin		**F25, 28, 29 + 30**	**F33**	**F36**	**F37**	**MPPX**	**MPP Run 2**
LIMS		11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	10357-DEC10	10357-DEC10
Paste pH	units	9.12	9.54	9.58	9.57	9.59	9.51
Fizz Rate	---	3	3	3	3	3	3
Sample weight	g	2.04	2.05	1.97	2.00	1.97	1.96
HCl added	mL	40.00	31.20	44.30	39.60	50.50	33.50
HCl	Normality	0.10	0.10	0.10	0.10	0.10	0.10
NaOH	Normality	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3	mL	21.97	13.81	17.73	21.55	23.86	14.82
Final pH	units	1.61	1.97	1.94	1.60	1.75	1.92
NP	t $CaCO_3$/1000 t	44.2	42.4	67.4	45.1	67.6	47.7
AP	t $CaCO_3$/1000 t	0.31	0.31	0.31	0.31	0.31	0.31
Net NP	t $CaCO_3$/1000 t	43.9	42.1	67.1	44.8	67.3	47.4
NP/AP	ratio	143	137	217	145	218	154
S	%	0.021	0.016	0.023	0.019	< 0.005	< 0.005
SO_4^-S	%	0.02	0.02	0.02	0.02	< 0.01	< 0.01
Sulphide-S	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C	%	0.690	0.655	0.992	0.713	0.930	0.680
CO_3	%	1.97	1.98	3.30	2.26	3.21	2.08
CO_3 NP	t $CaCO_3$/1000 t	32.7	32.9	54.8	37.5	53.3	34.5
CO_3 Net NP	t $CaCO_3$/1000 t	32.4	32.6	54.5	37.2	53.0	34.2
CO_3 NP/AP	ratio	105	106	177	121	172	111
NP Attributed to CO_3	%	74.0	77.5	81.3	83.2	78.8	72.4

Net Acid Generation Testing

Parameter	Unit	Head Samples Master Comp 3	Avalon Head Sample 1	Avalon Head Sample 2	Avalon Head Sample 3	XPS PP Comp 2 Head	XPS PP Comp 3 Head
		F25, 28, 29 + 30	**F33**	**F36**	**F37**	**MPPX**	**MPP Run 2**
LIMS		11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	10358-DEC10	10358-DEC10
Sample weight	g	1.53	1.48	1.49	1.53	1.47	1.50
Vol H_2O_2	mL	150	150	150	150	150	150
Final pH	units	10.88	10.65	10.63	10.90	10.76	10.84
NaOH	Normality	0.10	0.10	0.10	0.10	0.10	0.10
Vol NaOH to pH 4.5	mL	0.00	0.00	0.00	0.00	0.00	0.00
Vol NaOH to pH 7.0	mL	0.00	0.00	0.00	0.00	0.00	0.00
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0	0

Modified Acid Base Accounting

Parameter	Unit	Tailings Samples								
		F25 Comb Tls	F28 Comb Tls	F29 Comb Tls	F33 Comb Tls	F36 Comb Tls	F37 Comb Tls	Master Tls	XPS PP Comp 1 Tls	XPS PP Comp 2 Tls
Sample Origin								**F25, 28, 29 + 30**	**MPP Run 1**	**MPP Run 2**
LIMS		11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	11613-NOV10	10330-DEC10
Paste pH	units	9.40	9.40	8.90	9.37	9.38	9.41	9.30	9.32	8.92
Fizz Rate	---	2	2	2	2	2	2	2	1	2
Sample weight	g	2.00	2.02	2.01	1.98	1.98	1.97	2.04	2.02	2.03
HCl added	mL	20.00	20.00	20.00	20.00	25.40	20.00	20.00	20.00	20.00
HCl	Normality	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH	Normality	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3	mL	12.31	11.92	10.83	11.95	15.20	11.62	10.85	12.62	13.21
Final pH	units	1.58	1.57	1.31	1.74	1.60	1.75	1.86	1.69	1.51
NP	t $CaCO_3$/1000 t	19.2	20.0	22.8	20.3	25.8	21.3	22.4	18.3	16.7
AP	t $CaCO_3$/1000 t	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31	0.31
Net NP	t $CaCO_3$/1000 t	18.9	19.7	22.5	20.0	25.5	21.0	22.1	18.0	16.4
NP/AP	ratio	61.9	64.5	73.5	65.5	83.2	68.7	72.3	59.0	53.9
S	%	0.007	< 0.005	0.006	0.008	0.006	0.006	0.006	0.007	< 0.005
SO_4^-S	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
Sulphide-S	%	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
C	%	0.344	0.321	0.377	0.312	0.406	0.316	0.405	0.214	0.196
CO_3	%	0.608	0.599	0.699	0.604	0.903	0.622	0.810	0.515	0.469
CO_3 NP	t $CaCO_3$/1000 t	10.1	9.9	11.6	10.0	15.0	10.3	13.4	8.5	7.8
CO_3 Net NP	t $CaCO_3$/1000 t	9.8	9.6	11.3	9.7	14.7	10.0	13.1	8.2	7.5
CO_3 NP/AP	ratio	32.6	32.1	37.4	32.3	48.4	33.3	43.4	27.6	25.1
NP Attributed to CO_3	%	52.6	49.7	50.9	49.4	58.1	48.5	60.0	46.7	46.6

Net Acid Generation Testing

Parameter	Unit	Tailings Samples								
		F25 Comb Tls	F28 Comb Tls	F29 Comb Tls	F33 Comb Tls	F36 Comb Tls	F37 Comb Tls	Master Tls	XPS PP Comp 1 Tls	XPS PP Comp 2 Tls
								F25, 28, 29 + 30	**MPP Run 1**	**MPP Run 2**
LIMS		11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	11614-NOV10	10331-DEC10
Sample weight	g	1.50	1.49	1.52	1.54	1.53	1.51	1.50	1.49	1.55
Vol H_2O_2	mL	150	150	150	150	150	150	150	150	150
Final pH	units	10.39	10.41	10.50	10.39	10.42	10.51	10.40	9.76	10.21
NaOH	Normality	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10	0.10
Vol NaOH to pH 4.5	mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vol NaOH to pH 7.0	mL	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0	0	0	0	0

Modified Acid Base Accounting

Parameter	Unit	Concentrate Samples: F33 Mozley Conc Comp	F36 Mozley Conc Comp	F37 Mozley Conc Comp	Master Conc	XPS PP1 Comp 1 Conc
Sample Origin					**F25, 28, 29 + 30**	**MPP Run 1**
LIMS		11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10	11295-NOV10
Paste pH	units	9.10	9.21	9.17	9.29	8.96
Fizz Rate	---	3	3	3	3	3
Sample weight	g	1.97	1.96	1.95	2.05	2.02
HCl added	mL	70.70	108.90	75.50	87.30	124.70
HCl	Normality	0.10	0.10	0.10	0.10	0.10
NaOH	Normality	0.10	0.10	0.10	0.10	0.10
NaOH to pH=8.3	mL	27.37	41.60	34.21	30.18	48.60
Final pH	units	1.87	1.62	1.77	1.90	1.74
NP	t $CaCO_3$/1000 t	110	172	106	139	188
AP	t $CaCO_3$/1000 t	2.94	1.89	4.05	3.26	2.62
Net NP	t $CaCO_3$/1000 t	107	170	102	136	186
NP/AP	ratio	37.4	91.0	26.2	42.8	71.9
S	%	0.116	0.078	0.135	0.118	0.098
SO_4^-S	%	0.02	0.02	< 0.01	0.01	0.01
Sulphide-S	%	0.09	0.06	0.13	0.10	0.08
C	%	2.02	2.64	1.93	2.86	3.08
CO_3	%	5.36	8.50	4.81	7.03	9.59
CO_3 NP	t $CaCO_3$/1000 t	89.0	141	79.8	117	159
CO_3 Net NP	t $CaCO_3$/1000 t	86.0	139	75.8	113	157
CO_3 NP/AP	ratio	30.3	74.7	19.7	35.8	60.8
NP Attributed to CO_3	%	80.9	82.0	75.3	84.0	84.7

Net Acid Generation Testing

Parameter	Unit	Concentrate Samples: F33 Mozley Conc Comp	F36 Mozley Conc Comp	F37 Mozley Conc Comp	Master Conc	XPS PP Comp 1 Conc
					F25, 28, 29 + 30	**MPP Run 1**
LIMS		11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10	11296-NOV10
Sample weight	g	1.55	1.52	1.51	1.49	1.53
Vol H_2O_2	mL	150	150	150	150	150
Final pH	units	10.50	10.34	10.84	10.61	9.40
NaOH	Normality	0.10	0.10	0.10	0.10	0.10
Vol NaOH to pH 4.5	mL	0.00	0.00	0.00	0.00	0.00
Vol NaOH to pH 7.0	mL	0.00	0.00	0.00	0.00	0.00
NAG@pH4.5	kg H_2SO_4/t	0	0	0	0	0
NAG@pH7.0	kg H_2SO_4/t	0	0	0	0	0

Shake Flask Extraction 3:1 L:S

Parameter	Unit	*MMER	Head Samples					
			Master Comp 3	Avalon Head Sample 1	Avalon Head Sample 2	Avalon Head Sample 3	XPS PP Comp 2 Head	XPS PP Comp 3 Head
Sample Origin			**F25, 28, 29 + 30**	**F33**	**F36**	**F37**	**MPPX**	**MPP Run 2**
LIMS			11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	10837-JAN11	10837-JAN11
Sample weight	g		500	348	216	388	250	250
Volume D.I. H_2O	mL		1500	1044	650	1163	750	750
Initial pH	units		9.90	9.82	9.87	9.86	9.97	9.86
Final pH	units		9.56	9.50	9.61	9.54	9.46	9.51
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.3	< 0.1	< 0.4	< 0.3	< 0.1	< 0.3
^{210}Pb	Bq/L		0.3	0.1	< 0.1	0.2	< 0.1	< 0.1
pH	units	6.0-9.5	9.27	9.21	8.96	9.33	8.50	8.92
Conductivity	uS/cm		237	227	223	228	258	242
F	mg/L		12.0	12.2	10.3	11.8	0.98	11.0
Cl	mg/L		11	11	11	10	12	11
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ag	mg/L		< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Al	mg/L		0.11	0.13	0.11	0.11	0.03	0.05
As	mg/L	0.50	0.0010	0.0010	0.0011	0.0010	0.0013	0.0008
B	mg/L		0.110	0.109	0.116	0.103	0.167	0.133
Ba	mg/L		0.404	0.457	0.311	0.345	0.654	0.550
Be	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bi	mg/L		0.00004	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Ca	mg/L		8.09	7.30	7.25	7.99	7.12	6.44
Cd	mg/L		0.000024	0.000032	0.000020	0.000018	0.000113	0.000043
Ce	mg/L		0.00061	0.00076	0.00056	0.00020	0.00048	0.00054
Co	mg/L		0.000036	0.000026	0.000029	0.000023	0.000029	0.000016
Cr	mg/L		< 0.0005	< 0.0005	< 0.0005	0.0006	< 0.0005	< 0.0005
Cu	mg/L	0.30	< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0013	0.0009
Dy	mg/L		0.000072	0.000094	0.000075	0.000033	0.000058	0.000061
Er	mg/L		0.000032	0.000043	0.000042	0.000019	0.000036	0.000028
Eu	mg/L		0.000125	0.000137	0.000098	0.000094	0.000085	0.000076
Fe	mg/L		0.015	0.018	0.010	0.003	0.012	0.014
Ga	mg/L		0.0105	0.0105	0.00752	0.01086	0.00511	0.00833
Gd	mg/L		0.00009	0.00011	0.00009	< 0.00005	0.00007	0.00008
Hf	mg/L		0.000035	0.000041	0.000064	0.000017	0.000138	0.000069
Ho	mg/L		0.000014	0.000019	0.000016	0.000006	0.000013	0.000011
K	mg/L		27.9	24.4	24.2	28.3	24.0	20.2
La	mg/L		0.00029	0.00034	0.00027	0.00009	0.00024	0.00028
Li	mg/L		0.023	0.024	0.031	0.024	0.038	0.023
Lu	mg/L		0.000005	0.000003	0.000004	0.000001	0.000003	0.000002
Mg	mg/L		3.52	3.00	3.38	3.57	3.31	2.83
Mn	mg/L		0.00243	0.00402	0.00414	0.00168	0.0133	0.00536
Mo	mg/L		0.0246	0.0381	0.0153	0.0251	0.0162	0.0239
Na	mg/L		21.8	25.1	21.8	22.0	22.2	16.8
Nb	mg/L		0.000475	0.000525	0.000503	0.000564	0.000519	0.000536
Nd	mg/L		0.00039	0.00046	0.00038	0.00012	0.00028	0.00032
Ni	mg/L	0.50	0.0004	0.0004	0.0004	0.0003	0.0003	0.0003
Pb	mg/L	0.20	< 0.00002	< 0.00002	< 0.00002	< 0.00002	0.00047	0.00072
Pr	mg/L		0.00009	0.00011	0.00008	0.00003	0.00007	0.00007
Sb	mg/L		0.0008	0.0008	0.0007	0.0011	0.0007	0.0006
Sc	mg/L		0.00457	0.00384	0.00459	0.00347	0.00067	0.00044
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		3.36	3.50	4.28	3.46	4.42	2.67
Sm	mg/L		0.00009	0.00011	0.00009	0.00003	0.00007	0.00007
Sn	mg/L		0.00002	< 0.00001	0.00016	0.00015	0.00007	0.00006
Sr	mg/L		0.0438	0.0402	0.0478	0.0423	0.0547	0.0361
Ta	mg/L		0.000082	0.000057	0.000048	0.000226	0.000059	0.000056
Tb	mg/L		0.000007	0.000009	0.000002	< 0.000001	< 0.000001	< 0.000001
Th	mg/L		0.00223	0.000577	0.000365	0.000066	0.000489	0.000300
Ti	mg/L		0.0002	0.0001	0.0001	< 0.0001	0.0002	0.0002
Tl	mg/L		0.00003	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Tm	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001
U	mg/L		0.000143	0.000327	0.000169	0.000462	0.000160	0.000165
V	mg/L		0.00009	0.00005	0.00003	0.00051	0.00009	0.00009
Y	mg/L		0.000323	0.000335	0.000440	0.000128	0.000390	0.000315
Yb	mg/L		0.000019	0.000028	0.000028	0.000010	0.000027	0.000016
Zn	mg/L	0.50	0.001	0.002	0.002	0.001	0.006	0.003
Zr	mg/L		0.00119	0.00161	0.00276	0.00061	0.00292	0.00128

**Department of Justice Canada. 2002.* Metal Mining Effluent Regulations*, Fisheries Act SOR-2002-222.*

Available Online: http://laws.justice.gc.ca/en/F-14/SOR-2002-222/119716.html

Shake Flask Extraction 3:1 L:S

Parameter	Unit	*MMER	Tailings Samples								
			F25 Comb Tls	**F28 Comb Tls**	**F29 Comb Tls**	**F33 Comb Tls**	**F36 Comb Tls**	**F37 Comb Tls**	**Master Tls**	**XPS PP Comp 1 Tls**	**XPS PP Comp 2 Tls**
Sample Origin									**F25, 28, 29 + 30**	**MPP Run 1**	**MPP Run 2**
LIMS			11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	11611-NOV10	10837-JAN11
Sample weight	g		500	500	500	500	500	500	500	300	500
Volume D.I. H_2O	mL		1500	1500	1500	1500	1500	1500	1500	900	1500
Initial pH	units		8.30	8.59	8.62	8.86	8.84	8.92	8.52	9.28	9.08
Final pH	units		8.44	8.66	8.66	8.91	8.84	8.95	8.59	8.81	8.82
^{226}Ra	Bq/L	0.37	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.2	< 0.1	< 0.3	< 0.1	< 0.1	< 0.1	< 0.1	< 0.3	< 0.3
^{210}Pb	Bq/L		0.2	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.91	7.87	7.81	7.90	8.02	8.09	7.81	7.95	8.12
Conductivity	uS/cm		104	105	111	150	140	140	112	216	209
F	mg/L		1.29	1.23	1.39	2.40	2.33	2.71	1.40	1.83	4.43
Cl	mg/L		1.4	1.7	1.9	2.6	3.3	3.6	1.8	3.6	5.0
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ag	mg/L		0.00052	0.00010	0.00018	0.00007	0.00011	0.00005	0.00039	< 0.00001	0.00003
Al	mg/L		0.56	0.26	0.28	0.10	0.11	0.10	0.58	0.03	0.05
As	mg/L	0.50	0.0024	0.0027	0.0031	0.0079	0.0081	0.0066	0.0032	0.0199	0.0060
B	mg/L		0.0784	0.0565	0.0614	0.0650	0.0805	0.0695	0.0894	0.103	0.118
Ba	mg/L		0.206	0.0984	0.125	0.110	0.218	0.158	0.183	0.199	0.507
Be	mg/L		0.00009	0.00002	0.00005	0.00002	0.00003	< 0.00002	0.00008	< 0.00002	< 0.00002
Bi	mg/L		0.00006	0.00002	0.00002	< 0.00001	< 0.00001	< 0.00001	0.00003	< 0.00001	< 0.00001
Ca	mg/L		13.1	12.8	13.0	13.1	13.8	14.1	13.3	21.0	14.5
Cd	mg/L		0.000339	0.000081	0.000131	0.000056	0.000078	0.000034	0.000248	0.000043	0.000019
Ce	mg/L		0.0645	0.0123	0.0327	0.00739	0.0112	0.00995	0.0501	0.00062	0.00120
Co	mg/L		0.000103	0.000075	0.000076	0.000076	0.000083	0.000071	0.000084	0.0104	0.000035
Cr	mg/L		0.0036	0.0049	0.0062	0.0023	0.0031	0.0022	0.0048	< 0.0005	< 0.0005
Cu	mg/L	0.30	0.0042	0.0020	0.0029	0.0049	0.0063	0.0056	0.0028	0.0010	0.0008
Dy	mg/L		0.00741	0.00209	0.00387	0.00148	0.00204	0.00173	0.00610	0.000114	0.000144
Er	mg/L		0.00320	0.000909	0.00177	0.000654	0.000917	0.000666	0.00271	0.000054	0.000061
Eu	mg/L		0.000964	0.000235	0.000475	0.000166	0.000266	0.000212	0.000735	0.000027	0.000070
Fe	mg/L		0.304	0.081	0.123	0.041	0.079	0.056	0.198	0.041	0.072
Ga	mg/L		0.00150	0.00118	0.00154	0.00134	0.00104	0.00176	0.00161	0.00111	0.00185
Gd	mg/L		0.00792	0.00183	0.00390	0.00126	0.00184	0.00162	0.00604	0.00011	0.00017
Hf	mg/L		0.00333	0.000671	0.00109	0.000430	0.000735	0.000313	0.00249	0.000109	0.000207
Ho	mg/L		0.00132	0.000386	0.000739	0.000278	0.000380	0.000300	0.00113	0.000020	0.000030
K	mg/L		2.33	3.44	3.47	7.79	8.52	7.96	2.69	8.76	12.8
La	mg/L		0.0291	0.00512	0.01394	0.00328	0.00505	0.00463	0.0218	0.00027	0.00053
Li	mg/L		0.007	0.009	0.006	0.014	0.016	0.011	0.007	0.011	0.010
Lu	mg/L		0.000259	0.000063	0.000124	0.000038	0.000055	0.000035	0.000207	0.000005	0.000007
Mg	mg/L		2.41	2.20	2.10	2.46	2.70	2.50	2.30	3.20	5.31
Mn	mg/L		0.112	0.0725	0.0717	0.0339	0.0479	0.0219	0.0729	0.0145	0.00824
Mo	mg/L		0.0204	0.0220	0.0242	0.0151	0.0158	0.0144	0.0247	0.0366	0.0321
Na	mg/L		6.70	6.75	9.29	9.95	10.3	10.9	9.18	13.4	17.4
Nb	mg/L		0.0280	0.00556	0.0108	0.00426	0.00737	0.00520	0.0219	0.000656	0.001073
Nd	mg/L		0.0306	0.00678	0.0165	0.00403	0.00606	0.00543	0.0245	0.00036	0.00065
Ni	mg/L	0.50	0.0023	0.0012	0.0016	0.0019	0.0020	0.0015	0.0018	0.0059	0.0015
Pb	mg/L	0.20	0.00044	0.00016	0.00017	0.00008	0.00018	0.00013	0.00031	0.00004	0.00006
Pr	mg/L		0.00724	0.00153	0.00383	0.00092	0.00137	0.00125	0.00576	0.00008	0.00016
Sb	mg/L		0.0007	0.0007	0.0008	0.0006	0.0007	0.0007	0.0008	0.0026	0.0031
Sc	mg/L		0.00796	0.00635	0.00610	0.00579	0.00565	0.00522	0.00703	0.00125	0.00045
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		7.72	6.44	6.17	5.74	5.85	5.58	7.56	4.72	3.35
Sm	mg/L		0.00734	0.00157	0.00369	0.00101	0.00156	0.00131	0.00573	0.00010	0.00017
Sn	mg/L		0.00062	0.00012	0.00016	0.00013	0.00076	0.00031	0.00063	0.00010	0.00025
Sr	mg/L		0.0473	0.0401	0.0404	0.0434	0.0507	0.0405	0.0444	0.0599	0.0801
Ta	mg/L		0.00333	0.000712	0.00119	0.000461	0.000826	0.000529	0.00239	0.000116	0.000195
Tb	mg/L		0.00140	0.000362	0.000704	0.000246	0.000356	0.000301	0.00111	0.000020	0.000030
Th	mg/L		0.00280	0.000702	0.00186	0.000354	0.000577	0.000420	0.002330	0.000832	0.000377
Ti	mg/L		0.0019	0.0005	0.0008	0.0004	0.0005	0.0004	0.0012	0.0004	0.0003
Tl	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Tm	mg/L		0.000365	0.000088	0.000189	0.000053	0.000084	0.000055	0.000302	0.000006	0.000010
U	mg/L		0.00132	0.00119	0.00131	0.00410	0.00429	0.00514	0.00136	0.00535	0.00535
V	mg/L		0.00024	0.00029	0.00022	0.00030	0.00027	0.00025	0.00021	0.00033	0.00014
Y	mg/L		0.0342	0.0121	0.0227	0.0100	0.0127	0.0111	0.0328	0.000546	0.000850
Yb	mg/L		0.00210	0.000529	0.00106	0.000333	0.000489	0.000316	0.00171	0.000036	0.000041
Zn	mg/L	0.50	0.008	0.006	0.006	0.004	0.008	0.010	0.011	0.003	0.010
Zr	mg/L		0.142	0.0284	0.0480	0.0178	0.0311	0.0130	0.108	0.00382	0.00364

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Shake Flask Extraction 3:1 L:S

Parameter	Unit	*MMER	F33 Mozley Conc Comp	F36 Mozley Conc Comp	F37 Mozley Conc Comp	Master Conc	XPS PP Comp 1 Conc
			Concentrate Samples				
Sample Origin						F25, 28, 29 + 30	MPP Run 1
LIMS			11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10	11297-NOV10
Sample weight	g		500	500	500	500	500
Volume D.I. H_2O	mL		1500	1500	1500	1500	1500
Initial pH	units		8.92	8.68	8.87	9.10	8.90
Final pH	units		8.93	8.75	8.89	9.02	8.80
^{226}Ra	Bq/L	0.37	< 0.01	0.01	< 0.01	< 0.01	< 0.01
^{228}Ra	Bq/L		< 0.1	< 0.1	< 0.1	< 0.1	< 0.3
^{210}Pb	Bq/L		< 0.1	0.1	< 0.1	< 0.1	< 0.1
pH	units	6.0-9.5	7.93	7.61	7.61	7.71	7.78
Conductivity	uS/cm		75	87	78	84	83
F	mg/L		0.97	0.90	0.90	1.31	1.08
Cl	mg/L		1.1	1.1	1.0	1.3	2.0
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ag	mg/L		0.00005	0.00015	0.00001	0.00010	< 0.00001
Al	mg/L		0.07	0.06	0.02	0.06	0.09
As	mg/L	0.50	0.0113	0.0107	0.0093	0.0047	0.0019
B	mg/L		0.0755	0.0996	0.0801	0.0795	0.0653
Ba	mg/L		0.0231	0.0536	0.0308	0.0737	0.105
Be	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Bi	mg/L		< 0.00001	< 0.00001	< 0.00001	0.00002	< 0.00001
Ca	mg/L		7.20	8.18	7.46	10.1	10.4
Cd	mg/L		0.000035	0.000095	0.000015	0.000066	0.000015
Ce	mg/L		0.00586	0.00416	0.00192	0.0170	0.00053
Co	mg/L		0.000066	0.000043	0.000042	0.000056	0.000046
Cr	mg/L		0.0007	0.0006	< 0.0005	0.0012	< 0.0005
Cu	mg/L	0.30	0.0020	0.0008	0.0006	0.0020	0.0006
Dy	mg/L		0.000647	0.000713	0.000214	0.00130	0.000071
Er	mg/L		0.000325	0.000479	0.000113	0.000567	0.000042
Eu	mg/L		0.000082	0.000078	0.000036	0.000233	0.000039
Fe	mg/L		0.083	0.070	0.031	0.104	0.014
Ga	mg/L		0.00163	0.00101	0.00194	0.00146	0.00266
Gd	mg/L		0.00068	0.00053	0.00024	0.00176	0.00008
Hf	mg/L		0.000351	0.000965	0.000093	0.000671	0.000095
Ho	mg/L		0.000122	0.000157	0.000041	0.000231	0.000015
K	mg/L		1.57	4.52	2.75	0.872	1.73
La	mg/L		0.00256	0.00168	0.00083	0.00711	0.00022
Li	mg/L		0.006	0.008	0.006	0.004	0.005
Lu	mg/L		0.000028	0.000053	0.000011	0.000054	0.000004
Mg	mg/L		0.855	1.12	0.929	0.914	1.53
Mn	mg/L		0.0204	0.0359	0.0159	0.0272	0.0332
Mo	mg/L		0.00524	0.00332	0.00349	0.00531	0.00690
Na	mg/L		8.53	7.14	8.13	7.79	4.56
Nb	mg/L		0.00328	0.00288	0.00184	0.00534	0.000428
Nd	mg/L		0.00296	0.00201	0.00100	0.00830	0.00028
Ni	mg/L	0.50	0.0005	0.0004	< 0.0001	< 0.0001	0.0004
Pb	mg/L	0.20	0.00017	0.00005	0.00003	0.00039	0.00002
Pr	mg/L		0.00070	0.00048	0.00024	0.00196	0.00007
Sb	mg/L		0.0011	0.0010	0.0010	0.0009	0.0013
Sc	mg/L		0.00346	0.00318	0.00319	0.00320	0.00243
Se	mg/L		< 0.001	< 0.001	< 0.001	0.001	< 0.001
Si	mg/L		3.50	3.29	3.40	3.31	2.65
Sm	mg/L		0.00067	0.00051	0.00023	0.00183	0.00006
Sn	mg/L		0.00029	0.00023	0.00006	0.00037	0.00008
Sr	mg/L		0.0228	0.0313	0.0237	0.0357	0.0341
Ta	mg/L		0.000341	0.000515	0.000152	0.000638	0.000061
Tb	mg/L		0.000108	0.000098	0.000028	0.000254	0.000006
Th	mg/L		0.000248	0.000169	0.000089	0.000514	0.000039
Ti	mg/L		0.0004	0.0006	0.0003	0.0007	0.0002
Tl	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
Tm	mg/L		0.000027	0.000055	0.000003	0.000060	< 0.000001
U	mg/L		0.000180	0.000078	0.000103	0.00105	0.00154
V	mg/L		0.00045	0.00026	0.00028	0.00028	0.00032
Y	mg/L		0.00376	0.00518	0.00148	0.00652	0.000354
Yb	mg/L		0.000220	0.000411	0.000082	0.000409	0.000028
Zn	mg/L	0.50	0.008	0.006	0.005	0.004	0.004
Zr	mg/L		0.0147	0.0430	0.00413	0.0292	0.00313

**Department of Justice Canada. 2002.* Metal Mi

Available Online: http://laws.justice.gc.ca/en/F-1

ICP-OES/MS Solution Analyses

			Water Samples							
Parameter	Unit	*MMER	Thor Lake Water # 4		Thor Lake Water # 7		XPS Tap Water 14-JAN-11		Ortech Tap Water	
LIMS			11346-NOV10+10168-DEC10		11346-NOV10+10168-DEC10		10262-JAN11+10289-JAN11		10289-JAN11	
^{226}Ra	Bq/L	0.37	< 0.01	---	< 0.01	---	< 0.01	---	< 0.01	---
^{228}Ra	Bq/L		< 0.2	---	< 0.2	---	< 0.1	---	< 0.1	---
^{210}Pb	Bq/L		< 0.1	---	< 0.1	---	< 0.1	---	< 0.2	---
Temp on Receipt	°C		19.0	19.0	19.0	19.0	18.0	---	18.0	---
pH	units	6.0-9.5	8.19	---	8.26	---	7.62	---	7.96	---
Alkalinity	mg/L as $CaCO_3$		144	---	142	---	51	---	89	---
EMF	mV		303	---	281	---	686	---	576	---
Acidity	mg/L as $CaCO_3$		< 2	---	< 2	---	< 2	---	< 2	---
Conductivity	µS/cm		277	---	280	---	311	---	308	---
TDS	mg/L		186	---	180	---	200	---	186	---
TSS	mg/L	15.00	< 2	---	2	---	< 2	---	< 2	---
Cl	mg/L		3.8	---	3.8	---	48	---	29	---
SO_4	mg/L		0.4	---	0.4	---	20	---	27	---
F	mg/L		1.01	---	1.02	---	0.06	---	0.34	---
NO_2	as N mg/L		< 0.06	---	< 0.06	---	< 0.06	---	< 0.06	---
NO_3	as N mg/L		< 0.05	---	< 0.05	---	0.27	---	0.49	---
NO_2+NO_3	as N mg/L		< 0.06	---	< 0.06	---	0.27	---	0.49	---
Tot.Reactive P	mg/L		< 0.03	---	< 0.03	---	0.15	---	< 0.03	---
TOC	mg/L		12.2	---	13.0	---	2.3	---	1.6	---
NH_3+NH_4	as N mg/L		< 0.1	---	< 0.1	---	< 0.1	---	< 0.1	---
Thiosalts	as S_2O_3 mg/L		< 10	---	< 10	---	< 10	---	CNBD	---
S_2O_3	mg/L		---	---	---	---	---	---	< 2	---
Metals			**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ag	mg/L		< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Al	mg/L		0.01	< 0.01	< 0.01	< 0.01	< 0.01	< 0.01	0.04	0.04
As	mg/L	0.50	0.0009	0.0008	0.0008	0.0009	0.0015	0.0017	0.0007	0.0008
Ba	mg/L		0.0674	0.0621	0.0650	0.0629	0.0074	0.0074	0.0224	0.0218
Be	mg/L		< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002	< 0.00002
B	mg/L		0.0231	0.0223	0.0229	0.0230	0.0088	0.0084	0.0250	0.0248
Bi	mg/L		0.00002	< 0.00001	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Ca	mg/L		32.1	30.5	31.3	30.2	25.6	30.2	35.4	35.4
Cd	mg/L		< 0.000003	0.000086	< 0.000003	< 0.000003	< 0.000003	0.000017	< 0.000003	< 0.000003
Co	mg/L		0.000071	0.000067	0.000061	0.000065	0.000041	0.000034	0.000053	0.000042
Cr	mg/L		< 0.0005	< 0.0005	< 0.0005	< 0.0005	0.0007	0.0006	< 0.0005	< 0.0005
Cu	mg/L	0.30	< 0.0005	0.0006	< 0.0005	< 0.0005	0.0342	0.0335	0.0025	0.0030
Fe	mg/L		0.019	< 0.002	0.013	0.008	0.008	0.002	0.006	0.003
K	mg/L		1.87	1.81	1.82	1.76	1.37	1.62	1.82	1.83
Li	mg/L		0.004	0.005	0.005	0.005	0.001	0.001	0.002	0.002
Mg	mg/L		17.5	16.4	17.1	16.3	5.57	6.60	9.37	9.43
Mn	mg/L		0.0116	0.00037	0.00613	0.0004	0.00024	0.00013	0.00118	0.00040
Mo	mg/L		0.00204	0.00179	0.00206	0.00192	0.00090	0.00121	0.00139	0.00131
Na	mg/L		5.94	5.55	5.83	5.49	20.3	23.5	16.1	16.2
Ni	mg/L	0.50	0.0006	0.0007	0.0006	0.0008	0.0009	0.0011	0.0008	0.0008
Pb	mg/L	0.20	0.00006	0.00007	0.00007	0.00008	0.00016	0.00005	0.00095	0.00085
Sb	mg/L		0.0003	< 0.0002	0.0002	< 0.0002	< 0.0002	< 0.0002	0.0002	0.0003
Se	mg/L		< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		3.12	2.95	3.03	2.92	7.15	8.40	0.47	0.49
Sn	mg/L		0.00012	0.00009	0.00012	0.00017	0.00039	0.00035	0.00133	0.00129
Sr	mg/L		0.0602	0.0568	0.0583	0.0564	0.0401	0.0474	0.184	0.186
Th	mg/L		0.000115	0.000022	0.000079	0.000023	0.000026	0.000006	0.000027	0.000004
Ti	mg/L		0.0002	< 0.0001	< 0.0001	< 0.0001	0.0003	0.0003	0.0004	0.0003
Tl	mg/L		< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
U	mg/L		0.000402	0.000338	0.000373	0.000350	0.000322	0.000345	0.000310	0.000289
V	mg/L		0.00008	0.00042	0.00009	0.00013	0.00080	0.00080	0.00024	0.00026
Y	mg/L		0.000007	0.000007	0.000007	0.000015	0.000006	0.000007	0.000017	0.000012
Zn	mg/L	0.50	< 0.002	< 0.002	< 0.002	< 0.002	0.204	0.241	0.007	0.006
Ce	mg/L		< 0.00007	< 0.00007	< 0.00007	0.00008	< 0.00007	< 0.00007	< 0.00007	< 0.00007
Dy	mg/L		< 0.000003	< 0.000003	< 0.000003	0.000003	< 0.000003	< 0.000003	0.000003	< 0.000003
Er	mg/L		0.000001	< 0.000001	0.000001	0.000001	0.000001	0.000001	0.000002	0.000001
Eu	mg/L		0.000006	0.000005	0.000006	0.000006	0.000001	0.000001	0.000002	0.000001
Ga	mg/L		< 0.00001	< 0.00001	< 0.00001	< 0.00001	0.00001	0.00002	0.00010	0.00006
Gd	mg/L		< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005	< 0.00005
Hf	mg/L		0.000401	0.000069	0.000200	0.000073	< 0.000005	< 0.000005	< 0.000005	< 0.000005
Ho	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	0.000001	< 0.000001
La	mg/L		< 0.00004	< 0.00004	< 0.00004	< 0.00004	< 0.00004	< 0.00004	< 0.00004	< 0.00004
Lu	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001
Nb	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	0.000002	< 0.000001	< 0.000001	< 0.000001
Nd	mg/L		< 0.00003	< 0.00003	< 0.00003	0.00004	< 0.00003	< 0.00003	< 0.00003	< 0.00003
Pr	mg/L		< 0.00001	< 0.00001	< 0.00001	0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Sc	mg/L		0.00061	0.00029	0.00050	0.00034	0.00086	0.00083	0.00008	< 0.00005
Sm	mg/L		< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001	< 0.00001
Ta	mg/L		0.000012	< 0.000001	< 0.000001	< 0.000001	0.000001	0.000001	< 0.000001	< 0.000001
Tb	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001
Tm	mg/L		< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001	< 0.000001
Yb	mg/L		< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	< 0.000002	0.000002	< 0.000002
Zr	mg/L		0.00013	0.00005	0.00008	0.00004	< 0.00001	0.00007	0.00001	< 0.00001

**Department of Justice Canada. 2002.* Metal Mining Effluent Regulations, *Fisheries Act SOR-2002-222.*
Available Online: http://laws.justice.gc.ca/en/F-14/SOR-2002-222/119716.html

CNBD-could not be determined

ICP-OES/MS Solution Analyses

			Simulated Hydromet Tails Filtrate	Hydromet Tails After Ra Removal
Parameter	**Unit**	***MMER**	**CH-WT1 PLS +Wash**	**RAR-1 Filtrate**
LIMS			10242-DEC10+10361-DEC10	10242-DEC10+10361-DEC10
^{226}Ra	Bq/L	0.37	0.10	< 0.01
^{228}Ra	Bq/L		< 0.2	< 0.4
^{210}Pb	Bq/L		< 0.1	0.1
Temp on Receipt	°C		13.0	13.0
pH	units	6.0-9.5	7.73	7.46
Alkalinity	mg/L as $CaCO_3$		118	82
EMF	mV		214	---
Acidity	mg/L as $CaCO_3$		< 2	< 2
Conductivity	µS/cm		13400	13300
TDS	mg/L		16800	---
TSS	mg/L	15.00	---	---
Cl	mg/L		55	---
SO_4	mg/L		11000	12000
F	mg/L		1.82	---
NO_2	as N mg/L		< 0.6	---
NO_3	as N mg/L		< 0.5	---
NO_2+NO_3	as N mg/L		< 0.6	---
Tot.Reactive P	mg/L		0.07	---
TOC	mg/L		53.9	---
NH_3+NH_4	as N mg/L		91.7	---
Thiosalts	as S_2O_3 mg/L		< 10	---
S_2O_3	mg/L		---	---
Metals			**Diss**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001
Ag	mg/L		0.00012	0.00007
Al	mg/L		< 0.01	< 0.01
As	mg/L	0.50	0.0022	0.0024
Ba	mg/L		0.0772	0.0328
Be	mg/L		0.00002	0.00002
B	mg/L		0.0971	0.104
Bi	mg/L		0.00008	0.00011
Ca	mg/L		393	387
Cd	mg/L		0.000232	0.000321
Co	mg/L		0.00402	0.00666
Cr	mg/L		0.0188	0.0043
Cu	mg/L	0.30	0.0226	0.0470
Fe	mg/L		0.150	0.138
K	mg/L		86.8	87.8
Li	mg/L		2.18	2.22
Mg	mg/L		1530	1550
Mn	mg/L		6.15	6.33
Mo	mg/L		0.00902	0.0113
Na	mg/L		1580	1470
Ni	mg/L	0.50	0.0701	0.0726
Pb	mg/L	0.20	0.00052	0.00075
Sb	mg/L		0.0002	0.0003
Se	mg/L		0.005	0.008
Si	mg/L		2.47	2.55
Sn	mg/L		0.00013	0.00019
Sr	mg/L		11.2	11.0
Th	mg/L		0.002945	0.000690
Ti	mg/L		0.0051	0.0047
Tl	mg/L		0.0002	0.0003
U	mg/L		0.0239	0.0167
V	mg/L		0.00063	0.00083
Y	mg/L		0.009046	0.0344
Zn	mg/L	0.50	< 0.002	0.030
Ce	mg/L		0.00529	0.791
Dy	mg/L		0.000800	0.00800
Er	mg/L		0.000400	0.00150
Eu	mg/L		0.000100	0.00270
Ga	mg/L		0.00049	0.00085
Gd	mg/L		0.00090	0.0313
Hf	mg/L		0.000638	0.000139
Ho	mg/L		0.000200	0.00100
La	mg/L		0.0120	0.566
Lu	mg/L		< 0.000001	0.000100
Nb	mg/L		0.00465	0.000411
Nd	mg/L		0.00370	0.219
Pr	mg/L		0.00090	0.06850
Sc	mg/L		0.00120	0.00120
Sm	mg/L		0.00070	0.0256
Ta	mg/L		0.000088	0.000030
Tb	mg/L		0.000100	0.00280
Tm	mg/L		0.000100	0.000100
Yb	mg/L		0.000300	0.000600
Zr	mg/L		0.0351	0.00395

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ICP-OES/MS Solution Analyses

Parameter	Unit	*MMER	Pilot Plant Tailings Decant Solutions							
			MPP Run 1				MPP Run 2			
			Nov 24/10 XPS PP Comp 1 Tls Decant Day 5		Jan 18/11 XPS PP Comp 1 Tls Decant Day 60		Dec 20/10 XPS PP Comp 2 Tls Decant Day 5		Feb 14/11 XPS PP Comp 2 Tls Decant Day 61	
LIMS			10297-NOV10+10168-DEC10		10262-JAN11+10289-JAN11		10361-DEC10		11122-FEB11	
^{226}Ra	Bq/L	0.37	< 0.01	---	0.02	---	< 0.01	---	< 0.01	---
^{228}Ra	Bq/L		0.3	---	< 0.3	---	< 0.4	---	< 0.1	---
^{210}Pb	Bq/L		< 0.1	---	< 0.1	---	0.1	---	0.1	---
Temp on Rec	°C		20.0	---	18.0	---	15.0	---	19.0	---
pH	units	6.0-9.5	8.20	---	8.16	---	8.41	---	8.39	---
Alkalinity	mg/L as $CaCO_3$		119	---	126	---	148	---	154	---
EMF	mV		284	---	207	---	178	---	190	---
Acidity	mg/L as $CaCO_3$		< 2	---	< 2	---	< 2	---	< 2	---
Conductivity	µS/cm		617	---	662	---	603	---	576	---
TDS	mg/L		400	---	406	---	354	---	371	---
TSS	mg/L	15.00	14	---	< 2	---	2	---	5	---
Cl	mg/L		44	---	44	---	63	---	68	---
SO_4	mg/L		100	---	110	---	29	---	31	---
F	mg/L		4.43	---	4.46	---	9.53	---	9.19	---
NO_2	as N mg/L		< 0.06	---	< 0.06	---	< 0.06	---	< 0.06	---
NO_3	as N mg/L		< 0.05	---	< 0.05	---	< 0.05	---	< 0.05	---
NO_2+NO_3	as N mg/L		< 0.06	---	< 0.06	---	< 0.06	---	< 0.06	---
Tot.Reactive P	mg/L		0.10	---	0.20	---	0.05	---	0.11	---
TOC	mg/L		12.2	---	7.2	---	17.1	---	11.0	---
NH_3+NH_4	as N mg/L		< 0.1	---	< 0.1	---	< 0.1	---	< 0.1	---
Thiosalts	as S_2O_3 mg/L		< 10	---	< 10	---	< 10	---	< 10	---
Metals			**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**	**Total**	**Diss**
Hg	mg/L		< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001	< 0.0001
Ag	mg/L		0.00003	< 0.00001	< 0.00001	< 0.00001	0.00004	< 0.00001	< 0.00001	< 0.00001
Al	mg/L		0.62	0.06	0.05	0.02	1.05	0.05	0.07	0.04
As	mg/L	0.50	0.0022	0.0025	0.0019	0.0019	0.0047	0.0048	0.0049	0.0049
Ba	mg/L		0.0131	0.0113	0.0114	0.0110	0.0131	0.0111	0.0121	0.0119
Be	mg/L		0.00006	< 0.00002	< 0.00002	< 0.00002	0.00005	< 0.00002	< 0.00002	< 0.00002
B	mg/L		0.128	0.126	0.131	0.124	0.179	0.171	0.179	0.177
Bi	mg/L		0.00013	0.00007	< 0.00001	0.00001	0.00003	< 0.00001	< 0.00001	< 0.00001
Ca	mg/L		43.7	40.0	41.2	40.9	21.8	22.1	22.1	21.5
Cd	mg/L		0.000067	0.000067	< 0.000003	0.000013	0.000077	0.000043	0.000015	0.000005
Co	mg/L		0.000198	0.000176	0.000111	0.000053	0.000155	0.000118	0.000059	0.000056
Cr	mg/L		0.0011	0.0015	0.0005	< 0.0005	0.0016	0.0013	0.0015	0.0017
Cu	mg/L	0.30	0.0023	0.0024	0.0012	0.0027	0.0007	0.0027	0.0018	0.0018
Fe	mg/L		0.570	0.025	0.025	< 0.002	0.706	0.020	0.041	0.003
K	mg/L		28.8	27.0	26.4	26.4	37.0	36.8	39.6	38.4
Li	mg/L		0.031	0.030	0.027	0.027	0.028	0.027	0.028	0.029
Mg	mg/L		9.14	8.15	8.56	8.43	12.3	12.3	12.4	12.0
Mn	mg/L		0.0788	0.0488	0.00808	0.00140	0.0317	0.0240	0.0217	0.0216
Mo	mg/L		0.0471	0.0440	0.0444	0.0421	0.0786	0.0767	0.0724	0.0707
Na	mg/L		70.4	66.0	66.5	66.5	74.5	74.8	77.3	73.5
Ni	mg/L	0.50	0.0070	0.0066	0.0048	0.0046	0.0068	0.0065	0.0061	0.0060
Pb	mg/L	0.20	0.00060	0.00033	0.00051	0.00011	0.00026	0.00011	0.00029	0.00008
Sb	mg/L		0.0033	0.0035	0.0037	0.0038	0.0048	0.0048	0.0051	0.0052
Se	mg/L		< 0.001	0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001	< 0.001
Si	mg/L		8.10	6.24	6.31	6.23	8.19	4.70	4.88	4.63
Sn	mg/L		0.00123	0.00077	0.00885	0.00085	0.00142	0.00136	0.00022	0.00027
Sr	mg/L		0.237	0.125	0.130	0.129	0.112	0.114	0.114	0.108
Th	mg/L		0.000694	0.000082	0.000385	0.000084	0.00140	0.000193	0.000020	< 0.000004
Ti	mg/L		0.0032	0.0018	0.0009	0.0008	0.0027	0.0008	0.0010	0.0009
Tl	mg/L		< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002	< 0.0002
U	mg/L		0.00880	0.00836	0.00865	0.00863	0.00784	0.00742	0.00698	0.00685
V	mg/L		0.00058	0.00068	0.00011	0.00011	< 0.00003	< 0.00003	0.00137	0.00101
Y	mg/L		0.00877	0.000376	0.000174	0.000091	0.00436	0.000464	0.000512	0.000231
Zn	mg/L	0.50	0.007	0.004	0.003	< 0.002	0.002	0.003	< 0.002	< 0.002
Ce	mg/L		0.139	0.00149	0.00023	0.00013	0.0193	0.00112	0.00126	0.00017
Dy	mg/L		0.00252	0.000085	0.000028	0.000011	0.00125	0.000082	0.000103	0.000027
Er	mg/L		0.000581	0.000028	0.000015	0.000008	0.000490	0.000042	0.000044	0.000015
Eu	mg/L		0.00109	0.000021	0.000005	0.000002	0.000257	0.000022	0.000020	0.000007
Ga	mg/L		0.00286	0.00186	0.00179	0.00173	0.00354	0.00228	0.00210	0.00199
Gd	mg/L		0.00937	0.00016	< 0.00005	< 0.00005	0.00211	0.00015	0.00014	< 0.00005
Hf	mg/L		0.000267	0.000053	0.000015	< 0.000005	0.000171	0.000038	0.000017	< 0.000005
Ho	mg/L		0.000312	0.000012	0.000006	0.000003	0.000206	0.000018	0.000018	0.000005
La	mg/L		0.0688	0.00074	0.00012	0.00007	0.00818	0.00044	0.00055	0.00008
Lu	mg/L		0.000033	0.000001	0.000001	0.000001	0.000030	0.000003	0.000003	0.000001
Nb	mg/L		0.00257	0.000209	0.000110	0.000025	0.00395	0.000405	0.000405	0.000128
Nd	mg/L		0.0616	0.00083	0.00015	0.00008	0.0102	0.00092	0.00075	0.00014
Pr	mg/L		0.0173	0.00022	0.00003	0.00002	0.00242	0.00018	0.00017	0.00003
Sc	mg/L		0.00339	0.00223	0.00082	0.00073	0.00277	0.00164	0.00156	0.00146
Sm	mg/L		0.0110	0.00017	0.00003	0.00002	0.00211	0.00015	0.00016	0.00003
Ta	mg/L		0.000230	0.000029	0.000016	0.000003	0.000514	0.000041	0.000059	0.000005
Tb	mg/L		0.000819	0.000015	0.000006	0.000001	0.000279	0.000013	0.000019	0.000003
Tm	mg/L		0.000046	< 0.000001	0.000002	< 0.000001	0.000045	< 0.000001	0.000004	< 0.000001
Yb	mg/L		0.000324	0.000014	0.000008	0.000006	0.000229	0.000028	0.000025	0.000009
Zr	mg/L		0.00329	0.00072	0.00075	0.00009	0.00648	0.00089	0.00085	0.00021

**Department of Justice Canada. 2002.* Metal Mining Effluent Regulations*, Fisheries Act SOR-2002-222.*
Available Online: http://laws.justice.gc.ca/en/F-14/SOR-2002-222/119716.html

Appendix B – Analytical Certificates of Analysis

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Environmental Met
Attn : Barb Bowman

Project : CALR-11806-007

Friday, November 12, 2010

Date Rec. : 05 November 2010
LR Report: **CA11294-NOV10**
Reference: Whole Rock Analysis 11806-007-01

Copy: #2

CERTIFICATE OF ANALYSIS
Final Report - Revised

Sample ID	Sample Date & Time	SiO2 %	Al2O3 %	Fe2O3 %	MgO %	CaO %	Na2O %	K2O %	TiO2 %	P2O5 %	MnO %	Cr2O3 %	V2O5 %	LOI %	Sum %	Nb2O5 %	ZrO2 %
3: Analysis Approval Date		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
4: Analysis Approval Time		---	---	---	---	---	---	---	---	---	---	---	---	---	---	---	---
5: Master Comp 3	Date:N/A	54.0	10.8	12.7	2.83	2.60	2.94	4.89	0.05	0.11	0.19	< 0.01	< 0.01	1.14	92.2	0.43	3.65
6: F25 Comb Tls	Date:N/A	59.2	11.6	11.2	2.01	0.89	3.23	5.51	0.03	0.04	0.12	0.08	< 0.01	1.82	95.6	0.14	0.95
7: F28 Comb Tls	Date:N/A	63.6	12.0	9.66	1.47	0.91	3.37	5.53	0.03	0.04	0.11	0.09	< 0.01	1.67	98.4	0.16	1.01
8: F29 Comb Tls	Date:N/A	61.5	11.5	11.5	1.67	1.08	3.23	5.35	0.03	0.03	0.12	0.10	< 0.01	1.81	97.9	0.19	1.60
9: Master Conc	Date:N/A	25.8	2.92	16.6	3.08	9.03	0.41	1.32	0.11	0.66	0.65	< 0.01	< 0.01	10.8	71.3	1.88	17.3
10: Master Tls	Date:N/A	60.9	11.5	12.0	1.86	1.11	3.28	5.42	0.03	0.05	0.14	0.10	< 0.01	1.86	98.2	0.20	1.38
11: Avalon Head Sample 1	Date:N/A	54.7	11.3	11.5	2.68	2.59	2.93	5.24	0.05	0.08	0.22	< 0.01	< 0.01	3.42	94.7	0.39	3.14
12: F33 Mozley Conc Comp	Date:N/A	30.6	4.13	13.8	3.62	8.45	0.56	1.93	0.14	0.80	0.57	< 0.01	< 0.01	9.62	74.2	1.69	16.0
13: F33 Comb Tls	Date:N/A	60.2	12.7	11.8	1.85	0.98	3.49	5.78	0.02	0.03	0.12	0.10	< 0.01	1.74	98.8	0.15	0.92
14: Avalon Head Sample 2	Date:N/A	53.6	9.15	13.3	3.34	3.08	2.39	4.44	0.05	0.05	0.40	< 0.01	< 0.01	4.54	94.3	0.46	3.73
15: F36 Mozley Conc Comp	Date:N/A	30.1	3.14	17.7	4.31	8.50	0.80	1.46	0.14	0.44	0.98	< 0.01	< 0.01	10.8	78.3	1.54	13.0
16: F36 Comb Tls	Date:N/A	60.2	10.9	12.8	2.23	1.15	2.95	5.10	0.03	0.01	0.16	0.10	0.01	1.96	97.6	0.18	1.55
17: Avalon Head Sample 3	Date:N/A	53.9	10.6	12.4	2.77	2.68	2.88	4.81	0.04	0.12	0.19	< 0.01	0.01	3.42	93.9	0.50	3.75
18: F37 Mozley Conc Comp	Date:N/A	29.9	4.17	13.7	3.60	7.39	0.58	1.88	0.18	0.80	0.47	0.02	< 0.01	8.78	71.5	1.80	18.0
19: F37 Comb Tls	Date:N/A	59.8	12.0	13.0	1.82	1.00	3.38	5.35	0.03	0.03	0.09	0.10	< 0.01	1.61	98.2	0.16	0.97
20: XPS PP Comp 1 Conc	Date:N/A	26.5	3.59	13.1	3.64	12.1	0.58	1.49	0.09	0.61	0.84	< 0.01	< 0.01	12.4	74.9	1.53	13.5

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Revised sample identification Nov. 12/10

Dianne Griffin
Project Specialist

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-11806-007

Monday, December 20, 2010

Environmental Met
Attn : Barb Bowman

Date Rec. : 22 November 2010
LR Report: **CA11612-NOV10**
Reference: Whole Rock Analysis

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	**5: XPS PP Comp 1Tls**
Sample Date & Time	Date:N/A
Nb2O5 [%]	0.18
ZrO2 [%]	1.52
SiO2 [%]	60.2
Al2O3 [%]	13.2
Fe2O3 [%]	10.7
MgO [%]	2.43
CaO [%]	0.85
Na2O [%]	3.35
K2O [%]	6.05
TiO2 [%]	0.03
P2O5 [%]	0.04
MnO [%]	0.09
Cr2O3 [%]	< 0.01
V2O5 [%]	< 0.01
LOI [%]	1.54
Sum [%]	98.5

Dianne Griffin
Project Specialist

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Environmental Met
Attn : Barb Bowman

Project : CALR-11806-007

Monday, January 10, 2011

Date Rec. : 16 December 2010
LR Report: **CA10329-DEC10**
Reference: Whole Rock Analysis

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	5: XPS PP Comp 2 Tls
SiO2 [%]	61.9
Al2O3 [%]	12.8
Fe2O3 [%]	10.0
MgO [%]	1.93
CaO [%]	0.75
Na2O [%]	3.71
K2O [%]	5.65
TiO2 [%]	0.04
P2O5 [%]	0.04
MnO [%]	0.08
Cr2O3 [%]	< 0.01
V2O5 [%]	< 0.01
LOI [%]	1.50
ZrO2 [%]	1.45
Nb2O5 [%]	0.22
Sum [%]	98.4

Dianne Griffin
Project Specialist

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-11806-007

Monday, January 10, 2011

Environmental Met
Attn : Barb Bowman

Date Rec. : 17 December 2010
LR Report: **CA10356-DEC10**
Reference: CofC:11806-007-12

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	5: XPS PP Comp 2 Head	6: XPS PP Comp 3 Head
SiO2 [%]	54.2	53.8
Al2O3 [%]	9.42	10.8
Fe2O3 [%]	13.5	12.6
MgO [%]	3.35	2.79
CaO [%]	2.99	2.58
Na2O [%]	2.43	2.78
K2O [%]	4.48	4.86
TiO2 [%]	0.05	0.04
P2O5 [%]	0.06	0.12
MnO [%]	0.40	0.20
Cr2O3 [%]	0.11	< 0.01
V2O5 [%]	< 0.01	< 0.01
LOI [%]	4.25	3.68
ZrO2 [%]	3.57	3.58
Nb2O5 [%]	0.46	0.44
Sum [%]	95.2	94.3

Dianne Griffin
Project Specialist

OnLine LIMS

SGS Canada Inc.
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Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Environmental Met
Attn : Barb Bowman

Project : CALR-11806-007

Monday, December 13, 2010

Date Rec. : 22 November 2010
LR Report: **CA11622-NOV10**
Reference: 11806-007-06

Copy: #2

CERTIFICATE OF ANALYSIS
Final Report - Reissue

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MasterF25 Comp 3	6: Comb TlsF28	7: Comb TlsF29	8: Comb Tls	9: Master Conc	10: Master Tls	11: Avalon Head Sample 1	12: F33 Mozley Conc Comp
Sample Date & Time			Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA
Mercury [µg/g]	01-Dec-10	11:59	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver [g/t]	07-Dec-10	15:32	23	6.5	7.3	11	130	9.8	17	110
Aluminum [µg/g]	07-Dec-10	15:42	56000	65000	64000	60000	15000	62000	59000	21000
Arsenic [g/t]	07-Dec-10	15:32	13	3.1	2.5	4.2	77	4.4	4.8	27
Boron [g/t]	07-Dec-10	15:32	15	8	7	9	45	9	18	43
Barium [g/t]	07-Dec-10	15:32	110	73	65	72	190	73	95	170
Beryllium [g/t]	07-Dec-10	15:32	11	3.8	3.8	5.2	47	4.9	8.5	38
Bismuth [g/t]	07-Dec-10	15:32	1.0	0.46	0.37	0.44	3.8	0.47	0.92	3.9
Calcium [µg/g]	07-Dec-10	15:42	18000	6400	6300	7300	61000	7700	17000	56000
Cadmium [g/t]	07-Dec-10	15:32	14	3.9	4.6	6.8	80	6.0	11	64
Cobalt [g/t]	07-Dec-10	15:32	0.68	5.6	4.9	5.3	3.8	5.5	0.63	3.2
Chromium [g/t]	07-Dec-10	15:32	79	640	560	640	160	640	75	110
Copper [g/t]	07-Dec-10	15:32	3.6	19	14	17	16	18	4.7	21
Iron [µg/g]	07-Dec-10	15:42	87000	81000	68000	80000	110000	83000	78000	94000
Potassium [µg/g]	07-Dec-10	15:42	39000	46000	44000	42000	12000	43000	41000	17000
Lithium [g/t]	07-Dec-10	15:32	52	48	35	40	59	44	51	70
Magnesium [µg/g]	07-Dec-10	15:42	17000	13000	9400	10000	19000	12000	16000	22000
Manganese [g/t]	07-Dec-10	15:32	1300	860	760	890	4700	950	1500	3800

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-11806-007
LR Report : **CA11622-NOV10**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: MasterComp 3	6: F25 Comb Tls	7: F28 Comb Tls	8: F29 Comb Tls	9: Master Conc	10: Master Tls	11: Avalon Head Sample 1	12: F33 Mozley Conc Comp
Molybdenum [g/t]	07-Dec-10	15:32	2.5	73	61	72	20	73	2.5	16
Sodium [µg/g]	07-Dec-10	15:42	20000	23000	24000	21000	2500	22000	19000	3600
Nickel [g/t]	07-Dec-10	15:32	16	330	270	320	86	330	13	77
Total Phosphorus [ug/g]	10-Dec-10	07:08	400	170	130	180	2000	170	340	2800
Lead [g/t]	07-Dec-10	15:32	17	8.9	9.2	10	63	9.9	14	52
Antimony [g/t]	07-Dec-10	15:32	< 0.8	< 0.8	< 0.8	< 0.8	1.3	< 0.8	< 0.8	1.3
Selenium [g/t]	07-Dec-10	15:32	7.6	1.9	2.6	3.8	31	3.2	6.0	25
Tin [g/t]	07-Dec-10	15:32	42	23	21	26	120	26	36	100
Strontium [g/t]	07-Dec-10	15:32	32	16	16	18	92	19	31	86
Titanium [µg/g]	07-Dec-10	15:42	260	190	160	180	570	200	230	710
Thallium [g/t]	07-Dec-10	15:33	0.52	0.59	0.57	0.56	0.26	0.57	0.52	0.30
Thorium [g/t]	07-Dec-10	15:33	110	31	31	44	3.5	40	91	210
Uranium [g/t]	07-Dec-10	15:33	22	7.7	8.1	11	87	9.9	19	84
Vanadium [g/t]	07-Dec-10	15:33	< 1	10	10	9	8	12	10	< 1
Yttrium [g/t]	07-Dec-10	15:33	1100	310	310	440	4000	420	790	3600
Zinc [g/t]	07-Dec-10	15:33	140	74	55	61	270	68	140	260

Phosphorus added to report Dec. 10/10

Dianne Griffin
Project Specialist

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Environmental Met
Attn : Barb Bowman

Project : CALR-11806-007

Monday, December 13, 2010

Date Rec. : 22 November 2010
LR Report: **CA11622-NOV10**
Reference: 11806-007-06

Copy: #2

CERTIFICATE OF ANALYSIS

Final Report - Reissue

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	13: F33 Comb Tls	14: Avalon Head Sample 2	15: F36 Mozley Conc Comp	16: F36 Comb Tls	17: Avalon Head Sample 3	18: F37 Mozley Conc Comp	19: F37 Comb Tls	20: XPS PP Comp 1 Conc
Sample Date & Time			Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA	Date:NA
Mercury [µg/g]	01-Dec-10	11:59	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1	< 0.1
Silver [g/t]	07-Dec-10	15:32	7.4	18	78	9.1	25	130	8.9	87
Aluminum [µg/g]	07-Dec-10	15:42	68000	47000	16000	55000	58000	22000	63000	18000
Arsenic [g/t]	07-Dec-10	15:32	3.0	7.4	26	4.0	4.2	20	2.8	16
Boron [g/t]	07-Dec-10	15:32	13	19	49	12	14	39	8	38
Barium [g/t]	07-Dec-10	15:32	83	89	130	80	120	210	85	130
Beryllium [g/t]	07-Dec-10	15:32	4.5	19	63	7.3	8.7	39	4.2	40
Bismuth [g/t]	07-Dec-10	15:32	0.55	0.67	1.9	0.46	0.60	3.1	0.47	5.0
Calcium [µg/g]	07-Dec-10	15:42	6500	21000	56000	7600	19000	50000	6900	81000
Cadmium [g/t]	07-Dec-10	15:32	4.6	12	48	5.4	16	80	5.4	55
Cobalt [g/t]	07-Dec-10	15:32	5.6	0.50	1.9	5.6	0.65	2.9	5.3	7.3
Chromium [g/t]	07-Dec-10	15:32	630	86	70	660	69	77	600	15
Copper [g/t]	07-Dec-10	15:32	21	7.9	13	23	3.8	17	22	45
Iron [µg/g]	07-Dec-10	15:42	82000	90000	120000	87000	90000	96000	89000	89000
Potassium [µg/g]	07-Dec-10	15:42	46000	35000	13000	39000	40000	17000	42000	13000
Lithium [g/t]	07-Dec-10	15:32	44	65	70	49	52	62	35	51
Magnesium [µg/g]	07-Dec-10	15:42	12000	20000	26000	13000	18000	22000	11000	22000
Manganese [g/t]	07-Dec-10	15:32	870	2700	6400	1200	1400	3000	680	5400

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-11806-007
LR Report : CA11622-NOV10

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	13: F33 Comb Tls	14: Avalon Head Sample 2	15: F36 Mozley Conc Comp	16: F36 Comb Tls	17: Avalon Head Sample 3	18: F37 Mozley Conc Comp	19: F37 Comb Tls	20: XPS PP Comp 1 Conc
Molybdenum [g/t]	07-Dec-10	15:32	74	2.9	18	74	2.0	13	70	4.1
Sodium [µg/g]	07-Dec-10	15:42	24000	16000	5000	20000	20000	4200	24000	3600
Nickel [g/t]	07-Dec-10	15:32	340	12	44	340	14	48	320	100
Total Phosphorus [ug/g]	10-Dec-10	07:08	130	180	1700	110	440	2900	170	2200
Lead [g/t]	07-Dec-10	15:32	9.0	15	54	9.4	18	64	8.6	55
Antimony [g/t]	07-Dec-10	15:32	< 0.8	< 0.8	1.5	< 0.8	< 0.8	1.3	< 0.8	1.2
Selenium [g/t]	07-Dec-10	15:32	1.8	7.2	25	2.4	7.4	26	2.4	24
Tin [g/t]	07-Dec-10	15:32	25	45	110	48	43	110	25	92
Strontium [g/t]	07-Dec-10	15:32	20	42	96	23	34	85	18	97
Titanium [µg/g]	07-Dec-10	15:42	170	250	840	200	290	990	180	470
Thallium [g/t]	07-Dec-10	15:33	0.56	0.47	0.25	0.51	0.52	0.29	0.50	0.24
Thorium [g/t]	07-Dec-10	15:33	29	73	53	31	110	210	34	2.2
Uranium [g/t]	07-Dec-10	15:33	8.9	17	65	9.1	23	89	10	67
Vanadium [g/t]	07-Dec-10	15:33	13	6	9	12	12	< 1	15	< 1
Yttrium [g/t]	07-Dec-10	15:33	310	1100	3600	440	920	3600	330	3200
Zinc [g/t]	07-Dec-10	15:33	75	160	300	97	130	320	71	230

Phosphorus added to report Dec. 10/10

Dianne Griffin
Project Specialist

OnLine LIMS

SGS Canada Inc.
P.O. Box 4300 - 185 Concession St.
Lakefield - Ontario - KOL 2HO
Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-11806-007

Monday, December 13, 2010

Environmental Met
Attn : Barb Bowman

Date Rec. : 22 November 2010
LR Report: **CA11615-NOV10**
Reference: 11806-007-04

Copy: #2

CERTIFICATE OF ANALYSIS

Final Report - Reissue

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 1Tls
Sample Date & Time			
Mercury [µg/g]	01-Dec-10	11:59	< 0.1
Silver [µg/g]	07-Dec-10	15:30	11
Aluminum [µg/g]	07-Dec-10	15:41	67000
Arsenic [µg/g]	07-Dec-10	15:30	49
Boron [g/t]	07-Dec-10	15:30	16
Barium [µg/g]	07-Dec-10	15:30	94
Beryllium [µg/g]	07-Dec-10	15:30	4.8
Bismuth [µg/g]	07-Dec-10	15:30	0.67
Calcium [µg/g]	07-Dec-10	15:41	5800
Cadmium [µg/g]	07-Dec-10	15:30	6.6
Cobalt [µg/g]	07-Dec-10	15:30	1.0
Chromium [µg/g]	07-Dec-10	15:30	51
Copper [g/t]	07-Dec-10	15:30	5.4
Iron [µg/g]	07-Dec-10	15:41	72000
Potassium [µg/g]	07-Dec-10	15:41	47000
Lithium [µg/g]	07-Dec-10	15:30	51
Magnesium [µg/g]	07-Dec-10	15:41	14000
Manganese [µg/g]	07-Dec-10	15:30	670
Molybdenum [µg/g]	07-Dec-10	15:30	3.2
Sodium [µg/g]	07-Dec-10	15:41	22000
Nickel [µg/g]	07-Dec-10	15:31	17
Total Phosphorus [ug/g]	10-Dec-10	07:08	130
Lead [µg/g]	07-Dec-10	15:31	8.1
Antimony [µg/g]	07-Dec-10	15:31	1.7
Selenium [µg/g]	07-Dec-10	15:31	2.9
Tin [µg/g]	07-Dec-10	15:31	29
Strontium [µg/g]	07-Dec-10	15:31	20
Titanium [µg/g]	07-Dec-10	15:41	200

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Project : CALR-11806-007

LR Report : **CA11615-NOV10**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 1Tls
Thallium [μg/g]	07-Dec-10	15:31	0.58
Thorium [g/t]	07-Dec-10	15:31	39
Uranium [μg/g]	07-Dec-10	15:31	12
Vanadium [μg/g]	07-Dec-10	15:31	< 1
Yttrium [μg/g]	07-Dec-10	15:31	520
Zinc [g/t]	07-Dec-10	15:31	77

Phosphorus added to report Dec. 10/10

Dianne Griffin
Project Specialist

OnLine LIMS

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Project : CALR-11806-007

Tuesday, December 21, 2010

Environmental Met
Attn : Barb Bowman

Date Rec. : 13 December 2010
LR Report: **CA10271-DEC10**
Reference: 11806-007-10

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: F28 Conc Blend	6: F29 Conc Blend	7: F30 Conc Blend	8: F30 Comb Tls
Sample Date & Time			Date:N/A	Date:N/A	Date:N/A	Date:N/A
Mercury [µg/g]	14-Dec-10	15:25	< 0.1	< 0.1	< 0.1	< 0.1
Silver [g/t]	17-Dec-10	10:51	200	180	240	19
Aluminum [µg/g]	20-Dec-10	13:46	20000	19000	15000	73000
Arsenic [g/t]	17-Dec-10	10:51	81	62	100	4.5
Boron [g/t]	17-Dec-10	10:51	40	36	44	9
Barium [g/t]	17-Dec-10	10:51	170	160	210	70
Beryllium [g/t]	17-Dec-10	10:51	38	35	45	4.9
Bismuth [g/t]	17-Dec-10	10:51	2.7	2.2	5.0	0.56
Calcium [µg/g]	20-Dec-10	13:46	60000	71000	59000	9000
Cadmium [g/t]	17-Dec-10	10:51	120	110	150	12
Cobalt [g/t]	17-Dec-10	10:51	3.6	3.4	4.2	4.8
Chromium [g/t]	17-Dec-10	10:51	140	130	150	490
Copper [g/t]	17-Dec-10	10:51	17	12	22	15
Iron [µg/g]	20-Dec-10	13:46	110000	110000	120000	82000
Potassium [µg/g]	20-Dec-10	13:46	13000	13000	9900	43000
Lithium [g/t]	17-Dec-10	10:51	54	58	48	45
Magnesium [µg/g]	20-Dec-10	13:46	21000	22000	18000	12000
Manganese [g/t]	17-Dec-10	10:51	4100	4600	4000	920
Molybdenum [g/t]	17-Dec-10	10:51	17	16	18	57
Sodium [µg/g]	20-Dec-10	13:46	3100	2500	2000	22000
Nickel [g/t]	17-Dec-10	10:52	87	79	89	290
Total Phosphorus [ug/g]	20-Dec-10	13:46	1900	2200	2300	203
Lead [g/t]	17-Dec-10	10:52	48	52	62	11
Antimony [g/t]	17-Dec-10	10:52	1.5	1.4	1.9	< 0.8
Selenium [g/t]	17-Dec-10	10:52	32	32	43	5.3
Tin [g/t]	17-Dec-10	10:52	100	97	120	26
Strontium [g/t]	17-Dec-10	10:52	67	77	80	19
Titanium [µg/g]	20-Dec-10	13:46	600	570	640	204
Thallium [g/t]	17-Dec-10	10:52	0.25	0.25	0.20	0.56
Thorium [g/t]	17-Dec-10	10:52	45	85	90	66
Uranium [g/t]	17-Dec-10	10:52	70	66	87	11
Vanadium [g/t]	17-Dec-10	10:52	2	7	3	15

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Project : CALR-11806-007

LR Report : **CA10271-DEC10**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: F28 Conc Blend	6: F29 Conc Blend	7: F30 Conc Blend	8: F30 Comb Tls
Yttrium [g/t]	17-Dec-10	10:52	3100	4200	4600	590
Zinc [g/t]	17-Dec-10	10:52	260	260	290	77

Dianne Griffin
Project Specialist

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Project : CALR-11806-007

Thursday, December 23, 2010

Environmental Met
Attn : Barb Bowman

Date Rec. : 16 December 2010
LR Report: **CA10332-DEC10**

Copy: #1

CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 2 Tls
Sample Date & Time			
Mercury [µg/g]	21-Dec-10	14:41	< 0.1
Silver [g/t]	22-Dec-10	10:27	15
Aluminum [µg/g]	22-Dec-10	10:51	86000
Arsenic [g/t]	22-Dec-10	10:27	1.8
Boron [g/t]	22-Dec-10	10:27	10
Barium [g/t]	22-Dec-10	10:27	91
Beryllium [g/t]	22-Dec-10	10:27	5.1
Bismuth [g/t]	22-Dec-10	10:27	0.54
Calcium [µg/g]	22-Dec-10	10:51	5500
Cadmium [g/t]	22-Dec-10	10:27	9.3
Cobalt [g/t]	22-Dec-10	10:27	0.60
Chromium [g/t]	22-Dec-10	10:27	19
Copper [g/t]	22-Dec-10	10:27	3.0
Iron [µg/g]	22-Dec-10	10:52	75000
Potassium [µg/g]	22-Dec-10	10:52	54000
Lithium [g/t]	22-Dec-10	10:27	39
Magnesium [µg/g]	22-Dec-10	10:52	13000
Manganese [g/t]	22-Dec-10	10:27	550
Molybdenum [g/t]	22-Dec-10	10:27	3.9
Sodium [µg/g]	22-Dec-10	10:52	27000
Nickel [g/t]	22-Dec-10	10:27	8.5
Total Phosphorus [ug/g]	22-Dec-10	10:52	140
Lead [g/t]	22-Dec-10	10:27	7.0
Antimony [g/t]	22-Dec-10	10:27	< 0.8
Selenium [g/t]	22-Dec-10	10:27	2.6
Tin [g/t]	22-Dec-10	10:27	27
Strontium [g/t]	22-Dec-10	10:27	9.03
Titanium [µg/g]	22-Dec-10	10:52	200
Thallium [g/t]	22-Dec-10	10:27	0.40

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Project : CALR-11806-007

LR Report : **CA10332-DEC10**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 2 Tls
Thorium [g/t]	22-Dec-10	10:27	39
Uranium [g/t]	22-Dec-10	10:27	9.7
Vanadium [g/t]	22-Dec-10	10:27	< 1
Yttrium [g/t]	22-Dec-10	10:27	280
Zinc [g/t]	22-Dec-10	10:27	44

Dianne Griffin
Project Specialist

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Project : CALR-11806-007

Wednesday, January 05, 2011

Environmental Met
Attn : Barb Bowman

Date Rec. : 17 December 2010
LR Report: **CA10359-DEC10**
Reference: 11806-007-12

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CERTIFICATE OF ANALYSIS
Final Report

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 2 Head	6: XPS PP Comp 3 Head
Sample Date & Time				
Mercury [µg/g]	24-Dec-10	10:41	< 0.1	< 0.1
Silver [µg/g]	22-Dec-10	10:27	29	32
Aluminum [µg/g]	22-Dec-10	10:53	62000	73000
Arsenic [µg/g]	22-Dec-10	10:27	4.4	3.4
Boron [g/t]	05-Jan-11	08:58	22	17
Barium [µg/g]	22-Dec-10	10:27	93	110
Beryllium [µg/g]	22-Dec-10	10:27	19	10
Bismuth [µg/g]	22-Dec-10	10:27	0.33	0.33
Calcium [µg/g]	22-Dec-10	10:53	22000	19000
Cadmium [µg/g]	22-Dec-10	10:27	18	20
Cobalt [µg/g]	22-Dec-10	10:27	0.26	0.31
Chromium [µg/g]	22-Dec-10	10:27	83	82
Copper [g/t]	22-Dec-10	10:28	2.0	1.7
Iron [µg/g]	22-Dec-10	10:53	100000	94000
Potassium [µg/g]	22-Dec-10	10:53	43000	47000
Lithium [µg/g]	22-Dec-10	10:28	69	53
Magnesium [µg/g]	22-Dec-10	10:53	22000	19000
Manganese [µg/g]	22-Dec-10	10:28	2800	1300
Molybdenum [µg/g]	22-Dec-10	10:28	2.5	2.0
Sodium [µg/g]	22-Dec-10	10:53	18000	22000
Nickel [µg/g]	22-Dec-10	10:28	6.0	6.7
Total Phosphorus [ug/g]	22-Dec-10	10:53	190	490
Lead [µg/g]	22-Dec-10	10:28	10	11
Antimony [µg/g]	22-Dec-10	10:28	< 0.8	< 0.8
Selenium [µg/g]	22-Dec-10	10:28	13	12
Tin [µg/g]	22-Dec-10	10:28	46	42
Strontium [µg/g]	22-Dec-10	10:28	21	16
Titanium [µg/g]	22-Dec-10	10:53	280	290

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Project : CALR-11806-007

LR Report : **CA10359-DEC10**

Analysis	3: Analysis Approval Date	4: Analysis Approval Time	5: XPS PP Comp 2 Head	6: XPS PP Comp 3 Head
Thallium [µg/g]	22-Dec-10	10:28	0.29	0.32
Thorium [g/t]	04-Jan-11	15:05	61	80
Uranium [µg/g]	22-Dec-10	10:28	12	15
Vanadium [µg/g]	22-Dec-10	10:28	< 1	< 1
Yttrium [µg/g]	22-Dec-10	10:28	720	590
Zinc [g/t]	22-Dec-10	10:28	100	64

Dianne Griffin
Project Specialist

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