

ANNEX VIII: APPENDIX H

SULPHIDE AND NEUTRALIZATION POTENTIAL DEPLETION CALCULATIONS



Tables

Table H-1	Sulphide and Neutralization Potential Depletion Calculations.....	1
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Abbreviations

Abbreviation	Definition
AP	acid potential
Ca	calcium
CaCO ₃	calcium carbonate
HCT	humidity cell test
ID	identification
NP	neutralization potential
NP/AP	neutralization potential/acid potential
S	sulphur
SO ₄	sulphate

Units of Measure

Unit	Definition
%	percent
kg/t	kilograms per tonne
mg/kg	milligrams per kilogram
wt%	weight percentage

Table H-1 Sulphide and Neutralization Potential Depletion Calculations

Sample ID	Lithology	NP/AP	HCT Duration	Acidity Generated During HCT?	Initial HCT pH	Steady State HCT pH	Final HCT pH	Total Sulphur				Initial AP	Initial NP	NP (Empirical)			NP (SO ₄ -based)			NP (Ca-based)			NP (Alkalinity-based)		
		Initial	Remaining					Depletion Rate	Time to Depletion	Remaining	Depletion Rate			Time to Depletion	Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion					
		(wt% as S)	(%)					(mg/kg/ week)	(years)	(%)	(mg/kg/ week)			(years)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)		
Granite																									
HC-1 - Sable	2-Mica Granite/ Pegmatite	6.4	43	No	6.9	6.6	6.5	0.005	80	0.15	5.2	0.16	1.0	95	0.96	19	97	0.47	40	98	0.33	57	96	1.0	18
HC-2 - Sable	2-Mica Granite/ Pegmatite	3.4	43	No	8.0	7.8	7.8	0.12	98	0.15	151	3.8	13	96	8	28	100	0.47	523	99	6.0	41	96	8.2	29
HC-3 - Sable	Biotite Granite/ Schist	32	43	No	7.3	6.9	6.9	0.005	83	0.15	5.3	0.16	5.0	98	1.5	62	99	0.47	204	100	0.46	210	98	1.5	64
HC-4 - Sable	Biotite Granite/ Schist	1.1	57	No	7.0	6.4	6.4	0.080	98	0.20	75	2.5	2.9	96	0.8	65	98	0.6	86	99	0.7	79	97	0.6	98
HC-1 - Pigeon	Biotite Granite	35	43	No	7.7	7.1	7.1	0.005	81	0.15	5.2	0.16	5.4	96	2.2	46	99	0.47	220	98	2.3	44	96	2.2	46
HC-2 - Pigeon	Biotite Granite	2.0	43	No	7.0	6.6	6.6	0.050	83	0.46	17.3	1.6	3.1	90	1.9	29	91	1.4	38	97	1.6	36	98	0.9	67
HC-1 - Beartooth	Biotite Granite	27	43	No	7.9	7.7	7.8	0.010	92	0.15	12	0.31	8.3	95	6.6	23	100	0.47	339	98	6.6	24	95	6.6	23
BGT-04 - 48.38 - Beartooth	Biotite Granite	n/a ^(a)	38	No	7.9	7.5	7.5	0.19	99	0.38	95	5.9	n/a ^(a)	n/a ^(a)	4.4	n/a ^(a)	n/a ^(a)	1.2	n/a ^(a)	n/a ^(a)	4.5	n/a ^(a)	n/a ^(a)	4.0	n/a ^(a)
BDC7 - 20.28 - Beartooth	Biotite Granite	n/a ^(a)	38	No	7.3	6.8	6.9	0.12	98	0.40	56	3.8	n/a ^(a)	n/a ^(a)	1.6	n/a ^(a)	n/a ^(a)	1.3	n/a ^(a)	n/a ^(a)	0.8	n/a ^(a)	n/a ^(a)	1.4	n/a ^(a)
F 4-1 188 - Fox	Granite	8.8	111	No	9.2	7.2	7.8	0.040	94	0.21	35	1.3	11	88	9	20	99	0.64	327	93	6.2	32	88	9	20
KDC-03-480 - Koala	Granite	3.0	111	No	9.4	7.4	7.9	0.070	95	0.19	65	2.2	6.6	76	10	10	98	0.61	205	86	6.3	18	77	10	9.9
Diabase																									
HC-5 - Sable	Diabase	29	43	No	7.5	6.9	7.0	0.01	93	0.15	12	0.31	9.0	99	1.7	101	100	0.47	368	100	0.92	188	99	1.7	103
HC-3 - Pigeon	Diabase	34	43	No	7.5	6.9	7.0	0.01	91	0.15	12	0.31	11	99	1.7	117	100	0.47	434	100	1.1	188	99	1.7	122
HC-4 - Pigeon	Diabase	5	52	No	7.2	7.0	6.9	0.060	88	0.31	33	1.9	8.6	97	2.1	75	97	1.0	166	99	1.1	143	99	1.6	101
HC-PDef-1 - Pigeon	Diabase	9.6	51	No	8.7	7.1	7.1	0.050	94	0.33	27	1.6	15	98	1.7	170	99	1.0	276	99	3.9	73	99	1.6	173
HC-3 - Beartooth	Diabase	55	43	No	7.5	7.0	7.0	0.005	85	0.15	5.4	0.16	8.6	98	2.0	81	100	0.47	352	100	0.69	240	98	2.0	83
FUC 3-3 70 - Fox	Diabase	0.04	133	No	8.8	5.9	5.8	0.43	84	2.1	33	13	0.50	0	6.2	0	0	6.7	0	0	3.6	0	0	1.0	0

Table H-1 Sulphide and Neutralization Potential Depletion Calculations

Sample ID	Lithology	NP/AP	HCT Duration	Acidity Generated During HCT?	Initial HCT pH	Steady State HCT pH	Final HCT pH	Total Sulphur				Initial AP	Initial NP	NP (Empirical)			NP (SO ₄ -based)			NP (Ca-based)			NP (Alkalinity-based)		
								Initial	Remaining	Depletion Rate	Time to Depletion			Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion
		(kg/t as CaCO ₃)	(weeks)					(wt% as S)	(%)	(mg/kg/ week)	(years)	(kg/t as CaCO ₃)	(kg/t as CaCO ₃)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)
Metasediments																									
HC-31 - Pigeon	Biotite Schist	1.3	38	Yes	7.1	5.1	4.5	0.19	93	2.3	15	5.6	7.0	96	2.3	55	94	7.3	18	99	1.5	90	99	0.15	893
MDC-4 - 31.5 - Misery	Schist	1.4	111	Yes	7.7	4.0	4.0	0.18	83	2.3	13	5.6	8.0	89	3.9	35	88	7.2	19	95	1.8	82	98	0.20	1,006
MDC-4 - 59.04 - Misery	Schist	1.0	60	Yes	4.5	3.7	3.6	0.34	81	5.9	9.0	11	11	87	5.8	32	82	18	9.4	96	3.1	65	100	0.15	1,408
HC-PDef-3 - Pigeon	Metasediment	1.7	51	Yes	7.0	4.1	4.0	0.21	87	4.4	8.0	6.6	11	98	1.9	110	92	14	14	99	1.2	178	100	0.45	469
HC-PDef-4 - Pigeon	Metasediment	4.3	51	No	9.3	7.5	7.5	0.14	91	2.8	8.7	4.4	19	95	13	28	98	8.8	41	97	8.9	40	97	5.7	63
HC-PDef-5 - Pigeon	Metasediment	1.5	51	Yes	9.3	5.1	5.0	0.43	95	6.4	12	13	20	96	17	22	97	20	18	98	10	36	99	0.50	761
HC-PDef-10 - Pigeon	Metasediment	2.6	51	Yes	9.4	4.2	4.1	0.27	85	14	3.2	8.4	22	96	25	16	94	43	9.3	98	8.3	50	99	0.50	839
HC-PDef-16 - Pigeon	Metasediment	1.7	51	Yes	5.6	3.6	3.5	0.17	78	9.6	2.7	5.3	9.0	97	4.6	37	87	30	5.0	98	1.6	108	100	0.50	345
HC-Pdef-29 - Pigeon	Metasediment	16	44	No	9.2	7.6	7.6	0.020	97	0.12	30	0.63	10	96	4.6	40	100	0.38	502	97	4.6	40	96	5.8	32
HC-Pdef-30 - Pigeon	Metasediment	8.0	44	No	9.0	6.8	7.0	0.040	98	0.16	48	1.3	10	99	0.3	612	100	0.49	392	99	0.7	269	98	0.7	266
HC-2 - Beartooth	Biotite Schist	2.0	43	No	8.0	7.8	7.9	0.10	98	0.18	105	2.8	5.6	90	9.1	11	99	0.56	189	97	8.0	13	91	8.9	11
BDC5 - 41.75 - Beartooth	Biotite Schist	n/a ^(a)	38	No	8.1	7.7	7.6	0.30	97	1.3	44	9.4	n/a ^(a)	n/a ^(a)	8.4	n/a ^(a)	n/a ^(a)	3.9	n/a ^(a)	n/a ^(a)	11	n/a ^(a)	n/a ^(a)	5.2	n/a ^(a)
Kimberlite																									
HC-6 - Sable	Sulphur-Rich Kimberlite Phase	14	50	No	8.2	8.4	8.5	0.32	83	1.6	32	10	143	97	42	64	99	4.9	548	100	7.4	369	99	37	74
HC-7 - Sable	Typical Kimberlite Phase	45	41	No	8.1	8.3	8.4	0.11	80	0.76	22	3.4	154	99	28	104	100	2.4	1242	100	11	279	99	26	114
HC-5 - Pigeon	Sulphur-Rich Kimberlite Phase	16	50	No	8.2	8.2	8.2	0.27	75	3.6	11	8	135	97	38	67	98	11	229	99	16	157	99	27	96
HC-6 - Pigeon	Typical Kimberlite Phase	317	41	No	8.5	8.5	8.6	0.02	64	0.60	4.1	0.6	198	99	54	70	100	1.9	2029	100	7.6	503	99	52	73
HC-4 - Beartooth	Sulphur-rich Kimberlite Phase	9.0	50	No	8.2	7.9	8.1	0.46	94	1.5	54	14	130	98	19	131	99	4.8	516	100	8.1	307	99	14	172

Table H-1 Sulphide and Neutralization Potential Depletion Calculations

Sample ID	Lithology	NP/AP	HCT Duration	Acidity Generated During HCT?	Initial HCT pH	Steady State HCT pH	Final HCT pH	Total Sulphur				Initial AP	Initial NP	NP (Empirical)			NP (SO ₄ -based)			NP (Ca-based)			NP (Alkalinity-based)		
		Initial	Remaining					Depletion Rate	Time to Depletion	Remaining	Depletion Rate			Time to Depletion	Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion	Remaining	Depletion Rate	Time to Depletion		
		(kg/t as CaCO ₃)	(weeks)					(wt% as S)	(%)	(mg/kg/ week)	(years)			(kg/t as CaCO ₃)	(kg/t as CaCO ₃)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)	(%)	(mg/kg/ week)	(years)	(%)
Kimberlite (Continued)																									
HC-5 - Beartooth	Typical Kimberlite Phase	20	41	No	8.6	8.7	8.7	0.25	94	0.82	55	8	160	98	51	58	100	2.6	1,193	100	2.2	1,405	98	49	62
F1-1 216 - Fox	Kimberlite	265	124	No	8.9	8.7	8.9	0.04	0	0.50	0	1.3	331	n/a ^(a)	n/a ^(a)	n/a ^(a)	100	1.6	4,062	100	0.34	18,894	97	60	103
M19-100M - Misery	Kimberlite	7.3	129	No	8.1	7.7	7.6	0.75	85	3.4	35	23	172	96	31	104	98	11	301	99	9.2	357	98	20	160
M19-106M - Misery	Kimberlite	10	130	No	8.2	7.7	7.7	0.59	90	0.77	133	18	191	97	18	198	99	2.4	1519	99	6.3	580	98	16	221
Processed Kimberlite																									
HC 1 - CKRSA	Coarse Processed Kimberlite	20	17	No	8.5	8.4	8.0	0.39	94	4.1	17	12	244	n/a ^(a)	n/a ^(a)	n/a ^(a)	100	13	368	100	4.7	999	100	24	197
HC 2 - CKRSA	Coarse Processed Kimberlite	14	17	No	7.4	7.8	7.6	0.45	78	13	5.0	14	190	n/a ^(a)	n/a ^(a)	n/a ^(a)	98	42	86	100	14	254	100	21	174

a) Neutralization potential (NP) was not calculated and, therefore, these calculations cannot be completed.
ID = identification; NP = neutralization potential; AP = acid potential; HCT = humidity cell test; SO₄: sulphate; Ca = calcium; kg/t = kilograms per tonne; CaCO₃: calcium carbonate; wt% = weight percent; S = sulphur; % = percent; mg/kg = milligrams per kilogram; n/a = not available.