

**An Investigation into
THE RECOVERY OF GOLD
FROM MIRADO PROJECT SAMPLES**

prepared for

OREFINDERS RESOURCES INC.

Project 14373-001 - Final Report
January 30, 2014

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Executive Summary

Testwork was conducted on four samples received from the Mirado project. The gold head grade ranged from 0.76 g/t Au to 2.60 g/t Au.

A standard Bond ball mill grindability test was performed on each of the four samples. The Bond work index varied from 15.4 to 18.3 kWh/t falling in to the medium to hard range of hardness.

Preliminary cyanidation tests were conducted to investigate the recovery of gold. Each sample was preaerated for 6 hours at pH 11-11.5 then leached for 48 hours with 1 g/L NaCN. Gold extraction ranged from 91.2% to 94.4% and averaged 92.9% at an average grind size P₈₀ of 65 µm. The consumption of cyanide was low to moderate at 0.3-0.4 kg/t NaCN and lime consumption was ~0.7 kg/t CaO.

A composite of equal weights of the leach residues from each of the four samples was used for initial environmental characterisation. Modified acid base accounting determined that the combined residue would be classified as potentially acid generating. A shake flask extraction test was used to evaluate the mobility of the contaminants under the pH conditions imposed by the material itself using a deionized water leachant in a 3:1 water:solids ratio. The pH of the filtered solution was 8.4. None of the regulated elements exceeded the Schedule 4 limits of the Metal Mining Effluent Regulations.

Introduction

This report summarizes the results of preliminary metallurgical scoping testwork conducted on four samples from the Mirado project submitted by Mr. Bill Yeomans of Orefinders Resources Inc. The test program included determination of the Bond ball mill work index and cyanidation tests to investigate the recovery of gold. Basic environmental characterization tests were performed on a combined tailing sample. The results were sent to Mr. Yeomans as they became available.



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Testwork Summary

1. Sample Description

Eight pails were received from Orefinders Resources Inc. on November 6, 2013 and given our reference number 0096-NOV13. They contained four stockpile samples, two pails of each sample, from the Mirado project. Each sample was crushed to minus 6 mesh and 10 kg was removed for Bond work index determination. The remainder was crushed to minus 10 mesh for metallurgical testwork. The minus 10 mesh material was rotary split into 1 kg test charges. One test charge was submitted for gold assay by pulp and metallics. The entire kilogram was pulverized until less than 30 grams of plus 150 mesh material remained. The entire plus 150 mesh fraction was assayed for gold. Two separate 30 gram samples were riffled from the minus 150 mesh fraction and assayed to extinction for gold. The gold content was calculated from these results and is shown in Table 1. Because the gold grade was lower than expected for some samples, the pulp and metallics assay was repeated on two additional 1 kg Sample A test charges.

Table 1: Gold Assay by Pulp and Metallics

Sample	Assay Au, g/t	+150M		-150M g/t		
		Wt %	Au, g/t	Au1	Au2	Au, avg
A	0.95	3.1	4.01	0.75	0.96	0.86
A	0.94	3.1	6.50	0.78	0.75	0.77
A	0.71	2.6	0.43	0.67	0.77	0.72
A, avg.	0.87					
B	0.86	2.8	1.40	0.83	0.86	0.85
C	2.60	2.6	10.3	2.19	2.59	2.39
D	0.76	2.6	2.28	0.68	0.75	0.72

Additional analyses, including a whole rock analysis, were conducted on the four samples on a separate head sample which was riffled from a test charge. These analyses are given in Table 2.

In addition, a composite was prepared by mixing 1 kg of each of the four samples and labeled Comp ABCD. A head sample was riffled out and submitted for a multi-element ICP scan and specific gravity determination. The results are shown in Table 3. A sample of Comp ABCD was sent to LEX Scientific Inc. to determine the presence of asbestos. No asbestos was detected. The certificate of analysis is included in Appendix A.

Table 2: Head Analysis of Individual Samples

Element		A	B	C	D
Au	g/t	0.87	0.86	2.60	0.76
S	%	1.12	2.17	1.88	2.76
As	%	<0.001	<0.001	<0.001	<0.001
Whole Rock Analysis					
SiO ₂	%	59.8	57.1	61.3	54.1
Al ₂ O ₃	%	14.7	14.5	14.9	14.4
Fe ₂ O ₃	%	7.57	9.48	9.54	10.8
MgO	%	3.71	3.87	3.60	4.08
CaO	%	3.63	4.25	3.96	4.62
Na ₂ O	%	2.25	1.04	0.59	0.93
K ₂ O	%	1.78	2.25	2.64	2.25
TiO ₂	%	0.44	0.51	0.45	0.54
P ₂ O ₅	%	0.10	0.17	0.10	0.23
MnO	%	0.15	0.17	0.18	0.24
Cr ₂ O ₃	%	0.02	0.03	0.02	0.04
V ₂ O ₅	%	0.01	0.02	0.02	0.03
LOI	%	3.97	4.49	4.03	5.00
Sum	%	98.2	97.9	101.3	97.2

Table 3: ICP Scan and Specific Gravity of Comp ABCD

Element		ABCD	Element		ABCD
Ag	g/t	< 2	Mo	g/t	< 5
Al	g/t	75700	Na	g/t	9070
As	g/t	< 30	Ni	g/t	75
Ba	g/t	991	P	g/t	672
Be	g/t	0.48	Pb	g/t	< 20
Bi	g/t	< 20	Sb	g/t	< 20
Ca	g/t	29500	Se	g/t	< 30
Cd	g/t	< 2	Sn	g/t	< 20
Co	g/t	24	Sr	g/t	210
Cr	g/t	137	Ti	g/t	2780
Cu	g/t	280	Tl	g/t	< 30
Fe	g/t	64500	U	g/t	< 20
K	g/t	18300	V	g/t	102
Li	g/t	31	Y	g/t	8.6
Mg	g/t	22500	Zn	g/t	98
Mn	g/t	1490	SG		2.92

2. Bond Ball Mill Grindability Testwork

A standard Bond ball mill grindability test was performed on the four individual samples using a 100 mesh closing screen. The results are summarized in Table 4 and compared to the SGS database in Figure 1. Samples B and D fell in the medium range of hardness whereas Samples A and C fell in the hard range of hardness.

Table 4: Bond Ball Mill Grindability Test Results

Sample	Mesh of Grind	F ₈₀ µm	P ₈₀ µm	Grams per Revolution	Work Index kWh/t	Hardness Percentile
A	100	2,445	110	1.15	18.3	85
B	100	2,482	112	1.44	15.4	62
C	100	2,559	109	1.22	17.3	79
D	100	2,530	111	1.40	15.7	65

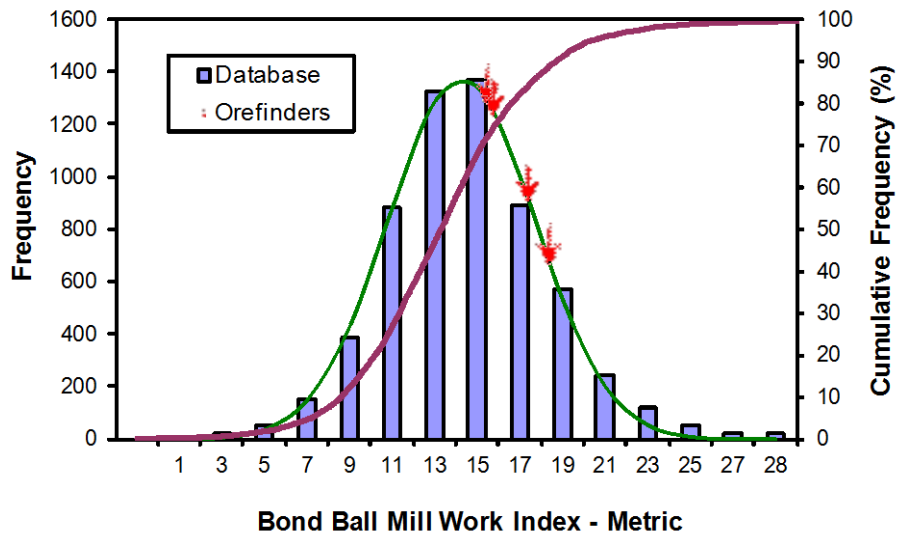


Figure 1: Bond Ball Mill Work Index Database

3. Cyanidation Testwork

Tests were conducted on the four samples to investigate the recovery of gold by carbon-in-leach cyanidation. The ground samples were preaerated at 50% solids for 6 hours maintaining pH 11-11.5. Then carbon and cyanide were added and the samples were leached for 24 hours. The cyanide addition was 1 g/L NaCN. This concentration was maintained once after 2 hours then allowed to drop. A second test was conducted on Sample B at a finer grind because the gold recovery in the first test was less than 90%. The results are presented in Table 5.

Table 5: Cyanidation Test Results

Sample	Test No.	Feed Size P ₈₀ , µm	Reagent Consumption kg/t of CN Feed		Final NaCN g/L	% Recovery Au	Residue g/t Au	Head, g/t Au	
			NaCN	CaO				calc.	direct
A	CN-1	66	0.43	0.70	0.63	94.4	0.05	0.80	0.87
B	CN-2	107	0.42	0.63	0.68	85.3	0.16	1.05	0.86
B	CN-5	46	0.31	0.54	0.80	91.2	0.09	1.02	0.86
C	CN-3	84	0.40	0.72	0.66	94.3	0.17	2.99	2.60
D	CN-4	63	0.28	0.66	0.83	91.6	0.09	1.02	0.76

The recovery of gold ranged from 91.2% to 94.4% under these conditions and averaged 92.9% (excluding test CN-2 which was conducted at the coarser grind). Reagent consumptions were moderate at 0.3-0.4 kg/t NaCN and ~0.7 kg/t CaO.

4. Environmental Testwork

A composite of leach residues was prepared for preliminary environmental characterisation. Equal weights of the wet residues from tests CN-1, CN-5, CN-3 and CN-4, representing the four samples, were combined and submitted for modified acid base accounting and a shake flask extraction test.

4.1. Modified Acid Base Accounting

The modified acid base accounting (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 neutralization potential (NP) of the samples by initiating a reaction with excess acid and then identified the quantity of acid neutralised 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. The results are shown in Table 6.

The modified ABA test results for the combined residues reported an alkaline paste pH of 8.4 and a fizz rate of 3 suggesting appreciable alkalinity and the presence of available reactive carbonate minerals. Determination of the neutralization potential (NP) resulted in a value of 48.0 t CaCO₃/1000 t, while the calculated carbonate NP (CO₃ NP) indicated that 82% of the total NP was due to fast-acting carbonate minerals. However, the combined residue had a significant sulphide concentration (1.77%) and the NP available would be insufficient to neutralize the acid generation potential (AP), as indicated by the negative Net NP value and a NP/AP ratio less than 1. Because of this, the combined residue is classified as potentially acid generating (PAG).

Table 6: Modified Acid Base Accounting Results

Parameter	Unit	Combined CN Residues
LIMS		14541-DEC13
Paste pH	units	8.4
Fizz Rate	---	3
Sample weight	g	2.02
HCl added	mL	29.70
HCl	Normality	0.10
NaOH	Normality	0.10
NaOH to	pH=8.3 mL	10.24
Final pH	units	1.54
NP	t CaCO ₃ /1000 t	48.0
AP	t CaCO ₃ /1000 t	55.3
Net NP	t CaCO ₃ /1000 t	-7.11
NP/AP	ratio	0.87
S	%	1.94
Acid Leachable SO ₄ -S	%	0.18
Sulphide	%	1.77
C	%	0.66
CO ₃	%	2.38
CO ₃ NP	t CaCO ₃ /1000 t	39.5
CO ₃ Net NP	t CaCO ₃ /1000 t	-15.8
CO ₃ NP/AP	ratio	0.71

4.2. Shake Flask Extraction Test

The shake flask extraction (SFE) test was used to evaluate the mobility of contaminants from the combined residue solids under the pH conditions imposed by the waste material itself and under the constraints imposed by contaminant solubility limitations. Deionised (DI) water leachant was added to the samples at a 3:1 liquid to solid ratio. The sample was 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 filtrate solution was analysed for pH, conductivity, alkalinity, acidity, anions (Cl, F, NO₂, NO₃ and SO₄) and dissolved metals analyses. The results are shown in Table 7 along with the Schedule 4 limits of the Metal Mining Effluent Regulations (MMER).

The pH of the leachate was 8.38. All analyses of regulated elements were well below the MMER limit.

Table 7: Shake Flask Extraction Test Results

Parameter	Unit	MMER*	Combined CN Residues
LIMS			14540-DEC13
Sample weight	g		235
Volume DI water	mL		705
Initial pH	-		9.1
Final pH	-		8.44
pH	-		8.38
Alkalinity	mg/L as CaCO ₃		49
Conductivity	µS/cm		322
Acidity	mg/L as CaCO ₃		<2
F	mg/L		0.07
Cl	mg/L		2.3
SO ₄	mg/L		110
NO ₂	as N mg/L		<0.3
NO ₃	as N mg/L		<0.6
Metals			
Hg	mg/L		< 0.00001
Ag	mg/L		< 0.00001
Al	mg/L		0.0448
As	mg/L	0.50	0.0002
Ba	mg/L		0.0138
Be	mg/L		< 0.00002
B	mg/L		0.0078
Bi	mg/L		< 0.00001
Ca	mg/L		53.2
Cd	mg/L		< 0.000003
Co	mg/L		0.000449
Cr	mg/L		< 0.0005
Cu	mg/L	0.30	0.0013
Fe	mg/L		0.018
K	mg/L		4.09
Li	mg/L		0.001
Mg	mg/L		4.65
Mn	mg/L		0.052
Mo	mg/L		0.00303
Na	mg/L		4.67
Ni	mg/L	0.50	0.0013
P	mg/L		0.016
Pb	mg/L	0.20	< 0.00002
Sb	mg/L		0.0004
Se	mg/L		< 0.001
Si	mg/L		1.29
Sn	mg/L		0.00002
Sr	mg/L		0.116
Th	mg/L		< 0.000004
Ti	mg/L		0.0001
Tl	mg/L		< 0.00002
U	mg/L		0.000060
V	mg/L		0.00010
W	mg/L		0.00020
Y	mg/L		< 0.000001
Zn	mg/L	0.50	0.002

*Schedule 4, Column 2, Maximum Authorized Monthly Mean Concentration.
Metal Mining Effluent Regulations (SOR/2002-222),

Appendix A – Details of Tests

- **Bond Work Index Tests**

- **Cyanidation Tests**

- **Certificates of Analysis**
 - ⇒ **Shake Flask Extraction**

 - ⇒ **Acid Base Accounting**

 - ⇒ **Determination of Asbestos Content**

SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001 Date: 18-Nov-13
 Sample: Sample A Laboratory: Lakefield (Canada)

Purpose: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Procedure: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Test Conditions: Feed 100% Passing 6 mesh
 Mesh of grind: 100 mesh
 Test feed weight (700 mL): 1,164 grams
 Equivalent to : 1,663 kg/m³ at Minus 6 mesh
 Weight % of the undersize material in the ball mill feed: 9.0%
 Weight of undersize product for 250% circulating load: 333 grams

Results: Gram per Rev Average for the Last Three Stages = **1.15 g**
 Circulation load = **250%**

CALCULATION OF A BOND WORK INDEX

$$BWI = \frac{44.5}{P_1^{0.23} \times Grp^{0.82} \times \left\{ \frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right\}}$$

P₁ = 100% passing size of the product 150 microns
 Grp = Grams per revolution 1.15 grams
 P₈₀ = 80% passing size of product 110 microns
 F₈₀ = 80% passing size of the feed 2,445 microns

BWI = **16.6 kWh/t** (imperial)

BWI = **18.3 kWh/t** (metric)

Comments:

Stage No.	# of Revs	New Feed (grams)	Product in Feed (grams)	Material to Be Ground (grams)	Material Passing 100 mesh in Product (grams)	Net Ground Material (grams)	Material Ground Per Mill Rev (grams)
1	100	1,164	105	228	242	137	1.37
2	226	242	22	311	267	245	1.09
3	284	267	24	309	339	315	1.11
4	272	339	30	302	344	314	1.15
5	262	344	31	302	332	301	1.15
6	263	332	30	303	333	303	1.15
7	263	333	30	303	333	303	1.15
Average for Last Three Stages =					333 g		1.15 g

SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001
Sample: Sample A

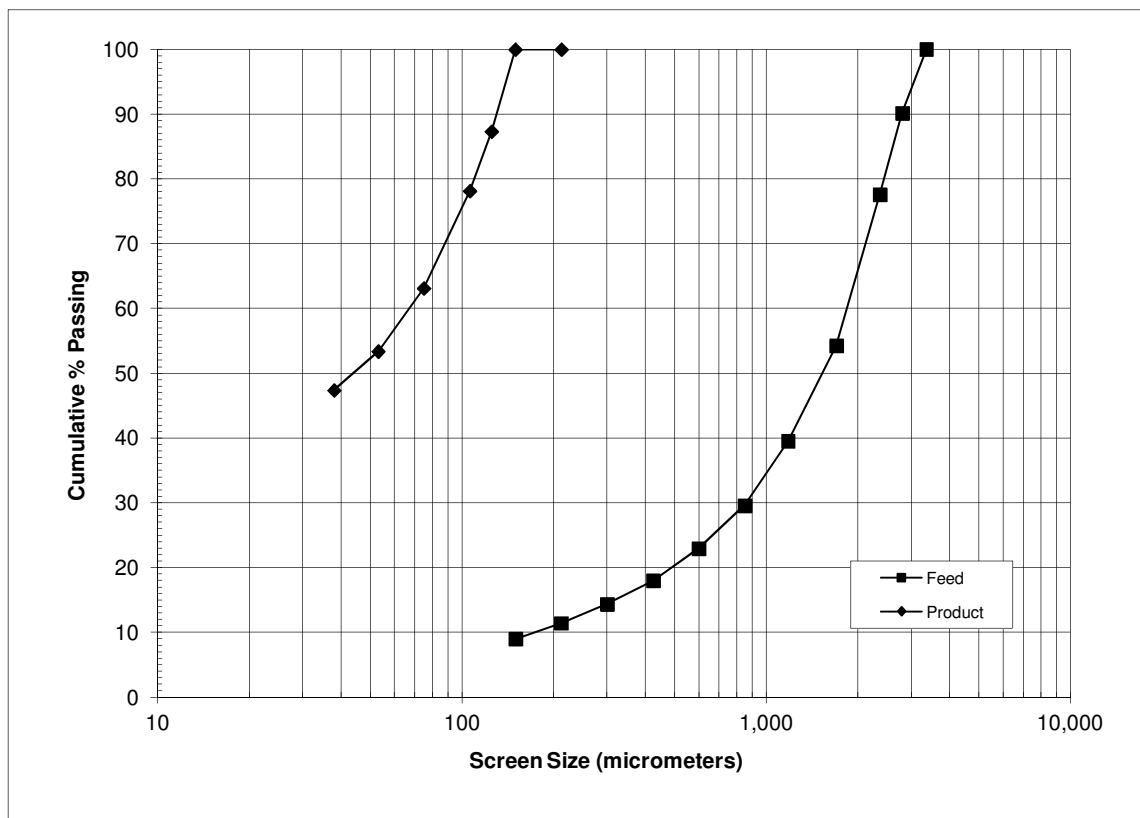
Date: 18-Nov-13
Laboratory: Lakefield (Canada)

Feed Particle Size Analysis

Size Mesh	µm	Weight grams	% Retained		% Passing		
			Individual	Cumulative	Cumulative		
6	3,360	0.00	0.00	0.00	100.0		
7	2,800	61.5	9.83	9.83	90.2		
8	2,360	79.0	12.6	22.5	77.5		
10	1,700	145.9	23.3	45.8	54.2		
14	1,180	92.0	14.7	60.5	39.5		
20	850	62.2	9.94	70.4	29.6		
28	600	41.6	6.65	77.1	22.9		
35	425	31.0	4.95	82.0	18.0		
48	300	22.7	3.63	85.6	14.4		
65	212	18.4	2.94	88.6	11.4		
100	150	15.2	2.43	91.0	8.98		
115	125	-	-	91.0	8.98		
150	106	13.1	2.09	93.1	6.89		
200	75						
270	53						
400	38						
Pan	-	43.1	6.9	100.0	-		
Total	-	625.7	100.0	F₈₀: 2,445	152.9	100.0	P₈₀: 110

Product Particle Size Analysis

Weight grams	% Retained		% Passing
	Individual	Cumulative	Cumulative
0.00	0.00	0.00	100.0
0.00	0.00	0.00	100.0
19.4	12.7	12.7	87.3
14.0	9.16	21.8	78.2
23.0	15.0	36.9	63.1
14.9	9.74	46.6	53.4
9.20	6.02	52.6	47.4
72.4	47.4	100.0	-



SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001 Date: 19-Nov-13
 Sample: Sample B Laboratory: Lakefield (Canada)

Purpose: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Procedure: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Test Conditions: Feed 100% Passing 6 mesh
 Mesh of grind: 100 mesh
 Test feed weight (700 mL): 1,208 grams
 Equivalent to : 1,726 kg/m³ at Minus 6 mesh
 Weight % of the undersize material in the ball mill feed: 9.6%
 Weight of undersize product for 250% circulating load: 345 grams

Results: Gram per Rev Average for the Last Three Stages = **1.44 g**
 Circulation load = **249%**

CALCULATION OF A BOND WORK INDEX

$$BWI = \frac{44.5}{P_1^{0.23} \times Grp^{0.82} \times \left\{ \frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right\}}$$

P₁ = 100% passing size of the product 150 microns
 Grp = Grams per revolution 1.44 grams
 P₈₀ = 80% passing size of product 112 microns
 F₈₀ = 80% passing size of the feed 2,482 microns

BWI = **14.0 kWh/t** (imperial)

BWI = **15.4 kWh/t** (metric)

Comments:

Stage No.	# of Revs	New Feed (grams)	Product in Feed (grams)	Material to Be Ground (grams)	Material Passing 100 mesh in Product (grams)	Net Ground Material (grams)	Material Ground Per Mill Rev (grams)
1	100	1,208	116	229	271	155	1.55
2	206	271	26	319	302	276	1.34
3	236	302	29	316	350	321	1.36
4	229	350	34	312	360	326	1.43
5	218	360	34	311	349	315	1.44
6	216	349	33	312	345	312	1.44
7	216	345	33	312	345	312	1.44
Average for Last Three Stages =					346 g		1.44 g

SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001
Sample: Sample B

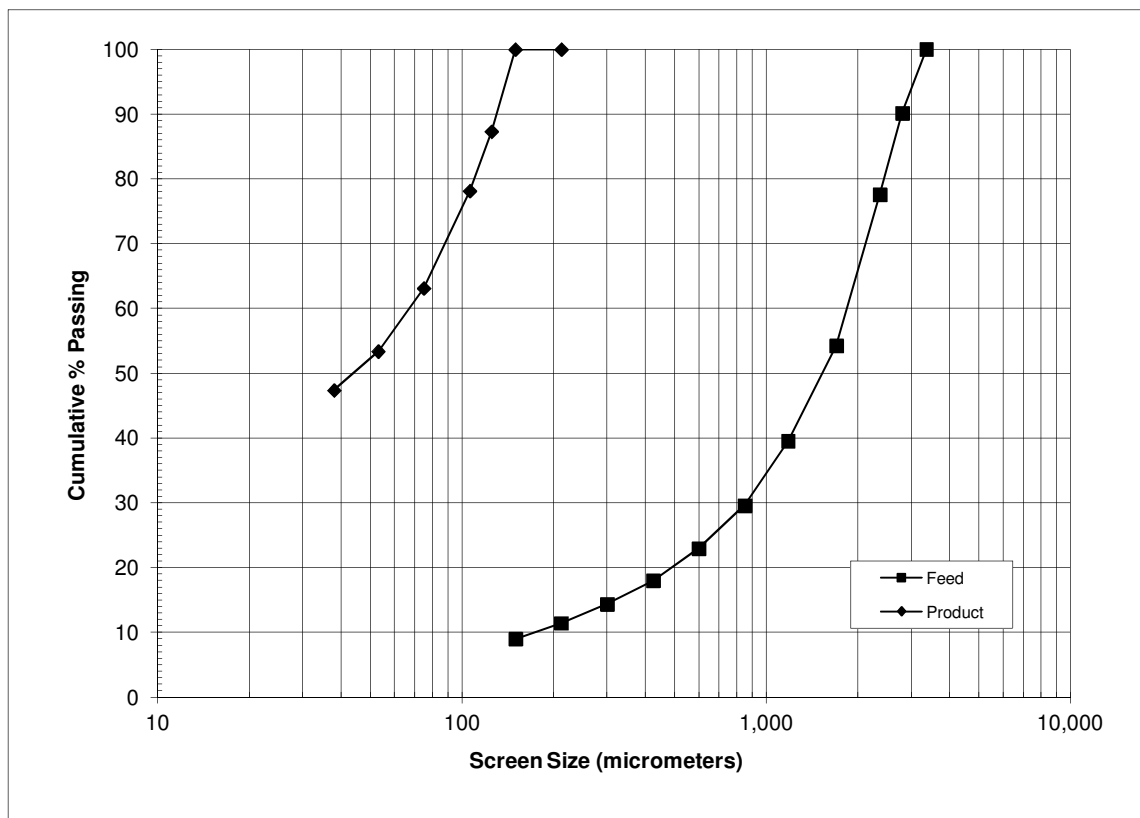
Date: 19-Nov-13
Laboratory: Lakefield (Canada)

Feed Particle Size Analysis

Size Mesh	µm	Weight grams	% Retained		% Passing
			Individual	Cumulative	Cumulative
6	3,360	0.00	0.00	0.00	100.0
7	2,800	70.2	11.3	11.3	88.7
8	2,360	74.5	12.0	23.4	76.6
10	1,700	139.5	22.5	45.9	54.1
14	1,180	89.2	14.4	60.3	39.7
20	850	61.4	9.92	70.2	29.8
28	600	40.8	6.59	76.8	23.2
35	425	31.3	5.06	81.9	18.1
48	300	22.4	3.62	85.5	14.5
65	212	17.0	2.75	88.2	11.8
100	150	13.5	2.18	90.4	9.58
115	125	-	-	90.4	9.58
150	106	11.6	1.87	92.3	7.70
200	75				
270	53				
400	38				
Pan	-	47.7	7.7	100.0	-
Total	-	619.1	100.0	F₈₀: 2,482	153.0

Product Particle Size Analysis

Weight grams	% Retained		% Passing
	Individual	Cumulative	Cumulative
0.00	0.00	0.00	100.0
0.00	0.00	0.00	100.0
22.2	14.5	14.5	85.5
12.7	8.30	22.8	77.2
19.6	12.8	35.6	64.4
12.7	8.30	43.9	56.1
7.90	5.16	49.1	50.9
77.9	50.9	100.0	-
P₈₀: 112			



SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001 Date: 19-Nov-13
 Sample: Sample C Laboratory: Lakefield (Canada)

Purpose: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Procedure: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Test Conditions: Feed 100% Passing 6 mesh
 Mesh of grind: 100 mesh
 Test feed weight (700 mL): 1,254 grams
 Equivalent to: 1,791 kg/m³ at Minus 6 mesh
 Weight % of the undersize material in the ball mill feed: 8.2%
 Weight of undersize product for 250% circulating load: 358 grams

Results: Gram per Rev Average for the Last Three Stages = **1.22 g**
 Circulation load = **247%**

CALCULATION OF A BOND WORK INDEX

$$BWI = \frac{44.5}{P_1^{0.23} \times Grp^{0.82} \times \left\{ \frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right\}}$$

P₁ = 100% passing size of the product 150 microns
 Grp = Grams per revolution 1.22 grams
 P₈₀ = 80% passing size of product 109 microns
 F₈₀ = 80% passing size of the feed 2,559 microns

BWI = 15.7 kWh/t (imperial)

BWI = 17.3 kWh/t (metric)

Comments:

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Stage No.	# of Revs	New Feed (grams)	Product in Feed (grams)	Material to Be Ground (grams)	Material Passing 100 mesh in Product (grams)	Net Ground Material (grams)	Material Ground Per Mill Rev (grams)
1	100	1,254	103	255	246	143	1.43
2	236	246	20	338	287	267	1.13
3	296	287	24	335	361	337	1.14
4	288	361	30	329	370	340	1.18
5	277	370	30	328	370	340	1.23
6	267	370	30	328	358	328	1.23
7	268	358	29	329	355	326	1.22
Average for Last Three Stages =					361 g	1.22 g	

SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001
Sample: Sample C

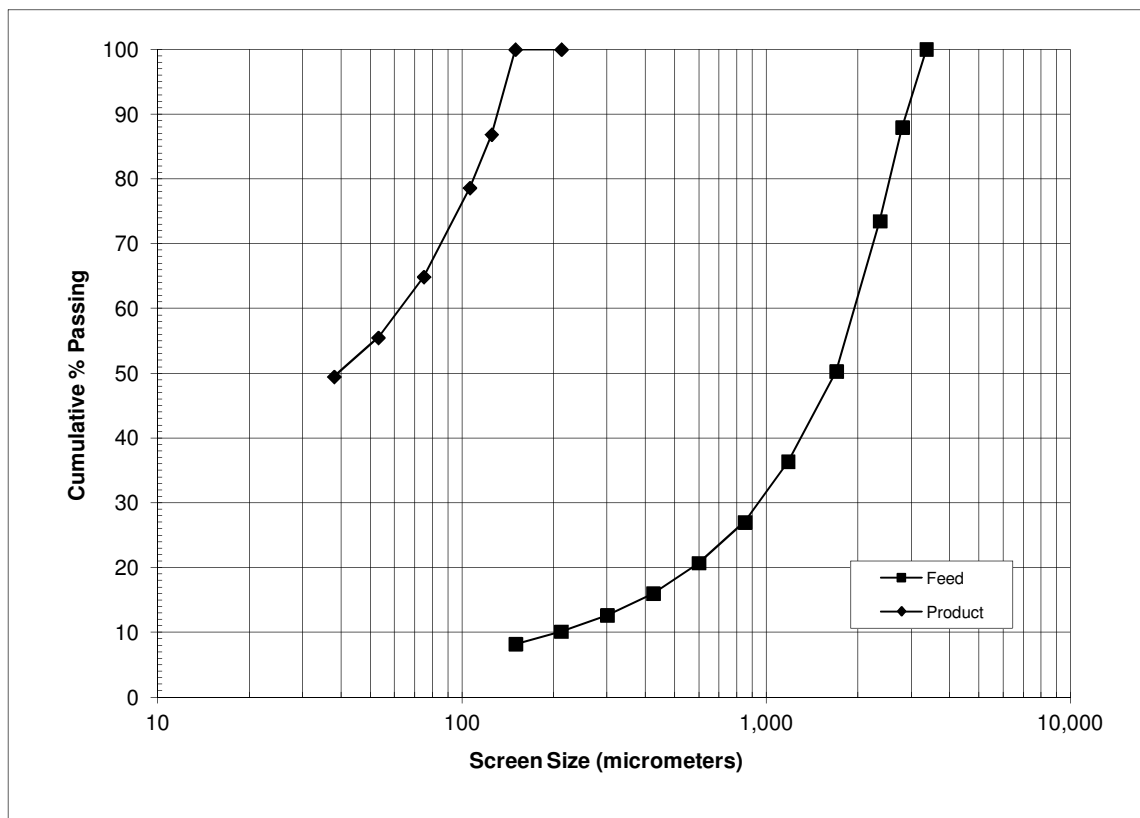
Date: 19-Nov-13
Laboratory: Lakefield (Canada)

Feed Particle Size Analysis

Size Mesh	µm	Weight grams	% Retained		% Passing Cumulative
			Individual	Cumulative	
6	3,360	0.00	0.00	0.00	100.0
7	2,800	81.7	12.1	12.1	87.9
8	2,360	98.0	14.5	26.5	73.5
10	1,700	157.2	23.2	49.7	50.3
14	1,180	94.5	13.9	63.7	36.3
20	850	63.3	9.34	73.0	27.0
28	600	42.6	6.29	79.3	20.7
35	425	32.0	4.72	84.0	16.0
48	300	22.8	3.36	87.4	12.6
65	212	17.0	2.51	89.9	10.1
100	150	13.0	1.92	91.8	8.20
115	125	-	-	91.8	8.20
150	106	11.0	1.62	93.4	6.58
200	75				
270	53				
400	38				
Pan	-	44.6	6.6	100.0	-
Total	-	677.7	100.0	F₈₀: 2,559	152.3

Product Particle Size Analysis

Weight grams	% Retained		% Passing Cumulative
	Individual	Cumulative	
0.00	0.00	0.00	100.0
0.00	0.00	0.00	100.0
20.0	13.1	13.1	86.9
12.6	8.27	21.4	78.6
20.9	13.7	35.1	64.9
14.3	9.39	44.5	55.5
9.20	6.04	50.6	49.4
75.3	49.4	100.0	-
P₈₀: 109			



SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001 Date: 20-Nov-13
 Sample: Sample D Laboratory: Lakefield (Canada)

Purpose: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Procedure: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Test Conditions: Feed 100% Passing 6 mesh
 Mesh of grind: 100 mesh
 Test feed weight (700 mL): 1,190 grams
 Equivalent to: 1,700 kg/m³ at Minus 6 mesh
 Weight % of the undersize material in the ball mill feed: 7.5%
 Weight of undersize product for 250% circulating load: 340 grams

Results: Gram per Rev Average for the Last Three Stages = **1.40 g**
 Circulation load = **246%**

CALCULATION OF A BOND WORK INDEX

$$BWI = \frac{44.5}{P_1^{0.23} \times Grp^{0.82} \times \left\{ \frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right\}}$$

P₁ = 100% passing size of the product 150 microns
 Grp = Grams per revolution 1.40 grams
 P₈₀ = 80% passing size of product 111 microns
 F₈₀ = 80% passing size of the feed 2,530 microns

BWI = **14.2 kWh/t (imperial)**

BWI = **15.7 kWh/t (metric)**

Comments:

Stage No.	# of Revs	New Feed (grams)	Product in Feed (grams)	Material to Be Ground (grams)	Material Passing 100 mesh in Product (grams)	Net Ground Material (grams)	Material Ground Per Mill Rev (grams)
1	100	1,190	89	251	245	156	1.56
2	207	245	18	322	283	265	1.28
3	249	283	21	319	345	324	1.30
4	242	345	26	314	353	327	1.35
5	232	353	27	313	347	320	1.38
6	227	347	26	314	345	319	1.40
7	224	345	26	314	340	314	1.40
Average for Last Three Stages =					344 g		1.40 g

SGS Minerals Services

Standard Bond Ball Mill Grindability Test

Project No.: 14373-001
Sample: Sample D

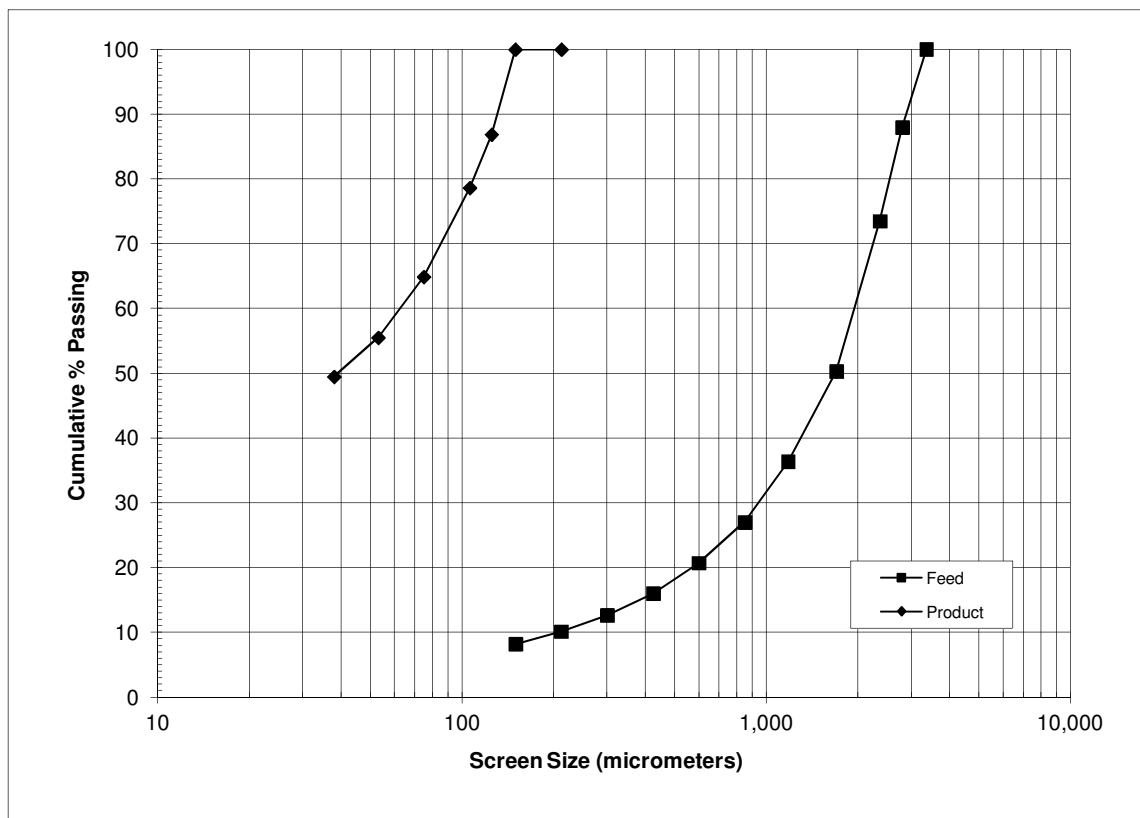
Date: 20-Nov-13
Laboratory: Lakefield (Canada)

Feed Particle Size Analysis

Size Mesh	µm	Weight grams	% Retained		% Passing
			Individual	Cumulative	Cumulative
6	3,360	0.00	0.00	0.00	100.0
7	2,800	76.4	12.0	12.0	88.0
8	2,360	83.8	13.1	25.1	74.9
10	1,700	148.4	23.2	48.3	51.7
14	1,180	93.9	14.7	63.0	37.0
20	850	61.8	9.68	72.7	27.3
28	600	41.9	6.56	79.3	20.7
35	425	31.5	4.93	84.2	15.8
48	300	22.8	3.57	87.8	12.2
65	212	17.0	2.66	90.4	9.58
100	150	13.2	2.07	92.5	7.52
115	125	-	-	92.5	7.52
150	106	10.3	1.61	94.1	5.90
200	75				
270	53				
400	38				
Pan	-	37.7	5.9	100.0	-
Total	-	638.7	100.0	F₈₀: 2,530	151.2

Product Particle Size Analysis

Weight grams	% Retained		% Passing
	Individual	Cumulative	Cumulative
0.00	0.00	0.00	100.0
0.00	0.00	0.00	100.0
20.9	13.8	13.8	86.2
12.4	8.20	22.0	78.0
20.0	13.2	35.3	64.7
13.1	8.66	43.9	56.1
8.20	5.42	49.3	50.7
76.6	50.7	100.0	-
P₈₀: 111			



Purpose: To investigate the recovery of gold from Sample A by direct cyanidation.

Procedure: The test feed was ground as per the desired conditions below. The slurry was then transferred to a bottle and pulped with water to the proper percent solids. The pH of the pulp was adjusted with lime. The pulp was conditioned as described below. The sodium cyanide, then carbon were added and the pulp was placed on the rolls. The NaCN concentration, and the pH were maintained for the duration of the test. The dissolved oxygen was monitored at various intervals during the test. At the end of the leach, the pulp was filtered and the residue was washed with three displacements of water. The wash water was discarded. The final products were submitted for the required assays.

Feed:	1000 g Sample A	Leach Duration:	24 h
Solution Volume:	1000 mL	Pre-conditioning:	6 h on rolls
Pulp Density:	50 % solids	Leach Aeration:	None
NaCN Concentration:	1.0 g/L NaCN maintained	Pb(NO₃)₂ Concentration:	0.0 kg/t
pH Range:	11-11.5 maintained with lime as required	Carbon Concentration:	20.0 g/L
Grind:	1 kg 35 min/kg 2 kg mill #2	Final Residue Size (P₈₀) =	66 µm

Reagent Addition (kg/t of cyanide feed)

NaCN: 1.09 CaO: 0.75

Reagent Consumption (kg/t of cyanide feed)

NaCN: 0.43 CaO: 0.70

Time hours	Added, Grams				Residual		Consumed		pH	DO mg/L
	Actual NaCN	Ca(OH) ₂	Equivalent NaCN	CaO	Grams NaCN	CaO	Grams NaCN	CaO		
Pre-conditioning									8.6	0.1
0-2		0.52		0.39					11.5-10.9	1.6
2-4		0.14		0.11					11.4-11.0	4.7
4-6		0.08		0.06					11.4-11.1	5.5
Cyanidation:										
0-2	1.02	0.09	1.00	0.07	0.91		0.09		11.4-11.2	7.1
2-20	0.09	0.07	0.09	0.06	0.86		0.14		11.5-11.1	8.1
20-24	0.00	0.08	0.00	0.06	0.66	0.05	0.20	0.69	11.4-11.2	6.4

Total	1.11	0.99	1.09	0.75	0.66	0.05	0.42	0.69		
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Cyanidation Results:

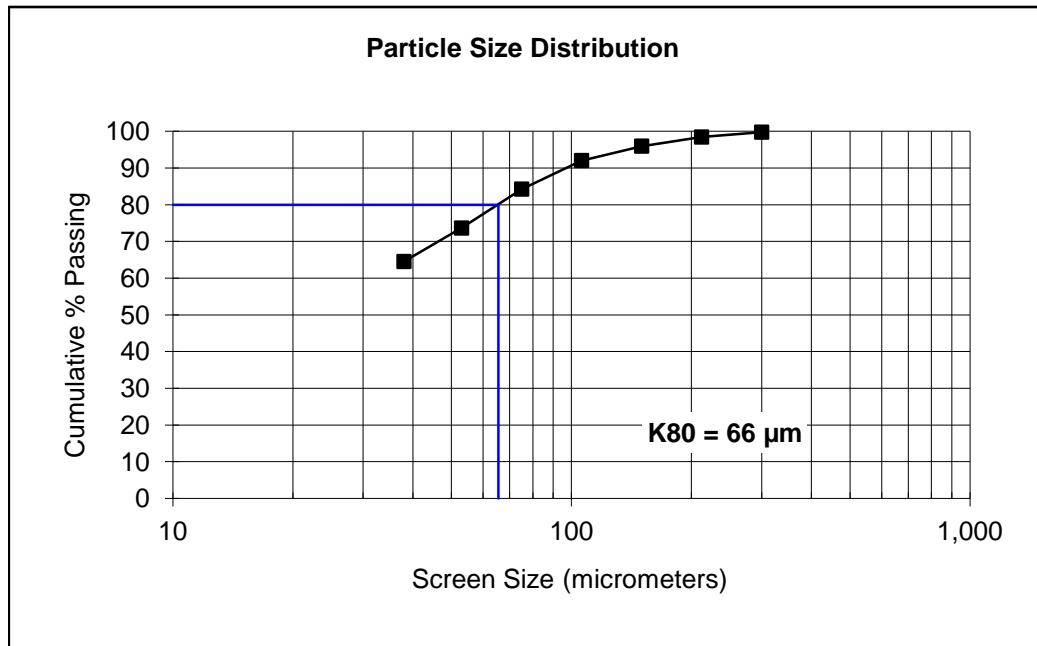
Product	Amount g, mL	Assays, mg/L, g/t	% Distribution	% Extraction
		Au	Au	Au
Carbon	20.75	36.0	93.1	94.4
Barren Solution	1,042	<0.01	1.3	
Final Residue	998	0.05	5.6	
Head (calc.)	998	0.80	100.0	
Head (dir.)				

Duplicate residue assays, Au, g/t = 0.04 g/t
0.05 g/t
Average 0.05 g/t

Sample: **CN 1 Residue**

Test No.:

Mesh	Size	Weight grams	% Retained		% Passing Cumulative
	µm		Individual	Cumulative	
48	300	0.4	0.2	0.2	99.8
65	212	2.3	1.3	1.6	98.4
100	150	4.3	2.5	4.0	96.0
150	106	6.8	3.9	8.0	92.0
200	75	13.5	7.8	15.7	84.3
270	53	18.4	10.6	26.4	73.6
400	38	15.8	9.1	35.5	64.5
Pan	-38	111.9	64.5	100.0	0.0
Total	-	173.4	100.0	-	-
K80	66				



Purpose: To investigate the recovery of gold from Sample B by direct cyanidation.

Procedure: The test feed was ground as per the desired conditions below. The slurry was then transferred to a bottle and pulped with water to the proper percent solids. The pH of the pulp was adjusted with lime. The pulp was conditioned as described below. The sodium cyanide, then carbon were added and the pulp was placed on the rolls. The NaCN concentration, and the pH were maintained for the duration of the test. The dissolved oxygen was monitored at various intervals during the test. At the end of the leach, the pulp was filtered and the residue was washed with three displacements of water. The wash water was discarded. The final products were submitted for the required assays.

Feed:	1000 g Sample B	Leach Duration:	24 h
Solution Volume:	1000 mL	Pre-conditioning:	6 h on rolls
Pulp Density:	50 % solids	Leach Aeration:	None
NaCN Concentration:	1.0 g/L NaCN maintained	Pb(NO₃)₂ Concentration:	0.0 kg/t
pH Range:	11-11.5 maintained with lime as required	Carbon Concentration:	20.0 g/L
Grind:	1 kg 25 min/kg 2 kg mill #2	Final Residue Size (P₈₀) =	107 µm

Reagent Addition (kg/t of cyanide feed)

NaCN: 1.10 CaO: 0.67

Reagent Consumption (kg/t of cyanide feed)

NaCN: 0.42 CaO: 0.63

Time hours	Added, Grams				Residual		Consumed		pH	DO mg/L
	Actual NaCN	Ca(OH) ₂	Equivalent NaCN	CaO	Grams NaCN	CaO	Grams NaCN	CaO		
Pre-conditioning									8.7	0.1
0-2		0.45		0.34					11.5-10.8	2.5
2-4		0.12		0.09					11.4-11.0	5.1
4-6		0.11		0.08					11.4-11.4	5.1
Cyanidation:										
0-2	1.02	0.10	1.00	0.07	0.90		0.10		11.5-11.2	7.2
2-20	0.10	0.06	0.10	0.04	0.90		0.10		11.5-11.2	7.5
20-24	0.00	0.04	0.00	0.03	0.68	0.04	0.22	0.63	11.4-11.2	6.4

Total	1.12	0.88	1.10	0.67	0.68	0.04	0.42	0.63		
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Cyanidation Results:

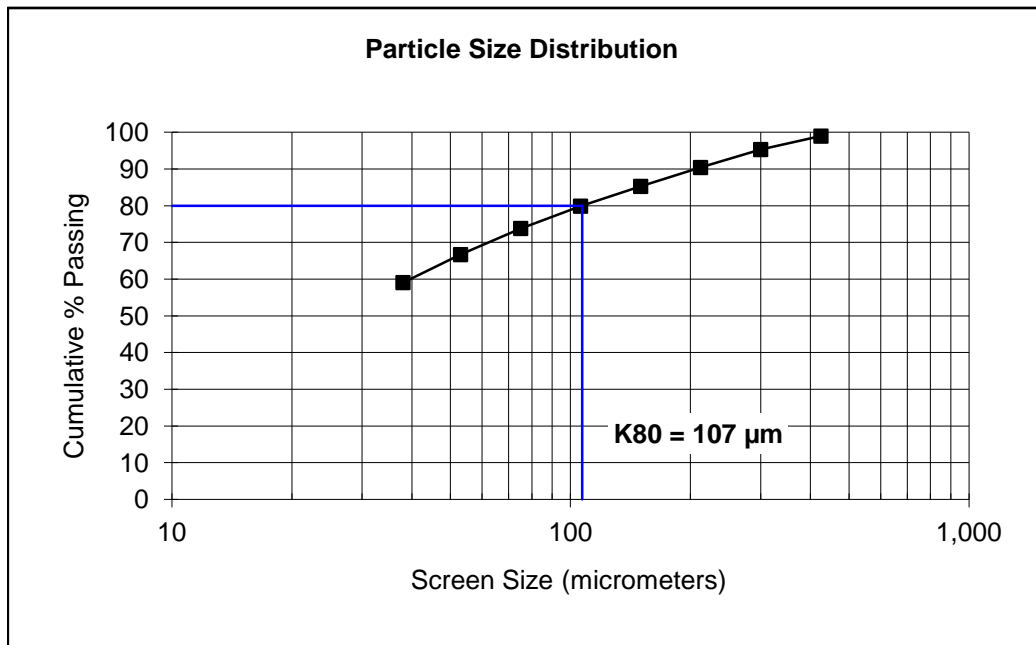
Product	Amount g, mL	Assays, mg/L, g/t Au	% Distribution	% Extraction
			Au	Au
Carbon	20.76	42.7	84.3	85.3
Barren Solution	1,041	<0.01	1.0	
Final Residue	997	0.16	14.7	
Head (calc.)	997	1.05	100.0	
Head (dir.)				

Duplicate residue assays, Au, g/t = 0.14 g/t
0.17 g/t
Average 0.16 g/t

Sample: **CN 2 Residue**

Test No.:

Mesh	Size	Weight grams	% Retained		% Passing Cumulative
	µm		Individual	Cumulative	
35	425	1.7	1.1	1.1	98.9
48	300	5.9	3.7	4.7	95.3
65	212	7.9	4.9	9.6	90.4
100	150	8.3	5.1	14.7	85.3
150	106	8.7	5.4	20.1	79.9
200	75	9.8	6.1	26.2	73.8
270	53	11.5	7.1	33.3	66.7
400	38	12.3	7.6	41.0	59.0
Pan	-38	95.3	59.0	100.0	0.0
Total	-	161.4	100.0	-	-
K80	107				



Test: CN-3

Project: I4373-001

Operator: LG

Date: November 21, 2013

Purpose: To investigate the recovery of gold from Sample C by direct cyanidation.

Procedure: The test feed was ground as per the desired conditions below. The slurry was then transferred to a bottle and pulped with water to the proper percent solids. The pH of the pulp was adjusted with lime. The pulp was conditioned as described below. The sodium cyanide, then carbon were added and the pulp was placed on the rolls. The NaCN concentration, and the pH were maintained for the duration of the test. The dissolved oxygen was monitored at various intervals during the test. At the end of the leach, the pulp was filtered and the residue was washed with three displacements of water. The wash water was discarded. The final products were submitted for the required assays.

Feed:	1000 g Sample C	Leach Duration:	24 h
Solution Volume:	1000 mL	Pre-conditioning:	6 h on rolls
Pulp Density:	50 % solids	Leach Aeration:	None
NaCN Concentration:	1.0 g/L NaCN maintained	Pb(NO₃)₂ Concentration:	0.0 kg/t
pH Range:	11-11.5 maintained with lime as required	Carbon Concentration:	20.0 g/L
Grind:	1 kg 27 min/kg 2 kg mill #2	Final Residue Size (P₈₀) =	84 µm

Reagent Addition (kg/t of cyanide feed)	NaCN: 1.07	CaO: 0.76
Reagent Consumption (kg/t of cyanide feed)	NaCN: 0.40	CaO: 0.72

Time hours	Added, Grams				Residual		Consumed		pH	DO mg/L
	Actual NaCN	Ca(OH) ₂	Equivalent NaCN	CaO	Grams NaCN	CaO	Grams NaCN	CaO		
Pre-conditioning									8.6	0.1
0-2		0.51		0.39					11.5-10.8	1.0
2-4		0.14		0.10					11.4-11.0	4.1
4-6		0.10		0.08					11.4-11.1	4.6
Cyanidation:										
0-2	1.02	0.09	1.00	0.07	0.94		0.06		11.5-11.1	7.3
2-20	0.06	0.08	0.06	0.06	0.89		0.11		11.5-11.1	7.2
20-24	0.00	0.07	0.00	0.05	0.66	0.04	0.23	0.72	11.4-11.2	6.5

Total	1.08	0.99	1.06	0.76	0.66	0.04	0.40	0.72
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Cyanidation Results:

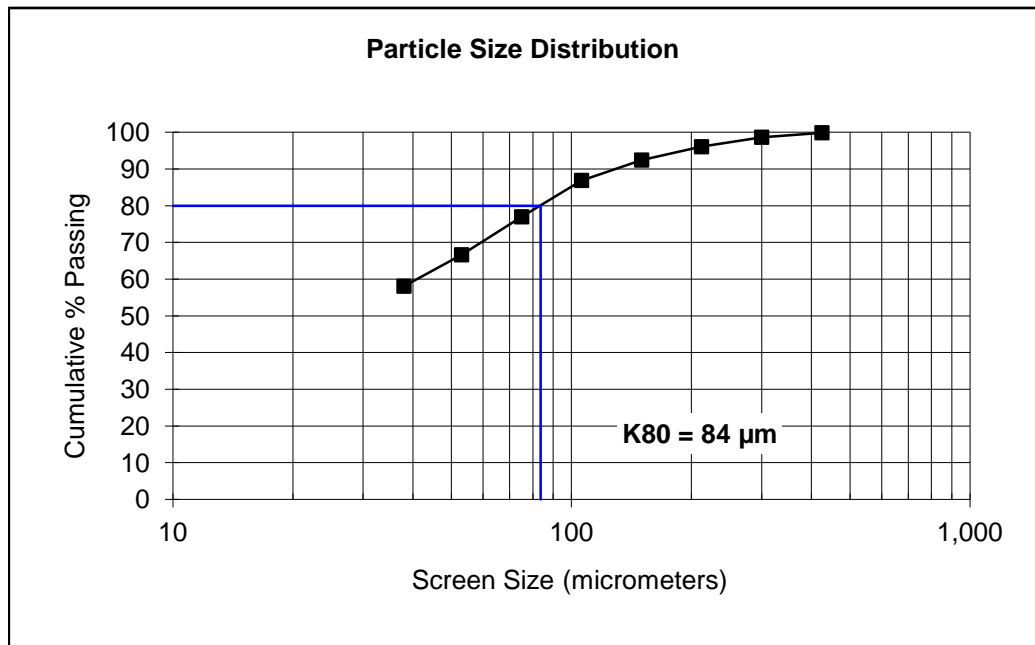
Product	Amount g, mL	Assays, mg/L, g/t	% Distribution	% Extraction
		Au	Au	Au
Carbon	20.85	134	94.0	94.3
Barren Solution	1,012	<0.01	0.3	
Final Residue	995	0.17	5.7	
Head (calc.)	995	2.99	100.0	
Head (dir.)				

Duplicate residue assays, Au, g/t = 0.17 g/t
 0.17 g/t
 Average 0.17 g/t

Sample: **CN 3 Res**

Test No.:

Mesh	Size	Weight grams	% Retained		% Passing Cumulative
	µm		Individual	Cumulative	
35	425	0.2	0.1	0.1	99.9
48	300	2.0	1.2	1.4	98.6
65	212	4.2	2.6	3.9	96.1
100	150	5.9	3.6	7.6	92.4
150	106	9.0	5.5	13.1	86.9
200	75	16.1	9.9	23.0	77.0
270	53	16.8	10.3	33.4	66.6
400	38	13.9	8.6	41.9	58.1
Pan	-38	94.3	58.1	100.0	0.0
Total	-	162.4	100.0	-	-
K80	84				



Test: CN-4

Project: I4373-001

Operator: LG

Date: November 21, 2013

Purpose: To investigate the recovery of gold from Sample D by direct cyanidation.

Procedure: The test feed was ground as per the desired conditions below. The slurry was then transferred to a bottle and pulped with water to the proper percent solids. The pH of the pulp was adjusted with lime. The pulp was conditioned as described below. The sodium cyanide, then carbon were added and the pulp was placed on the rolls. The NaCN concentration, and the pH were maintained for the duration of the test. The dissolved oxygen was monitored at various intervals during the test. At the end of the leach, the pulp was filtered and the residue was washed with three displacements of water. The wash water was discarded. The final products were submitted for the required assays.

Feed:	1000 g Sample D	Leach Duration:	24 h
Solution Volume:	1000 mL	Pre-conditioning:	6 h on rolls
Pulp Density:	50 % solids	Leach Aeration:	None
NaCN Concentration:	1.0 g/L NaCN maintained	Pb(NO₃)₂ Concentration:	0.0 kg/t
pH Range:	11-11.5 maintained with lime as required	Carbon Concentration:	20.0 g/L
Grind:	1 kg 23 min/kg 2 kg mill #2	Final Residue Size (P₈₀) =	63 µm

Reagent Addition (kg/t of cyanide feed)

NaCN: 1.11 CaO: 0.70

Reagent Consumption (kg/t of cyanide feed)**NaCN: 0.28 CaO: 0.66**

Time hours	Added, Grams				Residual		Consumed		pH	DO mg/L
	Actual		Equivalent		Grams		Grams			
	NaCN	Ca(OH) ₂	NaCN	CaO	NaCN	CaO	NaCN	CaO		
Pre-conditioning									8.6	0.1
0-2		0.43		0.33					11.5-10.9	0.4
2-4		0.12		0.09					11.4-11.0	2.3
4-6		0.10		0.08					11.4-11.0	2.6
Cyanidation:										
0-2	1.02	0.10	1.00	0.07	0.89		0.11		11.4-11.2	6.8
2-20	0.11	0.10	0.11	0.07	0.82		0.18		11.5-11.2	6.8
20-24	0.00	0.06	0.00	0.05	0.83	0.04	-0.01	0.66	11.4-11.3	6.2

Total	1.13	0.91	1.11	0.69	0.83	0.04	0.28	0.66		
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Cyanidation Results:

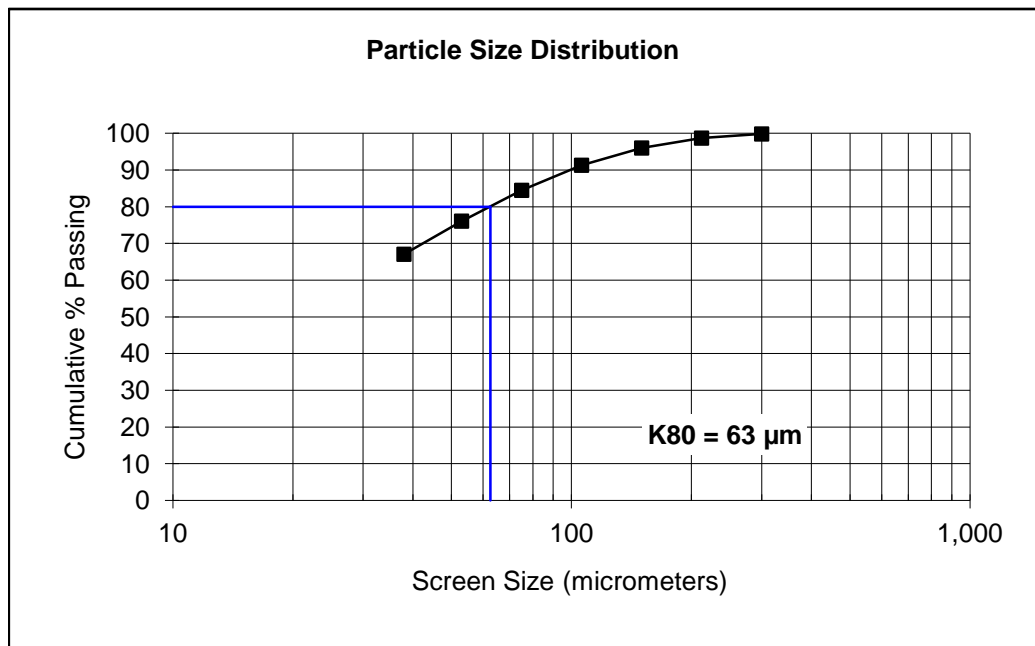
Product	Amount g, mL	Assays, mg/L, g/t	% Distribution	% Extraction
		Au	Au	Au
Carbon	20.56	44.6	90.6	91.6
Barren Solution	1,040	<0.01	1.0	
Final Residue	997	0.09	8.4	
Head (calc.)	997	1.02	100.0	
Head (dir.)				

Duplicate residue assays, Au, g/t = 0.09 g/t
0.08 g/t
Average 0.09 g/t

Sample: **CN 4 Residue**

Test No.:

Mesh	Size	Weight grams	% Retained		% Passing Cumulative
	µm		Individual	Cumulative	
48	300	0.3	0.2	0.2	99.8
65	212	1.8	1.1	1.3	98.7
100	150	4.3	2.7	4.0	96.0
150	106	7.5	4.7	8.7	91.3
200	75	10.9	6.8	15.5	84.5
270	53	13.4	8.4	23.9	76.1
400	38	14.4	9.0	33.0	67.0
Pan	-38	107.0	67.0	100.0	0.0
Total	-	159.6	100.0	-	-
K80	63				



Test: CN-5

Project: I4373-001

Operator: LG

Date: December 3, 2013²⁴

Purpose: To investigate the effect of a finer grind on the recovery of gold from Sample B.

Procedure: The test feed was ground as per the desired conditions below. The slurry was then transferred to a bottle and pulped with water to the proper percent solids. The pH of the pulp was adjusted with lime. The pulp was conditioned as described below. The sodium cyanide, then carbon were added and the pulp was placed on the rolls. The NaCN concentration, and the pH were maintained for the duration of the test. The dissolved oxygen was monitored at various intervals during the test. At the end of the leach, the pulp was filtered and the residue was washed with three displacements of water. The wash water was discarded. The final products were submitted for the required assays.

Feed:	1000 g Sample B	Leach Duration:	24 h
Solution Volume:	1000 mL	Pre-conditioning:	6 h on rolls
Pulp Density:	50 % solids	Leach Aeration:	None
NaCN Concentration:	1.0 g/L NaCN maintained	Pb(NO₃)₂ Concentration:	0.0 kg/t
pH Range:	11-11.5 maintained with lime as required	Carbon Concentration:	20.0 g/L
Grind:	1 kg 27.5 min/kg 2 kg mill #2	Final Residue Size (P₈₀) =	46 µm

Reagent Addition (kg/t of cyanide feed)	NaCN: 1.15	CaO: 0.57
Reagent Consumption (kg/t of cyanide feed)	NaCN: 0.31	CaO: 0.54

Time hours	Added, Grams				Residual		Consumed		pH	DO mg/L
	Actual		Equivalent		Grams		Grams			
	NaCN	Ca(OH) ₂	NaCN	CaO	NaCN	CaO	NaCN	CaO		
Pre-conditioning									8.5	1.9
0-2		0.35		0.26					11.0-10.2	0.9
2-4		0.21		0.16					11.1-10.7	3.0
4-6		0.05		0.04					11.0-10.8	3.6
Cyanidation:										
0-2	1.02	0.03	1.00	0.02	0.85		0.15		11.0-10.7	5.5
2-20	0.15	0.05	0.15	0.03	0.66		0.34		11.0-10.6	7.3
20-24	0.00	0.07	0.00	0.06	0.84	0.03	-0.18	0.54	11.0-10.8	7.1

Total	1.17	0.75	1.15	0.57	0.84	0.03	0.31	0.54		
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Cyanidation Results:

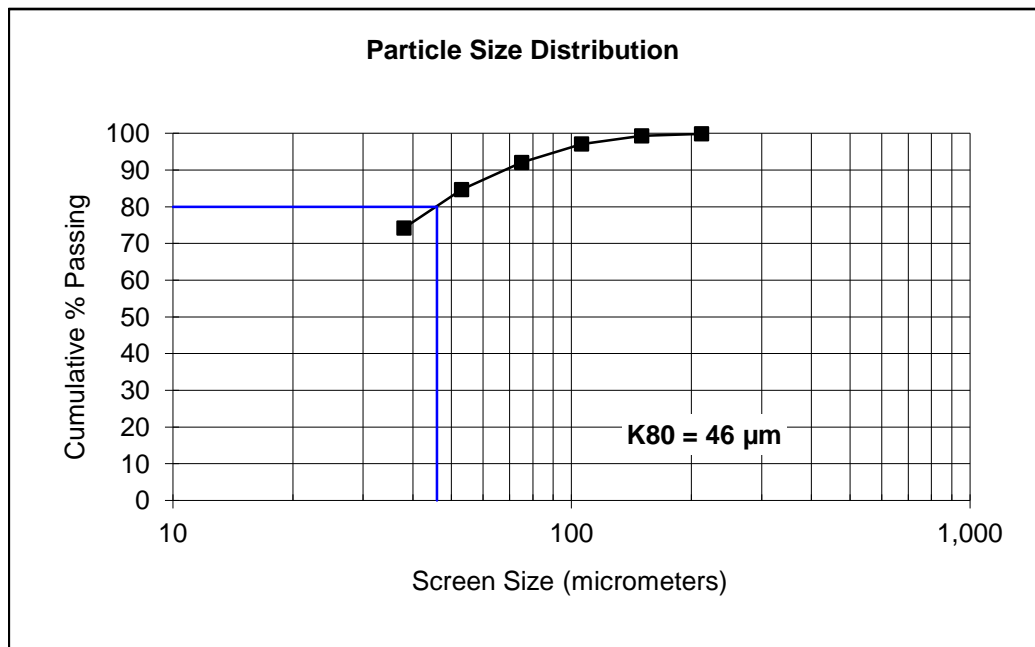
Product	Amount g, mL	Assays, mg/L, g/t	% Distribution	% Extraction
		Au	Au	Au
Carbon	20.03	46.0	90.2	91.2
Barren Solution	1,046	0.01	1.0	
Final Residue	997	0.09	8.8	
Head (calc.)	997	1.02	100.0	
Head (dir.)				

Duplicate residue assays, Au, g/t =	0.13 g/t	Re-assays:	0.08 g/t
	0.08 g/t		0.08 g/t
Average	0.11 g/t		0.08 g/t

Sample: **Residue**

Test No.: **CN 5**

Mesh	Size	Weight grams	% Retained		% Passing Cumulative
	µm		Individual	Cumulative	
65	212	0.2	0.1	0.1	99.9
100	150	0.9	0.6	0.7	99.3
150	106	3.5	2.2	2.9	97.1
200	75	8.0	5.0	7.9	92.1
270	53	11.7	7.4	15.3	84.7
400	38	16.6	10.5	25.8	74.2
Pan	-38	117.6	74.2	100.0	0.0
Total	-	158.5	100.0	-	-
K80	46				



SGS Canada Inc.

 P.O. Box 4300 - 185 Concession St.
 Lakefield - Ontario - KOL 2H0
 Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-14373-001

23-January-2014

Environmental Met

Attn : Barb Bowman

Date Rec. : 23 December 2013

LR Report: CA14540-DEC13

Reference: 14373-001-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: Comb CN Tailings Solids
Sample Date & Time					NA
Sample weight [g]	20-Jan-14	09:25	21-Jan-14	09:40	235
Volume D.I. Water [mL]	20-Jan-14	09:25	21-Jan-14	09:40	705
Initial pH	20-Jan-14	09:25	21-Jan-14	09:40	9.1
Final pH	21-Jan-14	09:25	21-Jan-14	09:40	8.44
pH [no unit]	21-Jan-14	12:57	22-Jan-14	14:09	8.38
Acidity [mg/L as CaCO ₃]	21-Jan-14	12:57	22-Jan-14	14:09	< 2
Alkalinity [mg/L as CaCO ₃]	21-Jan-14	12:57	22-Jan-14	14:09	49
Conductivity [µS/cm]	21-Jan-14	12:57	22-Jan-14	14:09	322
Fluoride [mg/L]	21-Jan-14	17:34	22-Jan-14	09:35	0.07
Chloride [mg/L]	22-Jan-14	13:57	23-Jan-14	12:05	2.3
Sulphate [mg/L]	22-Jan-14	13:57	23-Jan-14	12:05	110
Nitrite (as N) [mg/L]	22-Jan-14	16:50	23-Jan-14	10:10	< 0.3
Nitrate (as N) [mg/L]	22-Jan-14	16:50	23-Jan-14	10:10	< 0.6
Mercury [mg/L]	22-Jan-14	13:05	22-Jan-14	14:35	< 0.00001
Silver [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.00001
Aluminum [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0448
Arsenic [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0002
Barium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0138
Boron [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0078
Beryllium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.00002
Bismuth [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.00001
Calcium [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	53.2
Cadmium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.000003
Cobalt [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.000449
Chromium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.0005
Copper [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0013
Iron [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	0.018
Potassium [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	4.09

SGS Canada Inc.

 P.O. Box 4300 - 185 Concession St.
 Lakefield - Ontario - KOL 2H0
 Phone: 705-652-2000 FAX: 705-652-6365

Project : CALR-14373-001

LR Report : CA14540-DEC13

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: Comb CN Tailings Solids
Lithium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.001
Magnesium [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	4.65
Manganese [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0520
Molybdenum [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.00303
Sodium [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	4.67
Nickel [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0013
Phosphorus [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	0.016
Lead [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.00002
Antimony [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0004
Selenium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.001
Silicon [mg/L]	22-Jan-14	12:30	23-Jan-14	08:45	1.29
Tin [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.00002
Strontium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.116
Thorium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.000004
Titanium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.0001
Thallium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.00002
Uranium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.000060
Vanadium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.00010
Tungsten [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.00020
Yttrium [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	< 0.000001
Zinc [mg/L]	22-Jan-14	12:51	23-Jan-14	11:52	0.002

Patti Stark
 Project Specialist Environmental Services,
 Analytical

SGS Canada Inc.

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10-January-2014

Environmental Met

Attn : Barb Bowman

Date Rec. : 23 December 2013

LR Report: CA14541-DEC13

Reference: 14373-001-01

Copy: #1

CERTIFICATE OF ANALYSIS

Final Report

Analysis	1: Analysis Start Date	2: Analysis Start Time	3: Analysis Approval Date	4: Analysis Approval Time	5: Comb CN Tailings Solids
Sample Date & Time					NA
Paste pH	07-Jan-14	09:50	09-Jan-14	16:26	8.40
Fizz Rate [---]	07-Jan-14	09:50	09-Jan-14	16:26	3
Sample weight [g]	07-Jan-14	09:50	09-Jan-14	16:26	2.02
HCl added [mL]	07-Jan-14	09:50	09-Jan-14	16:26	29.70
HCl [Normality]	07-Jan-14	09:50	09-Jan-14	16:26	0.10
NaOH [Normality]	07-Jan-14	09:50	09-Jan-14	16:26	0.10
NaOH to [pH=8.3 mL]	07-Jan-14	09:50	09-Jan-14	16:26	10.24
Final pH	07-Jan-14	09:50	09-Jan-14	16:26	1.54
NP [t CaCO3/1000 t]	07-Jan-14	09:50	09-Jan-14	16:26	48
AP [t CaCO3/1000 t]	---	---	---	---	55.3
Net NP [t CaCO3/1000 t]	---	---	---	---	-7.11
NP/AP [ratio]	---	---	---	---	0.87
Sulphur (total) [%]	06-Jan-14	13:05	07-Jan-14	09:56	1.94
Acid Leachable SO4-S [%]	---	---	---	---	0.18
Sulphide [%]	07-Jan-14	09:51	07-Jan-14	09:56	1.77
Carbon (total) [%]	06-Jan-14	13:05	06-Jan-14	15:13	0.658
Carbonate [%]	06-Jan-14	13:09	06-Jan-14	15:11	2.38

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$$\begin{aligned} & *NP \text{ (Neutralization Potential)} \\ & = 50 \times (N \text{ of HCL} \times \text{Total HCL added} - N \text{ NaOH} \times \text{NaOH added}) \\ & \text{-----} \\ & \text{Weight of Sample} \end{aligned}$$

*AP (Acid Potential) = % Sulphide Sulphur x 31.25

*Net NP (Net Neutralization Potential) = NP-AP

NP/AP Ratio = NP/AP

*Results expressed as tonnes CaCO₃ equivalent/1000 tonnes of material
Samples with a % Sulphide value of <0.01 will be calculated using a 0.01 value.

Sulphur analysis performed following BC ARD Guidelines (Price 1997)

Patti Stark
*Project Specialist Environmental Services,
Analytical*



SOLUTIONS
FOR A WORKING WORLD

CERTIFICATE OF ANALYSIS

Company:	SGS Lakefield Research Ltd.	Report Date:	25-Nov-13
Contact:	Ms. Stephanie Downing	Analysis Date:	20-Nov-13
Client Address:	185 Concession Street, PO Box 4300, LAKEFIELD, ON	Received Date:	20-Nov-13
Client Reference:	MI5024-NOV13	LEX Project Number:	08131354
Sampling Date:	19-Nov-13	Number of Analyses:	1

Analysis Requested **Bulk Asbestos by PLM**

Page 1 of 1

Analysis was performed in accordance with the method EPA/600/R-93/116, Method for the Determination of Asbestos in Bulk Building Materials adopted in Designated Substance - Asbestos on Construction Projects and in Buildings and Repair Operations - made under the Occupational Health and Safety Act Ontario Regulation 278/05. LEX Scientific Inc. is accredited by the National Voluntary Laboratory Accreditation Program (NVLAP 101949) by the National Institute of Standards and Technology for analysis of bulk materials for asbestos.

German Leal, B.Sc.
Laboratory Manager

	Fibrous Asbestos Content %	Other Materials Content %
Client Sample: MI5024-NOV13	Asbestos Detected? No	
LEX Sample: 01	Chrysotile: None Detected	Cellulose: 1
Layers Analyzed: Sample Homogenized	Amosite: None Detected	MMVF: None Detected
Colour: Green/Grey	Crocidolite: None Detected	Other Fibres: None Detected
Description: Comp ABCD	Other Amphiboles: None Detected	Non Fibrous: 99
	Comments: N/A	

Other Amphiboles: ac=actinolite, a=anthophyllite, t-tremolite, u=unidentified
MMVF: Man Made Vitreous Fibres: Fibreglass, Min. Wool, Rockwool, Glasswool
PLM - method detection limit is 0.1%

Analyst

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