

Date:	17 th October 2011
To:	Shree Minerals
From:	Jerome Conway-Mortimer
Re:	Kinetic NAG test results and interpretation

Introduction

Shree Minerals requested SGS Lakefield Oretest Pty Ltd to undertake three Kinetic Net Acid Generation (KNAG) tests on samples that had also been tested via modified acid base accounting (MABA) and single addition Net Acid Generation (SANAG) tests. The purpose of the KNAG testing was to provide an indication of the potential time to the onset of acid generation. This relatively quick static derived test has, in some documented cases, been shown to provide reasonable proxy estimates for actual kinetic tests such as the longer duration free draining column leach test and humidity cell testwork. However, full kinetic tests are often recommended to allow verification of these proxy results.

Results

Static testwork (MABA & SANAG)

Results for static testwork on nine waste rock samples were as follows:

Table 1. Modified Acid Base Accounting, Single Addition NAG and TCLP Test Results

Test	Units	SN: 45398 45410 45524 45692 45694 45764 45769 45760 45949									
		DL	Result	Result	Result	Result	Result	Result	Result	Result	Result
Moisture Content	%	0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5	<0.5
pH in soil (1:5) - (pH)	pH Units	0	7.3	6.7	5.4	6.6	7.0	7.2	6.7	7.7	5.9
Conductivity and TDS by Calculation - Soil - (Conductivity)	µS/cm	1	110	210	210	360	210	160	170	110	230
pH in soil (1:2) - (pH (1:2) aged)	pH Units	0.1	6.8	6.2	5.3	6.6	6.8	6.7	6.3	7.0	5.7
Conductivity (1:2) in soil - (Conductivity (1:2) aged @ 25C)	µS/cm	1	230	490	500	830	490	390	410	270	490
TCLP for Metals - (pH 1:20)	pH Units	0	7.2	6.6	5.6	6.6	7.1	7.1	6.7	7.7	6.0
TCLP for Metals - (pH 1:20 plus HCL)	pH Units	0	1.4	1.5	1.4	1.4	1.6	1.6	1.5	1.5	1.5
TCLP for Metals - (pH TCLP after 18 hours)	pH Units	0	4.9	4.9	4.9	5.0	4.9	4.9	5.0	4.9	4.9
Metals in Soil (TCLP) by ICPOES - (Arsenic, As)	mg/L	0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Metals in Soil (TCLP) by ICPOES - (Cadmium, Cd)	mg/L	0.001	<0.001	0.001	0.001	<0.001	<0.001	<0.001	<0.001	<0.001	0.001
Metals in Soil (TCLP) by ICPOES - (Copper, Cu)	mg/L	0.005	0.014	0.014	2.3	<0.005	0.008	<0.005	0.092	0.007	0.25
Metals in Soil (TCLP) by ICPOES - (Chromium, Cr)	mg/L	0.005	0.13	0.051	0.022	0.14	0.036	0.013	0.025	0.018	0.054
Metals in Soil (TCLP) by ICPOES - (Nickel, Ni)	mg/L	0.005	0.032	0.14	0.071	0.051	0.028	0.030	0.051	0.024	0.16
Metals in Soil (TCLP) by ICPOES - (Lead, Pb)	mg/L	0.005	<0.005	<0.005	0.007	0.015	0.005	0.010	0.23	0.016	0.11
Metals in Soil (TCLP) by ICPOES - (Zinc, Zn)	mg/L	0.01	0.11	0.45	0.22	0.21	0.20	0.21	0.20	0.22	0.88
Mercury in Soil by TCLP Extract - (Mercury)	mg/L	0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005	<0.0005
Total Carbon/Sulphur in soil by LECO - (Sulphur)	%	0.005	0.044	0.275	0.116	1.98	0.331	0.266	0.402	0.16	1.03
Total Carbon/Sulphur in soil by LECO - (Maximum Potential Acidity)	kg H ₂ SO ₄ /t	0.1	1.3	8.4	3.6	61	10	8.1	12	4.9	32
HCl Extractable S, Ca and Mg in Soil ICP OES - (Acid Soluble Sulphur (SHCI))	%w/w	0.005	0.007	0.010	0.017	0.028	0.011	0.007	0.007	<0.005	0.015
MABA-ANC/NP - (Fizz Rating Reaction)	No unit	0	nil	nil	nil	nil	nil	nil	nil	nil	nil
MABA-ANC/NP - (Initial Effervescence)	No unit	0	no	no	no	no	no	no	no	no	no
MABA-ANC/NP - (Effervescence on Warming)	No unit	0	no	no	no	no	no	no	no	no	no
MABA-ANC/NP - (Titration - Green Colouration?)	No unit	0	no	no	no	yes	no	no	no	no	no
MABA-ANC/NP - (Titration - Precipitate Formed?)	No unit	0	yes	yes	yes	yes	yes	yes	yes	yes	yes
MABA-ANC/NP - (ANC as % CaCO ₃)	% CaCO ₃	0.1	<0.1	<0.1	<0.1	0.4	0.1	<0.1	<0.1	0.2	<0.1
MABA-ANC/NP - (ANC as % CaMg(CO ₃) ₂)	%w/w	0.1	<0.1	<0.1	<0.1	0.4	0.2	<0.1	<0.1	0.2	<0.1
MABA-ANC/NP - (Acid Neutralisation Capacity/Neutralisation Potential kg H ₂ SO ₄ /t)	kg H ₂ SO ₄ /t	1	<1	<1	<1	3.5	1.4	<1	<1	1.6	<1
MABA-ANC/NP - (ANC/NP kg H ₂ SO ₄ /t Siderite Corrected)	kg H ₂ SO ₄ /t	1	<1	<1	<1	3.5	1.4	<1	<1	1.6	<1
NAPP - (Total Oxidisable Sulphur)	kg H ₂ SO ₄ /t	0.25	1.1	8.1	3.0	60	9.8	7.9	12	4.8	31
NAPP - (Net Acid Production Potential)	kg H ₂ SO ₄ /t	-400	0	8	4	56	8	7	12	3	30
NAPP - (Total Oxidisable Sulphur)	%w/w	0.005	0.037	0.27	0.099	2.0	0.32	0.26	0.40	0.16	1.0
SANAG - (ECox (NAG Conductivity))	µS/cm	1	37	230	73	1900	220	240	380	130	820
SANAG - (pHox (NAG pH))	No unit	0	5.6	3.6	4.3	2.5	5.2	3.6	3.3	4.1	2.9
SANAG - (NAG as kg H ₂ SO ₄ /tonne to pH 4.5)	kg H ₂ SO ₄ /t	0.5	<0.5	2.2	<0.5	2.7	<0.5	2.0	3.7	<0.5	10
SANAG - (NAG as kg H ₂ SO ₄ /tonne to pH 7)	kg H ₂ SO ₄ /t	0.5	<0.5	6.2	2.1	36	1.8	5.9	8.7	12	18

Important results are plotted below and overleaf.

Figure 1. NAG pH vs NAPP for 9 Waste Rock Samples.

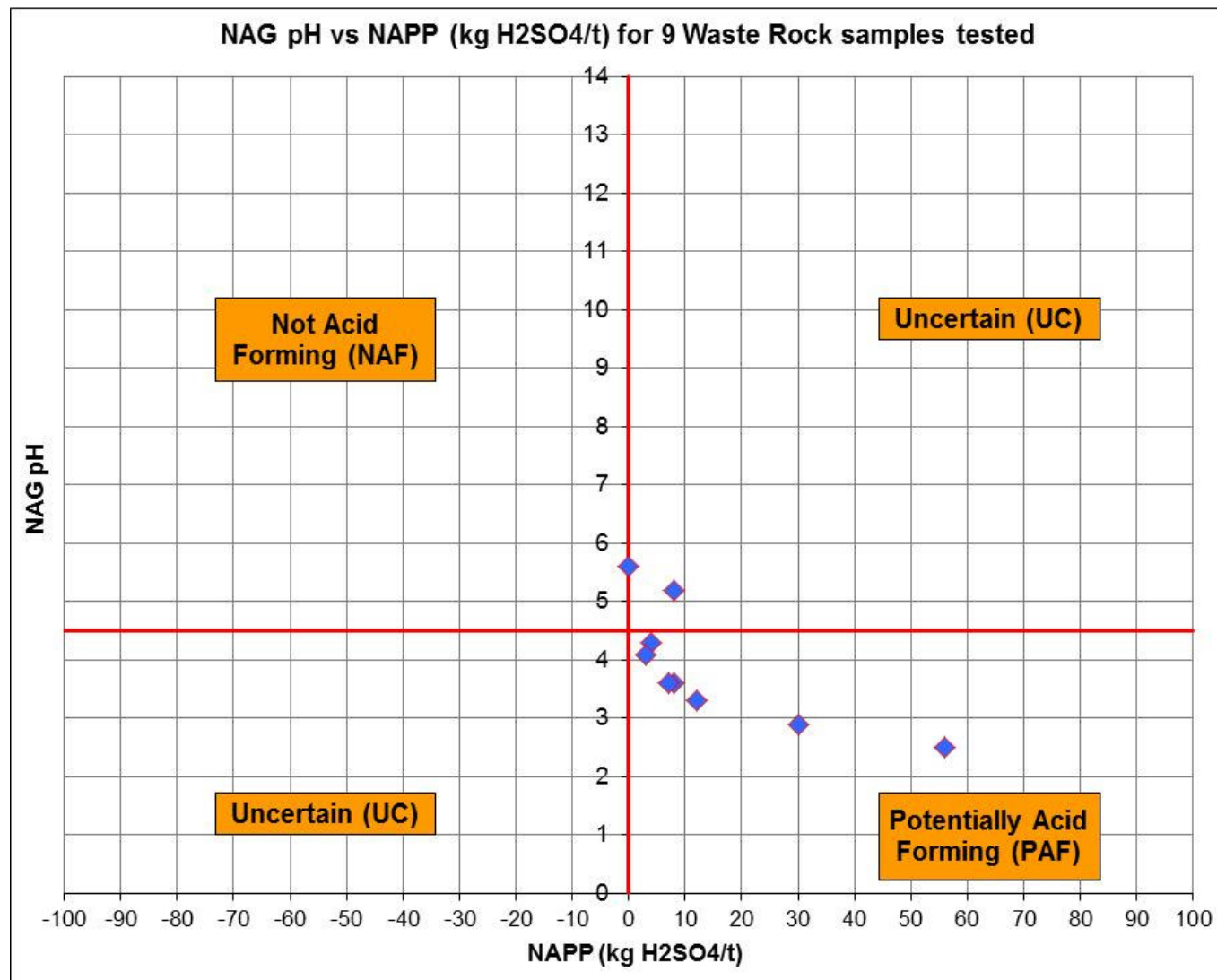
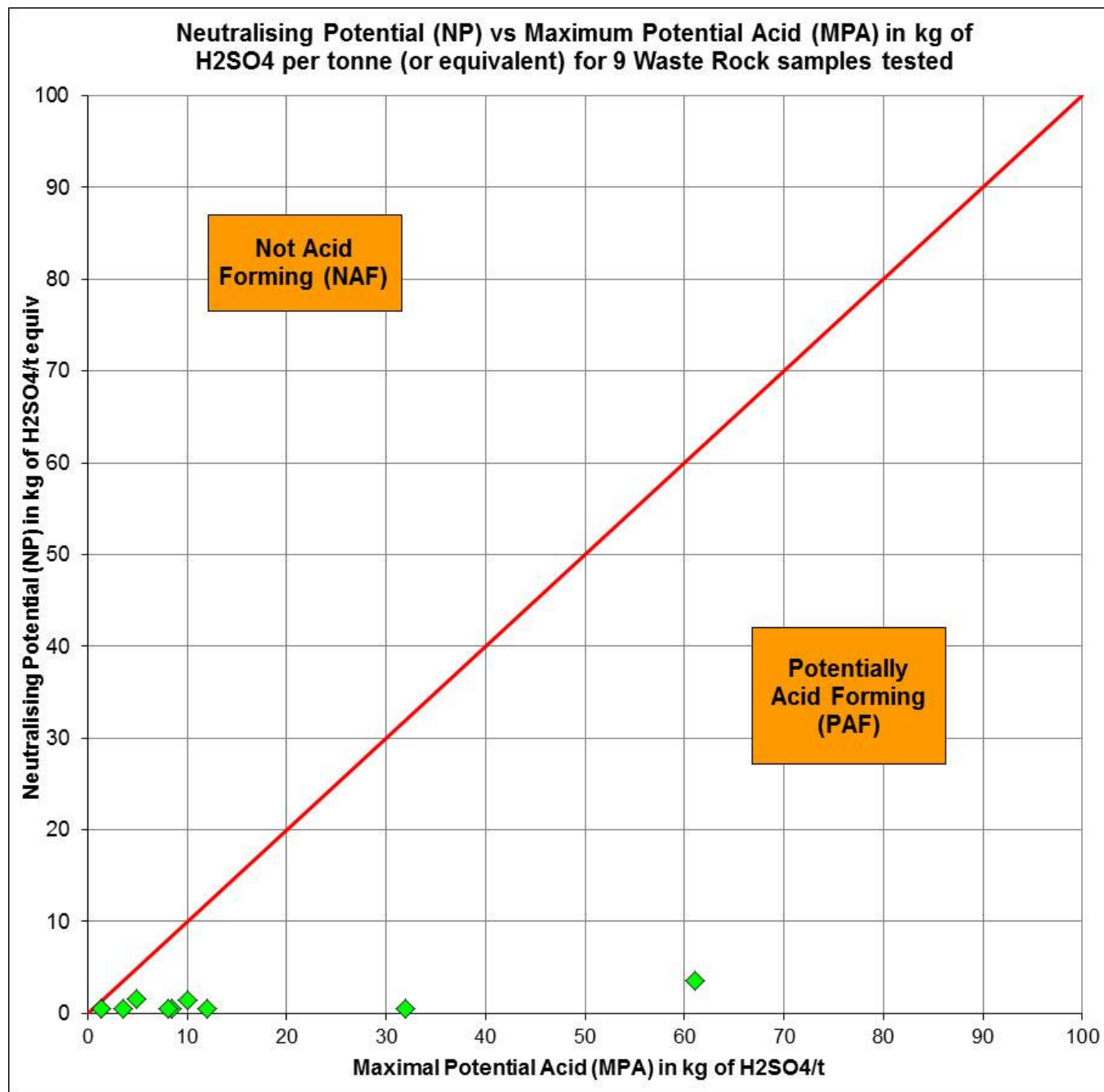


Figure 2. NP vs MPA for 9 DTR Tailings Samples.



These results are discussed later in this document.

Proxy Kinetic Testwork (KNAG)

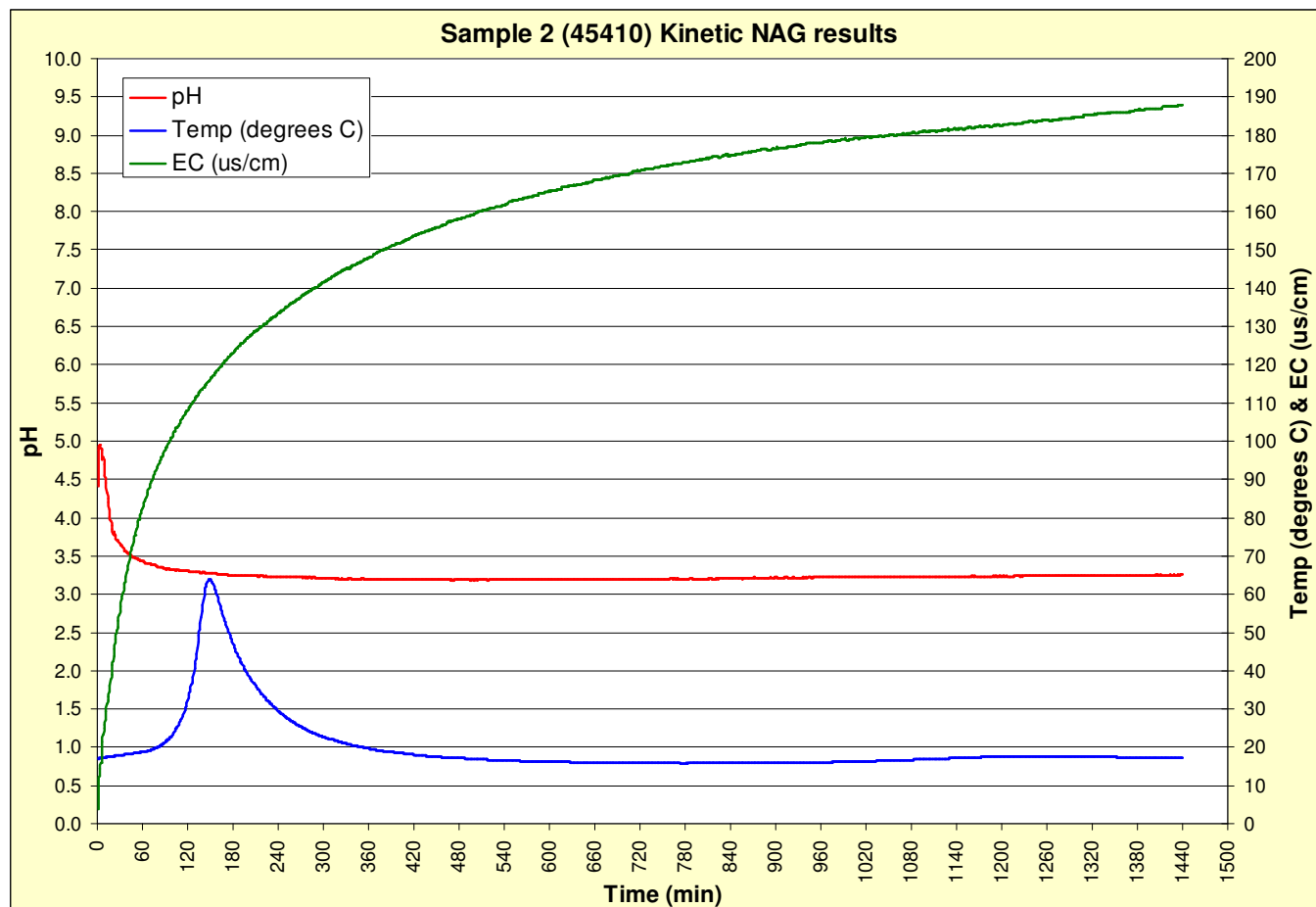
Results for the KNAG testing on three of the waste rock samples are presented overleaf.

Table 2. Kinetic NAG Results

Test No: 2 (45410)				Test No: 4 (45692)				Test No: 9 (45949)			
Time (min)	pH	Temp (C)	EC (us/cm)	Time (min)	pH	Temp (C)	EC (us/cm)	Time (min)	pH	Temp (C)	EC (us/cm)
1	4.41	16.9	3.9	1	3.98	16.9	4.4	1	3.65	16.8	5.8
2	4.89	17.0	11.4	2	4.81	17.0	22.5	2	3.73	16.8	5.0
3	4.96	17.1	12.4	3	4.96	17.1	26.2	3	4.18	16.8	16.4
4	4.96	17.1	14.5	4	4.95	17.1	28.7	4	4.16	16.8	15.6
5	4.90	17.2	16.0	5	4.91	17.2	30.9	5	4.06	16.8	21.0
6	4.89	17.2	16.0	6	4.82	17.2	33.1	6	4.02	16.9	23.8
7	4.76	17.2	21.3	7	4.76	17.2	35.2	7	3.92	16.9	28.2
8	4.79	17.3	23.3	8	4.70	17.3	36.8	8	3.85	16.9	33.8
9	4.70	17.3	25.0	9	4.64	17.3	39.2	9	3.78	17.0	35.7
10	4.56	17.4	25.9	10	4.56	17.4	41.7	10	3.72	17.0	37.2
11	4.52	17.4	27.1	11	4.48	17.4	44.3	11	3.69	17.1	41.2
12	4.46	17.4	29.3	12	4.41	17.4	46.0	12	3.63	17.1	44.6
13	4.33	17.5	31.3	13	4.32	17.5	49.1	13	3.60	17.2	46.6
14	4.25	17.5	32.2	14	4.23	17.5	52.6	14	3.58	17.3	49.3
15	4.20	17.5	33.3	15	4.16	17.5	55.5	15	3.54	17.3	53.1
16	4.11	17.6	34.4	16	4.07	17.6	58.5	16	3.52	17.4	56.0
17	4.01	17.6	36.0	17	4.00	17.6	61.7	17	3.49	17.4	58.9
18	3.96	17.6	37.7	18	3.93	17.6	65.2	18	3.47	17.5	61.3
19	3.90	17.6	39.1	19	3.85	17.6	70.4	19	3.45	17.6	64.1
20	3.85	17.7	41.4	20	3.75	17.7	72.2	20	3.43	17.6	67.0
21	3.79	17.7	42.6	21	3.71	17.7	72.2	21	3.41	17.7	69.8
22	3.77	17.7	43.9	22	3.65	17.7	80.4	22	3.39	17.8	72.0
23	3.81	17.7	45.8	23	3.58	17.7	82.4	23	3.37	17.9	74.9
24	3.77	17.8	47.4	24	3.55	17.8	88.1	24	3.36	17.9	77.9
25	3.73	17.8	48.4	25	3.51	17.8	90.6	25	3.34	18.0	80.2
26	3.70	17.8	50.4	26	3.46	17.8	95.6	26	3.32	18.1	83.2
27	3.70	17.8	51.5	27	3.42	17.8	102.2	27	3.31	18.2	85.5
28	3.69	17.9	53.1	28	3.39	17.9	106.3	28	3.30	18.3	88.4
29	3.68	17.9	54.5	29	3.35	17.9	109.8	29	3.28	18.4	90.9
30	3.66	17.9	55.6	30	3.32	17.9	113.9	30	3.27	18.4	93.8
31	3.65	17.9	57.0	31	3.29	17.9	120.7	31	3.25	18.5	96.5
32	3.64	18.0	58.9	32	3.27	18.0	126.3	32	3.24	18.6	99.0
33	3.62	18.0	59.3	33	3.24	18.0	132.2	33	3.23	18.7	101.8
34	3.61	18.0	60.3	34	3.21	18.0	136.1	34	3.22	18.8	104.2
35	3.59	18.0	61.7	35	3.18	18.0	141.6	35	3.21	18.9	107.3
36	3.57	18.1	62.5	36	3.16	18.1	146.7	36	3.20	19.0	109.5
37	3.57	18.1	63.2	37	3.14	18.1	152.2	37	3.18	19.1	112.1
38	3.56	18.1	64.4	38	3.11	18.1	158.7	38	3.17	19.3	114.5
39	3.55	18.1	65.4	39	3.09	18.1	162.8	39	3.16	19.4	117.0
40	3.54	18.2	66.5	40	3.07	18.2	169.6	40	3.15	19.5	119.7
41	3.53	18.2	67.4	41	3.04	18.2	177.4	41	3.14	19.6	122.6
42	3.53	18.2	68.4	42	3.03	18.2	182.1	42	3.13	19.7	125.1
43	3.52	18.2	69.4	43	3.01	18.2	189.8	43	3.12	19.8	128.0
44	3.51	18.3	70.2	44	2.99	18.3	195.7	44	3.11	20.0	130.2
45	3.50	18.3	71.6	45	2.97	18.3	201.6	45	3.10	20.1	132.9
46	3.50	18.3	72.0	46	2.95	18.3	210.1	46	3.09	20.2	135.8
47	3.49	18.3	72.8	47	2.93	18.3	216.9	47	3.09	20.4	138.2
48	3.48	18.4	73.8	48	2.92	18.4	227.4	48	3.07	20.5	140.8
49	3.48	18.4	74.4	49	2.90	18.4	232.1	49	3.07	20.6	143.6
50	3.48	18.4	75.5	50	2.88	18.4	235.3	50	3.06	20.8	146.1
51	3.47	18.4	75.5	51	2.86	18.4	246.3	51	3.05	20.9	148.9
52	3.47	18.5	77.1	52	2.85	18.5	247.3	52	3.04	21.1	151.5
53	3.46	18.5	77.9	53	2.83	18.5	257.5	53	3.03	21.2	154.8
54	3.45	18.5	78.9	54	2.81	18.5	262.7	54	3.02	21.4	157.0
55	3.45	18.6	79.4	55	2.80	18.6	271.0	55	3.02	21.6	160.3
56	3.44	18.6	79.7	56	2.78	18.6	282.9	56	3.01	21.7	163.4
57	3.44	18.6	80.5	57	2.76	18.6	289.3	57	3.00	21.9	166.3
58	3.44	18.7	81.1	58	2.75	18.7	297.4	58	2.99	22.1	168.7
59	3.44	18.7	81.8	59	2.73	18.7	306.0	59	2.99	22.3	172.4
60	3.44	18.8	82.5	60	2.72	18.8	315.0	60	2.98	22.5	174.3
70	3.40	19.3	88.4	70	2.59	19.3	408.0	70	2.91	24.7	205.0
80	3.36	20.0	93.4	80	2.47	20.0	522.0	80	2.85	27.7	240.1
90	3.34	21.3	97.8	90	2.38	21.3	643.0	90	2.79	32.2	285.6
100	3.32	23.3	101.6	100	2.31	23.3	769.0	100	2.72	40.5	353.0
110	3.31	26.7	104.9	110	2.26	26.7	884.0	110	2.70	61.6	491.0
120	3.30	32.2	107.9	120	2.23	32.2	1000.0	120	2.79	70.4	602.0
130	3.29	41.8	111.1	130	2.23	41.8	1130.0	130	2.77	60.4	654.0
140	3.29	57.1	113.7	140	2.30	57.1	1271.0	140	2.72	52.2	690.0
150	3.28	63.9	116.2	150	2.38	63.9	1356.0	150	2.69	46.0	717.0
160	3.26	59.0	118.6	160	2.41	59.0	1436.0	160	2.69	41.3	721.0
170	3.26	52.6	121.1	170	2.40	52.6	1513.0	170	2.66	37.5	748.0
180	3.25	47.1	123.1	180	2.37	47.1	1580.0	180	2.65	34.5	743.0
190	3.25	42.6	125.2	190	2.35	42.6	1635.0	190	2.64	31.9	744.0
200	3.24	39.0	127.0	200	2.32	39.0	1678.0	200	2.63	29.8	753.0
250	3.22	27.9	134.9	250	2.25	27.9	1809.0	250	2.64	23.3	773.0
300	3.21	22.7	141.5	300	2.24	22.7	1868.0	300	2.66	20.0	812.0
400	3.19	18.5	151.7	400	2.26	18.5	1895.0	400	2.68	17.3	823.0
500	3.18	16.9	159.3	500	2.28	16.9	1899.0	500	2.70	16.4	826.0
600	3.19	16.3	165.4	600	2.30	16.3	1887.0	600	2.71	16.1	827.0
700	3.20	15.9	169.7	700	2.31	15.9	1871.0	700	2.71	16.0	821.0
800	3.20	15.9	173.7	800	2.33	15.9	1842.0	800	2.72	16.1	838.0
900	3.22	15.9	176.4	900	2.34	15.9	1820.0	900	2.73	16.2	834.0
1000	3.22	16.3	179.0	1000	2.35	16.3	1788.0	1000	2.75	16.7	820.0
1100	3.23	16.8	180.7	1100	2.36	16.8	1764.0	1100	2.76	17.5	796.0
1200	3.23	17.5	182.5	1200	2.37	17.5	1734.0	1200	2.76	17.9	796.0
1300	3.24	17.7	184.7	1300	2.37	17.7	1720.0	1300	2.76	17.3	788.0
1400	3.25	17.4	186.9	1400	2.38	17.4	1712.0	1400	2.76	16.9	791.0
1440	3.26	17.4	187.8	1440	2.38	17.4	1709.0	1440	2.76	16.8	787.0

Important results are plotted below.

Figure 3. Sample 2 (45410) KNAG results.



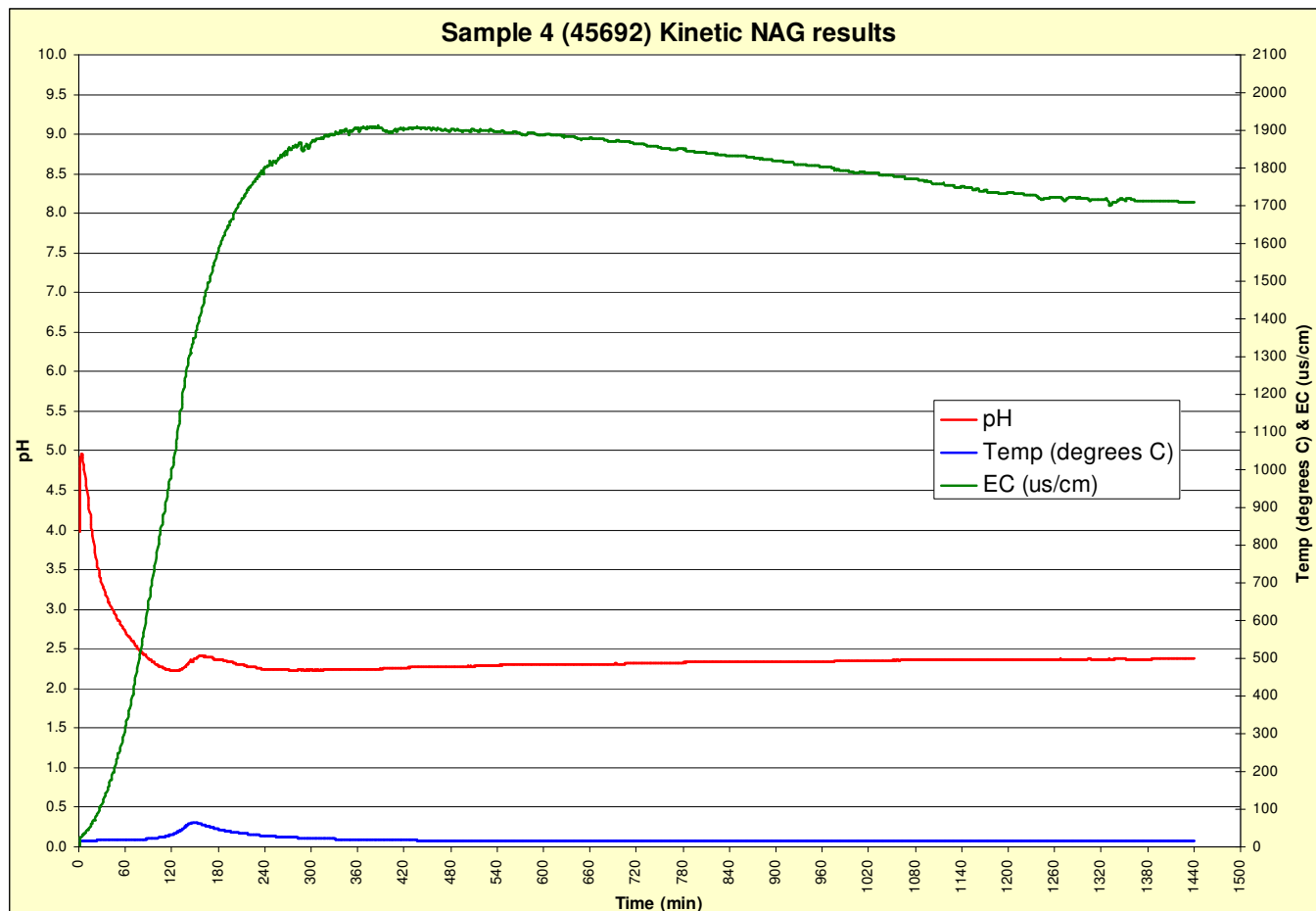
KNAG Time to pH 4 = 17 minutes

Predicted Lag Time to pH 4 in a column test = 8 to 16 weeks (9 weeks calculated)

Final KNAG pH = 3.26

Indicated Sample Type: Potentially Acid Forming (PAF)

Figure 4. Sample 4 (45692) KNAG results.



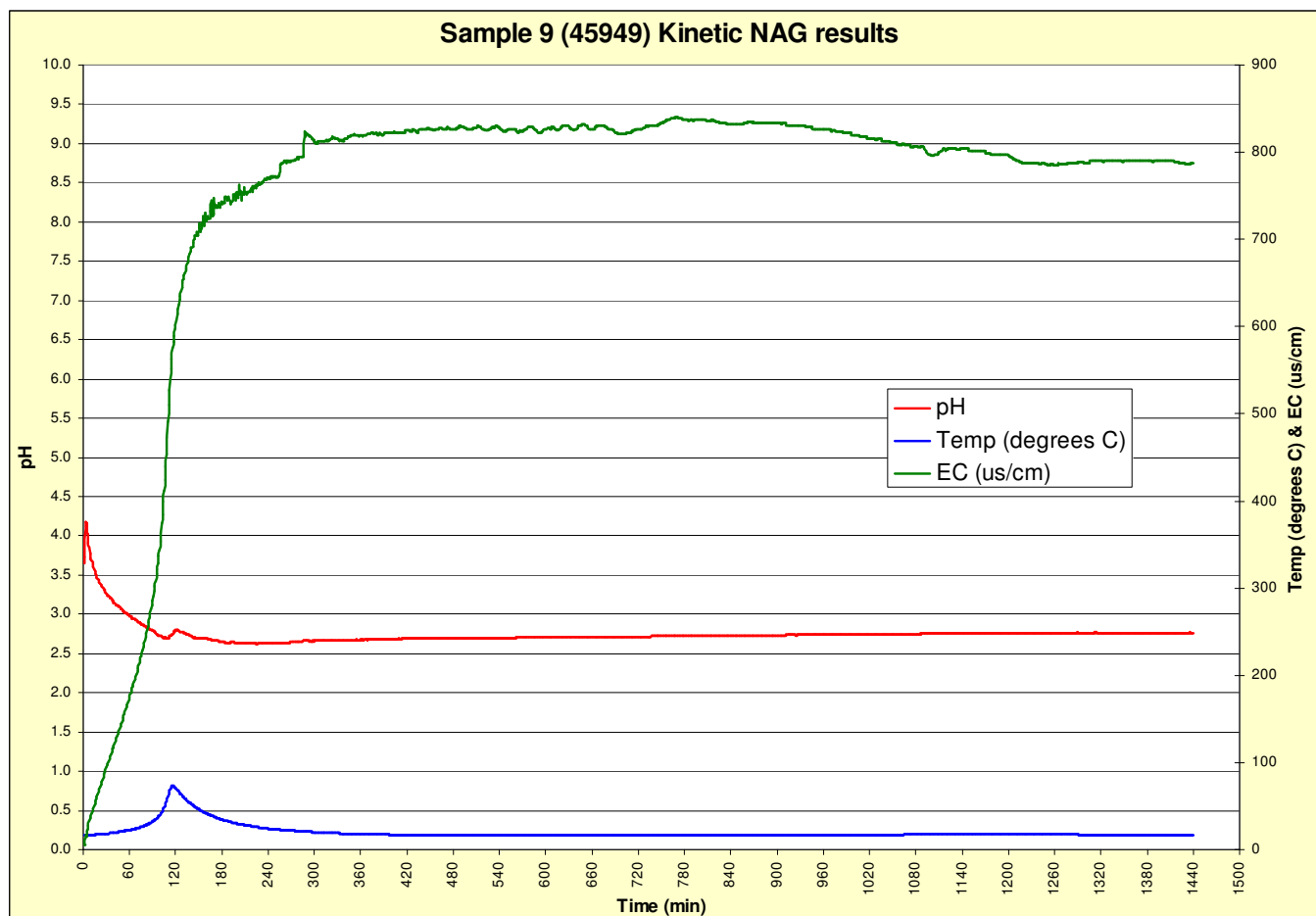
KNAG Time to pH 4 = 17 minutes

Predicted Lag Time to pH 4 in a column test = 8 to 16 weeks (9 weeks calculated)

Final KNAG pH = 2.38

Indicated Sample Type: Potentially Acid Forming (PAF)

Figure 5. Sample 9 (45949) KNAG results.



KNAG Time to pH 4 = 6 minutes
Predicted Lag Time to pH 4 in a column test = 4 to 8 weeks (3 weeks calculated)
Final KNAG pH = 2.76
Indicated Sample Type: Potentially Acid Forming (PAF)

These results are discussed in the following section of this document.

Interpretation and Discussion

The results have been assessed and the following conclusions are evident:

- All nine samples tested by SGS indicated significant potential to generate acid drainage.
- Acid base accounting test results indicate all samples are potentially acid forming (PAF), with high Maximum Potential Acid (MPA) values and very low Neutralising Potential (NP).
- This conclusion was confirmed by the results of the single addition NAG testing, with 7 of the 9 samples confirmed as PAF, while two were classified as borderline Uncertain (UC) (samples 45398 & 45694).

- Kinetic Net Acid Generation (KNAG) results indicate rapid onset of acid production from the 3 tested samples. The final pH of all three tests confirm the PAF status of these samples.
- Calculations have been performed to estimate the likely lag time to the onset of acid conditions in a column leach or humidity cell:
 - Sample 2; 8 to 16 weeks
 - Sample 4; 8 to 16 weeks
 - Sample 9; 4 to 8 weeks
- These broad ranges are provided as a guideline, as a number of factors can affect the predictions, namely:
 - Presence of non-pyrite sulphur species.
 - Pyrite liberation differences due to particle sizing.
 - Pyrite armouring inhibiting oxidation.
 - Presence of organic matter in the samples.
 - Low reactivity neutralising phases.
 - Liberation of neutralising minerals.
- The steady pH following peroxide decomposition observed in all three tests indicates there is no significant slow reacting neutralising potential in these waste rock samples.
- There may have been incomplete oxidation of the sulphide sulphur in Samples 4 and 9 during the KNAG testing, due to their S_{total} grades of over 1%. The estimates of acid generating potential for these samples may be conservative.
- Electrical conductivity of sample 4 is relatively high. Salinity drainage may be an issue.

SGS is not aware of how representative the tested samples are of the likely waste rock to be removed from this resource. The results and conclusions presented in this document are based solely on the tested samples and SGS does not warrant their representivity or suitability for this testing. Interpretation is limited to assessment of the tested samples only and does not generally extend to other materials in the resource.

Full kinetic testing (free draining column leach or humidity cell tests) is recommended to provide additional confidence in the results and conclusions of this preliminary assessment.