APPENDIX 27

Leach Metallurgy and Neutralization Summary, November 2010

Eagle Gold Heap Leach Project
Metallurgy and Detoxification Summary
November 2010

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1.0 METALLURGY

1.1 Summary

Column leach, bottle roll leach, gravity concentration and flotation tests were conducted on various samples from the Eagle Gold project. Most of the cyanidation testing was conducted from 1995 to 1997 by KCA with additional testing currently in progress at KCA. The gravity and flotation work was conducted in 2006 by Process Research Associates (PRA). In 2007, Analytical Solutions Ltd. (ASL) compared gold assays by fire and metallic screen assay procedures. The earlier test work was used in a feasibility study conducted by Rescan Engineering in 1997.

The results from the column leach test program indicate that gold recovery is sensitive to crush size and to a lesser extent to ore type. Overall gold recoveries ranged from 40 to 45% at a P80 crush size of about 35 mm up to 80 to 85% at a P80 crush size of 2 mm. KCA does not believe that crushing down to 2 mm is a viable heap leach process option for Eagle Gold. Therefore, based on crush size and crusher type versus net revenue trade-off studies, a 5 mm P80 crush size was chosen for this study. A crusher trade-off study was completed which can be found in the pre-feasibility study conducted for this project.

The column leach test results show that crushing down to a P80 size of 5 mm with High Pressure Grinding Roll (HPGR) crushers will lead to an overall average gold recovery of 72%. The results are preliminary and additional test work is required, but the use of HPGR crushers appears to increase gold recovery by several percentage points as compared to conventional crushing to the same P80 size.

Column leach tests were conducted at freezing conditions and compared to ambient temperature column leach test results. These tests showed similar results.

Sodium cyanide requirements were estimated to average 0.34 kg/t at a 5 mm crush size. Lime requirements were estimated to average 1.0 kg/t. However, preliminary agglomeration tests indicate that a minor amount of cement may be required in the lower lifts of the multi-lift heap leach operation. Additional test work is required, but up to 2 kg/t of cement may be required during the first couple of years of operation.

Gravity and flotation tests were conducted on various ore types at grind sizes ranging from approximately 63 to 147 microns. The results of these tests indicated high gold recoveries, with minor reductions in recovery with increasing grind size. Gravity concentration with flotation of the gravity tailings resulted in overall average gold recoveries of 95%. Gold recovery in the gravity stage varied somewhat between the various ore types, but averaged about 52%. Gravity concentration with cyanidation of the gravity tailings resulted in gold recoveries ranging from 85 to 95%.

The results of the KCA's leach test work are presented in Tables 1 and 2 and in Figures 1 through 3. Additional details are presented in Section 1.2. Column leach tests on composite samples crushed to minus 75, 19, 9.5 and 5 mm are currently in progress at KCA. Cyanidation and neutralization tests on the leached minus 5 mm composite have been completed but final tailings are not yet available. The preliminary cyanidation test results for this fine crush test are presented. The other tests at the coarser crush sizes are still leaching and therefore are not presented here due to their preliminary nature.

PRA's results are presented in Tables 3 and 4 with additional details in Section 1.3.

Cyanide neutralization and solution detoxification tests using hydrogen peroxide were conducted on column leach tailings. Most of this test work was conducted in 1996 and 1997 on coarser crusher samples. Neutralization and detoxification test on the minus 5 mm leached tailings were conducted and are presented. Reagent consumptions were relatively low. During the 1996 and 1997 testing program, the cyanide neutralized solutions were further treated to remove additional metals and other constituents. These final detoxified solutions passed fish toxicity testing.

ASL's work included a statistical data review to determine if there was any correlation between fire assay gold and other element concentrations, such as arsenic or bismuth, which could be used to request duplicate assaying of samples by metallic screen assay procedures. Their results are summarized in Section 1.4.

Table 1
KCA Column Leach Test Results

Test No.	Report Date	Ore Type	% of Each Type	Crush Type	p80 Crush Size, mm	Calc Hd, gpt Au	% Au Recovery	% Au w project'ns	Leach Time, Days	NaCN, kg/t	Lime, kg/t	Cement, kg/t	p20 Crush Size, mm
23030	Apr 97	A,C	60/40	Conventional	4.8	0.57	80.6%	**82.6%**	61	0.77	1.14	--	0.6
23018	Apr 97	A	100	Conventional	5.0	0.88	73.9%	73.9%	85	0.90	1.00	--	0.75
23021	Apr 97	A,B,C	37/40/23	Conventional	5.2	0.76	71.0%	**72.0%**	85	0.91	1.00	--	0.78
23027	Apr 97	B	100	Conventional	5.2	0.80	62.6%	**64.6%**	61	0.72	1.07	--	0.8
22660	Apr 96	A	100	Conventional	9.9	0.94	62.8%	**63.8%**	88	0.40	1.00	--	1.7
22666	Apr 96	A,B,C,D	na	Conventional	9.9	1.21	66.1%	66.1%	115	0.53	1.03	--	1.8
22662	Apr 96	B	100	Conventional	10.2	0.81	58.0%	**59.0%**	115	0.48	1.03	--	1.6
22664	Apr 96	C	100	Conventional	10.3	0.63	61.9%	61.9%	115	0.55	1.03	--	1.6
22687	Apr 96	A	100	Conv*	10.3	0.90	60.0%	60.0%	84	0.25	1.00	--	1.7
22656	Apr 96	C	100	Conventional	29	0.66	42.5%	**43.5%**	62	0.16	1.05	--	4.8
22650	Apr 96	C, D	na	Conventional	33	0.65	43.1%	43.1%	62	0.17	1.05	--	3
22685	Apr 96	A	100	Conv*	36.3	0.73	58.9%	58.9%	84	0.10	1.00	--	6.4
22652	Apr 96	A	100	Conventional	38	0.75	48.1%	48.1%	91	0.15	1.05	--	7.5
22654	Apr 96	B	100	Conventional	38	0.78	33.3%	**34.3%**	62	0.12	1.05	--	7.5
23036	Apr 97	A	100	Cone-HPGR	1.7	0.87	88.5%	**90.5%**	34	0.70	0.08	3.75	0.60
24640	Apr 97	A	100	Cone-HPGR	1.8	1.67	88.0%	88.0%	58	0.72	1.07	1.00	0.11
24610	Apr 97	A,C	84/16	Cone-HPGR	2.0	0.85	85.9%	85.9%	76	1.07	0.15	3.75	0.11
23075	Apr 97	A	100	Cone-HPGR	2.1	1.06	87.7%	**89.7%**	41	0.58	0.07	3.75	0.14
23078	Apr 97	A	100	Cone-HPGR	2.1	1.08	78.7%	**83.7%**	23	0.40	0.07	3.75	0.14
24604	Apr 97	A	100	Cone-HPGR	2.2	1.80	89.4%	89.4%	76	0.92	0.15	3.75	0.22
24607	Apr 97	B	100	Cone-HPGR	2.2	1.52	85.5%	85.5%	76	0.81	0.15	3.75	0.15
24637	Apr 97	A,B,C	25/50/25	Cone-HPGR	2.2	0.66	83.3%	83.3%	58	0.81	1.07	1.00	0.12
24601	Apr 97	E	100	Cone-HPGR	2.6	0.76	84.3%	84.3%	76	0.99	0.15	3.75	0.21

Table 1
KCA Column Leach Test Results (Continued)

Test No.	Report Date	Ore Type	% of Each Type	Crush Type	P80 Crush Size, mm	Calc Hd, gpt Au	% Au Recovery	% Au w project'ns	Leach Time, Days	NaCN, kg/t	Lime, kg/t	Cement, kg/t	P20 Crush Size, mm
23057	Apr 97	A	100	Jaw-HPGR 1	9.5	1.03	76.7%	76.7%	27	0.34	1.08	--	0.12
24625	Apr 97	A,B,C	25/50/25	Jaw-HPGR 1	9.5	0.69	65.2%	**69.2%**	31	0.57	1.07	1.00	0.50
24628	Apr 97	A	100	Jaw-HPGR 1	9.5	1.69	58.6%	**62.6%**	31	0.61	1.07	1.00	0.48
24631	Apr 97	A,B,C	25/50/25	Jaw-HPGR 1	9.6	0.60	66.6%	66.6%	58	0.59	1.08	1.00	0.62
24634	Apr 97	A	100	Jaw-HPGR 1	9.5	1.73	64.1%	**65.1%**	72	0.79	1.08	1.00	0.40
23060	Apr 97	A	100	Jaw-HPGR 2	4.8	1.00	79.0%	**80.0%**	27	0.43	0.10	3.75	0.19
24619	Apr 97	A,C	84/16	Barmac	5.0	0.97	85.6%	85.6%	60	0.84	0.10	3.75	0.30
42979*	Nov10+	A,B,C	45/28/27	Cone-HPGR	4+	0.51+	96%+	na	33	0.40	0	2.00	na

* Cold temperature leach, approx 0 C

1 indicates single pass, 2 double pass through a HPGR
+Preliminary data only, test not complete

Table 2
KCA Bottle Roll Leach Test Results

Test No.	Ore Type	Hole No.	Interval, m	Crush Size, mm	Calc Hd, gpt Au	% Au Recovery	Leach Time, Hours	NaCN, kg/t	Lime, kg/t
22648A	C, D	na	na	50	0.96	22.9	96	0.29	0.15
22648B	A	na	na	50	0.94	35.4	96	0.19	0.15
22668A	A	na	na	25	1.15	31.3	96	0.14	0.30
22669A	A	na	na	12.5	0.65	46.2	96	0.09	0.30
22670A	A	na	na	Pulv	0.68	92.6	24	0.08	1.60
22648C	B	na	na	50	0.74	29.7	96	0.14	0.25
22668B	B	na	na	25	0.61	26.2	96	0.14	0.20
22669B	B	na	na	12.5	0.73	32.9	96	0.14	0.20
22670B	B	na	na	Pulv	0.52	90.4	24	0.08	1.00
22649A	C	na	na	50	0.3	40.0	96	0.14	0.25
22668C	C	na	na	25	0.66	25.8	96	0.14	0.30
22669C	C	na	na	12.5	0.83	22.9	96	0.14	0.30
22670C	C	na	na	Pulv	0.44	90.4	24	0.18	1.00
22668D	A,B,C,D	na	na	25	1.06	43.4	96	0.14	0.25
22669D	A,B,C,D	na	na	12.5	1.32	42.4	96	0.19	0.25
22670D	A,B,C,D	na	na	Pulv	1.59	96.9	48	0.08	2.00
22626A	A	74C	9.1 - 47.3	Pulv	0.45	80.0	48	0.04	1.60
22626B	C	74C	47.3 - 99.1	Pulv	0.52	80.7	48	<0.01	1.40
22626C	B	74C	99.1 - 177.2	Pulv	0.38	71.1	48	0.15	1.20
22626D	C	74C	177.2 - 229.2 236.4 - 243.2	Pulv	0.33	78.8	48	0.04	1.60
22627A	B	74C	220.2 - 236.4	Pulv	0.33	66.7	48	0.15	1.40
22627B	E	75C	9.15 - 12.9	Pulv	<0.10	0.0	48	0.15	1.60
22627C	A	75C	12.9 - 13.9	Pulv	<0.10	0.0	48	0.05	1.60
22627D	E	75C	13.9 - 25.9	Pulv	0.29	75.9	48	0.15	1.00
22628A	A	75C	25.9 - 49.4	Pulv	0.76	84.2	48	0.04	1.60
22628B	E	75C	49.4 - 53.6	Pulv	0.6	88.3	48	0.15	1.60
22628C	A	75C	53.6 - 67.1	Pulv	0.85	85.9	48	0.05	1.60
22628D	E	75C	67.1 - 76.6	Pulv	0.98	87.8	48	0.15	1.60
22629A	A	75C	76.6 - 120.2	Pulv	0.65	86.2	48	0.05	2.00
22629B	D	75C	120.2 - 130.8	Pulv	0.68	76.5	48	0.05	1.60
22629C	B	75C	130.8 - 234.4	Pulv	1.1	89.1	48	0.15	1.60
22629D	A	76C	22.9 - 190.0	Pulv	0.49	89.8	48	0.05	1.60
22630A	C	76C	190.0 - 260.0	Pulv	0.6	85.0	48	0.05	1.00
22630B	A	77C	24.4 - 129.5	Pulv	2.01	95.0	48	0.05	1.60
22630C	B	77C	129.5 - 199.6	Pulv	0.59	84.7	48	0.15	1.60
22630D	B	78C	24.4 - 38.2	Pulv	0.28	75.0	48	0.05	1.60
22631A	C	78C	38.2 - 100.6	Pulv	0.48	89.6	48	0.05	1.60

Figure 1

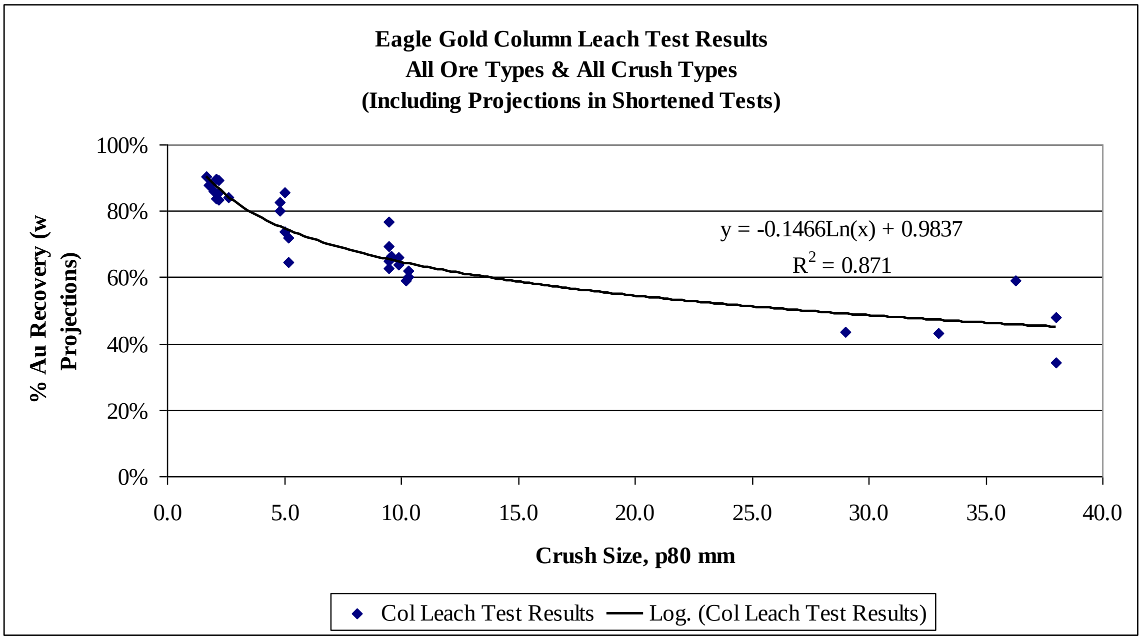


Figure 2

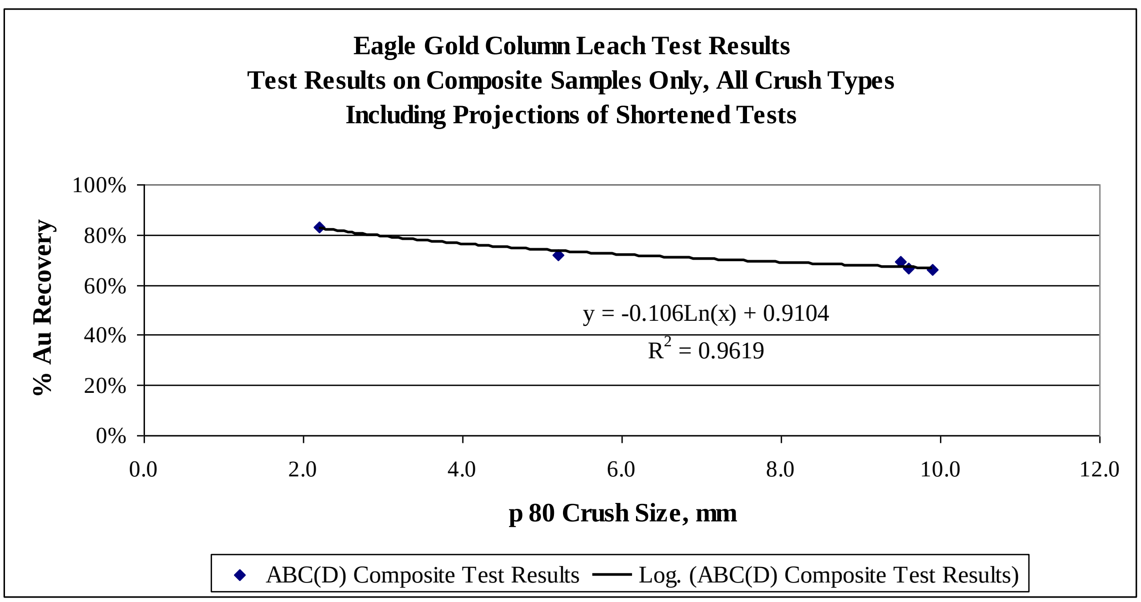


Figure 3

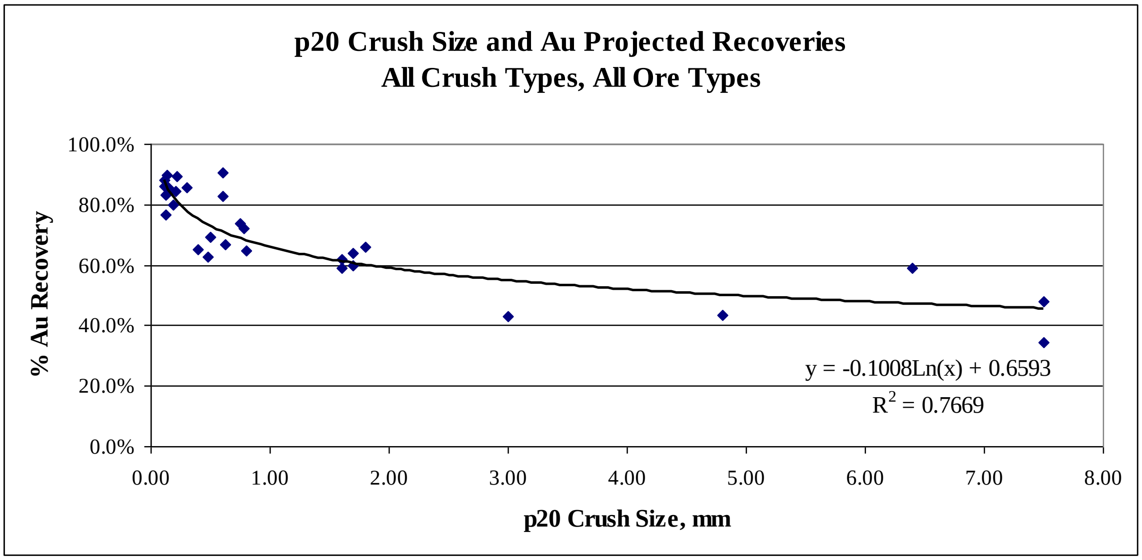


Table 3
Summary of PRA's Gravity-Flotation Test Results

Ore Type	Grind Size, p80, µm	Calc Head, gpt Au	Gravity Conc, gpt Au	Final Rougher Conc, gpt Au	Mass Pull, %	% Au Rec in Gravity Conc.	% Au Rec in Final Rougher Conc.	Overall % Au Recovery
Altered	79	0.89	188.0	4.40	10.2	44.6	50.3	95.0
Altered	107	0.94	130.8	5.42	6.7	56.7	38.4	95.1
Altered	147	0.94	101.9	8.63	6.1	32.7	55.4	88.1
Oxidized	63	1.12	817.4	2.62	11.3	70.3	26.5	96.8
Oxidized	101	0.66	434.0	2.45	9.8	57.1	36.1	93.2
Oxidized	140	1.01	1,171.1	4.68	6.9	62.5	32.0	94.5
Silicified	70	2.85	1,561.2	9.08	10.8	62.1	34.4	96.6
Silicified	96	3.00	963.3	8.32	15.1	54.6	42.0	96.6
Silicified	142	2.59	852.6	16.66	8.3	40.8	53.5	94.3
Unaltered	67	0.68	200.9	3.16	9.0	54.2	41.8	96.0
Unaltered	100	0.61	313.4	2.84	7.6	59.7	35.8	95.4
Unaltered	140	0.71	240.2	1.82	13.7	58.5	35.4	93.9

Table 4
Summary of PRA's Gravity-Cyanidation Test Results

Ore Type	Grind Size, p80, µm	Calc Head, gpt Au	Gravity Conc, gpt Au	% Au Rec in Gravity Conc.	% Au Rec in Cyani-dation	Overall % Au Recovery
Altered	79	0.94	118.8	35.8	50.4	86.2
Altered	99	1.06	75.2	42.1	42.9	85.0
Altered	146	0.99	104.5	33.6	50.3	83.9
Oxidized	67	0.61	141.5	45.3	46.5	91.8
Oxidized	96	0.48	137.8	23.6	64.0	87.6
Oxidized	144	0.76	464.1	58.5	34.9	93.4
Silicified	70	3.15	672.9	51.4	42.9	94.3
Silicified	96	7.46	2,350.3	76.1	20.7	96.8
Silicified	142	6.21	1,603.9	71.5	25.0	96.5
Unaltered	71	1.38	303.7	41.6	49.0	90.6
Unaltered	104	1.06	391.5	62.3	29.2	91.6
Unaltered	147	0.99	321.7	50.3	39.6	89.9

1.2 KCA Leach Data Review and Field Gold Recovery Estimates

KCA's test program was conducted on composites and on five ore types. These ore types are described in Table 5.

Table 5
Ore Type Description

Ore Type Designation	Rock Type Designation
A	Weathered granodiorite
B	Fresh to weakly altered granodiorite, <20% moderately or strongly altered
C	Sericite, chlorite, carbonate altered granodiorite
D	Fine grained granodiorite
E	Weathered sediments

Types D and E are relatively minor in comparison to the other three ore types and only a few select tests were conducted on these two. Weight percentages by ore type are 37% A, 40% B and 23% C.

All samples tested were from HQ core. The core tested mostly came from the central and southern sections of the ore body. There are some questions concerning the representativity of the samples tested due to potential loss of coarse gold during core drilling. This is discussed in the pre-feasibility study. A statistical study conducted by Rescan in their 1997 feasibility study indicated that twinned core holes tended to be lower grade than reverse circulation holes by about 15% with an average grade difference of 0.16 gpt Au. The potential absence of this coarse gold and its affect on recoveries and leach times were not taken into account in this metallurgical review. However, new samples were taken in the summer of 2009, both core and bulk samples. The 2009 core samples were taken with a triple tube core drill which should eliminate the problem of potentially washing out coarse gold. Additional testing is being conducted on these new samples and will be compared to past results.

As shown in Table 2, the results from the bottle roll leach tests generally indicate that finer crushing/grinding generally leads to higher gold recoveries. They also indicate that ore type A gives higher average gold recoveries than ore type C, which gives higher average gold recoveries than ore type B. There does not appear to be any correlation between interval depth and gold recoveries in the pulverized bottle roll test results.

Column leach tests were conducted on samples crushed to various sizes by several different types of crusher types. These crusher types tested were:

1. Conventional laboratory scale cone crushed material
2. Laboratory scale cone crushed, laboratory scale HPGR crushed material
3. Laboratory scale jaw crushed, pilot-scale HPGR – single pass – crushed material
4. Laboratory scale jaw crushed, pilot-scale HPGR – double pass – crushed material
5. Laboratory scale jaw crushed, pilot-scale Barmac crushed material

Average gold recoveries by ore type, crusher type and crush size based on the column leach test results conducted by KCA from 1995 to 1997 are summarized in Table 6.

Several of the column leach tests were still leaching when they were ended, per instructions from the client at that time. The leach recovery curves were reviewed and additional time and gold recovery were estimated for the shortened tests. As shown in Table 1, 14 of the 30 column leach tests were not run to completion. An additional 1 to 5 percentage points were added to the 14 tests. Additional time to obtain the ultimate column leach recoveries was generally in the 15 to 50-day time range.

Table 6
Average Column Leach Test Results by Ore Type, Crush Type & Crush Size

			Column Test Recoveries Including Projections, % Au			
P80 Crush Size, mm	**Crush Type**	**Ore Types w Available Test Data**	**Ore Type A**	**Ore Type B**	**Ore Type C**	**Composite Test Results**
33 to 38	Conventional	A, B, & C	54%	34%	44%	not available
9.9 to 10.3	Conventional	A, B, C & Composite	62%	59%	62%	66%
9.5 to 9.6	All HPGR	A & Composite	68%	not available	not available	68%
4.8 to 5.2	Conventional	A, B & Composite	74%	65%	not available	72%
4.8	All HPGR	A only	80%	not available	not available	not available
1.7 to 2.6	All HPGR	A, B & Composite	88%	86%	not available	83%

As shown in Table 6, there is a distinct increase in gold recovery with decreasing crush size for all ore types. There is also an indication that HPGR crushing results in an increase in gold recovery as compared to conventional crushing to the same P80 crush size. The data are not complete, but there is an apparent 2 to 6 percentage point increase between conventional and HPGR crushing, based on comparison of data at the P80 crush sizes of 10 mm and 5 mm. Additional testing is required, but the potential for an increase in gold recovery by the use of HPGR crushers led to the decision to utilize these crushers.

The results from the column leach test program, including the projected results, were used to estimate production heap leach recoveries at Eagle Gold. These estimated recoveries are presented in Table 7. The calculated overall recoveries are based on an ore type mix of 37% A, 40% B and 23% C. These calculated overall recoveries compare reasonably well with the recoveries from the column leach tests on composite samples.

The recoveries shown in Table 7 that are underlined and italicized were calculated based on available data. Differences in available gold recoveries at different crush sizes and/or crush types were compared, then similar differences added to the missing ore type recovery data. Available recovery data were also plotted and interpolations based on these curves were made.

The recovery data in Table 7 includes deductions of 2 to 3 percentage points to take into account the imperfect field conditions as compared to the more controlled conditions in the laboratory and to account for variations in ore types.

Table 7
Estimated Field Recoveries Based on Available Column Leach Test Results

			Estimated Field Recoveries, % Au*				
P80 Crush Size, mm	**Crush Type**	**Ore Types w Available Test Data**	**Ore Type A**	**Ore Type B**	**Ore Type C**	**Calculated Overall****	**Discounted Composite Test Results**
33 to 38	Conventional	A, B, & C	52%	32%	42%	***42%***	Not available
9.9 to 10.3	Conventional	A, B, C & Composite	60%	57%	60%	***59%***	63%
9.5 to 9.6	HPGR	A & Composite	66%	***60%***	***64%***	***63%***	65%
4.8 to 5.2	Conventional	A, B & Composite	72%	63%	***66%***	***67%***	69%
4.8	HPGR	A only	77%	***68%***	***72%***	***72%***	Not available
1.7 to 2.6	HPGR	A, B & Composite	85%	83%	***83%***	***84%***	80%

*Includes 2 to 3 percentage point deduction as deemed reasonable based on available leach test results
**Type A, B, and C mix of 37%, 40% & 23%, respectively
Italicized, underlined percentages are calculated based on other tests

Field cyanide consumption was based on the results from the conventional crushed sample at 5 mm since this is the only test available on composite material at the study crush size. The stated cyanide consumption for this test was 0.91 kg/t. However, it was not run to completion, so additional cyanide would have been consumed if allowed to do so. It was estimated that an additional 0.05 kg/t of cyanide would have been consumed. Field cyanide consumptions are generally 25 to 50% of the laboratory column leach consumptions, depending on ore type and other metal constituents, especially copper. KCA used a 35% factor to obtain a field consumption of 0.34 kg/t.

Field lime requirements are generally very close to the laboratory column leach test results. A 1.0 kg/t lime addition rate was estimated.

A series of compacted percolation tests was conducted to determine heap permeability under various pressures. The tests simulated loads at various heap heights between 0 and 100 meters. As shown in Table 1, cement instead of lime was added to several of the finer crushed tests for agglomeration purposes. The coarser crushed samples passed the compacted tests at all heap heights tested. However, there were several tests where % slump was high, which may lead to permeability issues in the field. Compacted test results on finer crush sizes are only available on an approximate 2 mm crushed sample. These tests all passed.

Due to limited compacted percolation testing results, it was decided to have the ability to add cement during the first year or two of operation to insure that there will not be any permeability issues. Additional tests are planned to better evaluate agglomeration requirements.

Production leach times were based on the 5 mm conventional test. Both tonnes of solution per tonne of ore and leach time data from the column leach test were used to estimate leach times. The tonnes of solution to tonnes of ore (T_s/T_o) ratio was estimated to be 0.67 from the applicable column leach test recovery curve. This ratio was estimated based on the quantity of solution applied to the column test just prior to when the recovery curve begins to flatten out. This ratio was then translated to leach times in the field to obtain a similar ratio (44 days). Additional leach time was then added to this calculated field time based on how much longer the column leach tests ran to obtain the final recoveries after reaching the selected T_s/T_o figure (approximately 80 days). A leach time of 120 days was selected.

1.3 PRA Test Results

PRA conducted a testing program on four composites: oxidized, altered, unaltered and silicified. The silicified composite contained 2.47 gpt Au while the other three contained less than 0.7 gpt Au.

Tests utilizing gravity separation followed by panning on samples milled from 63 to 147 microns were conducted. These tests gave the following average gold recoveries for each composite:

Oxidized:	53%
Altered:	41%
Unaltered:	54%
Silicified:	59%

The gravity tailings were treated by cyanidation and flotation. The gravity-cyanidation tests gave gold recoveries greater than 90% for all composites except the altered, which achieved an 85% overall gold recovery. Cyanide consumptions were low and averaged approximately 0.27 kg/t. The grind size did not appear to affect gold extraction in the cyanidation tests. The gravity-flotation tests resulted in gold recoveries averaging 95%. Gold recoveries increased slightly with a finer grind size.

The results of these tests were presented in Tables 3 and 4.

The potential to add a gravity circuit to the heap leach process to recover coarse gold will be evaluated in the near future. No additional flotation or milling test work is planned at this time.

The fine crush size chosen for this study will facilitate gravity operation since a gravity circuit should be fed a fairly fine feed fraction (<3 mm). A mineralogical study was conducted by PMET in 1995 and the results are included in the 1996 KCA laboratory report. The PMET report indicates that gold particles are in the 40 to 250 micron size range, which should be recoverable by gravity. PMET conducted a gravity test where over 60% of the gold was recovered into a gravity concentrate at an approximate 300 micron grind size.

1.4 ASL Statistical Review

ASL's statistical review of data determined that there are an approximate same number of assays where fire assay gold is greater than metallic screen assay gold and vice versa for two grade ranges: 0.1 to 1 gpt Au and greater than 1 gpt Au. In addition,

a) "for half the samples, only 3% of the gold reports to the coarse fraction;
b) for at least 80% of the samples no more than 10% of the gold is in the coarse fraction; and
c) only 5% of the samples have more than 30% of the gold in the coarse fraction."

"So that for most of the samples even if all of the coarse gold failed to fall within the assay aliquot, the overall assay would be expected to change by no more than 10%." ASL also indicated that "there is an important subset of the samples where the coarse fraction (greater than 100 mesh or 150 microns) contributes significantly to the overall grade of the material and this will likely cause sample representivity concerns."

ASL used multiple regression analyses to come up with a best fit equation that compared a calculated gold grade using gold, bismuth and arsenic data with a gold grade determined by fire assay. This equation, which is presented below, gave the best correlation with samples containing less than 0.5 gpt Au.

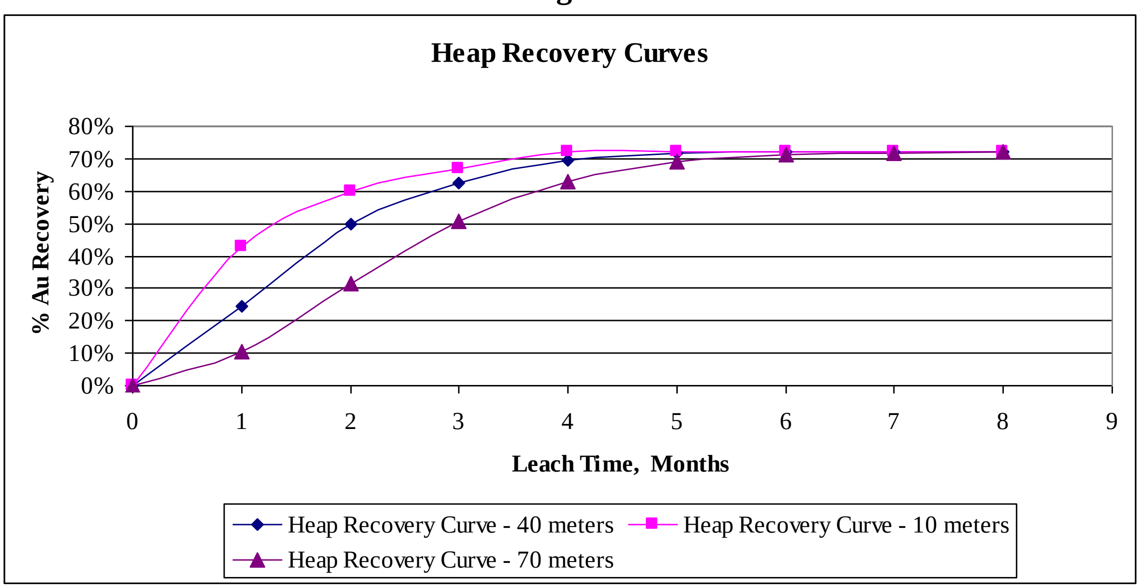
$$\text{Log Au} = 0.67655(\log \text{Au}) + 0.0108(\log \text{As}) + 0.14577(\log \text{Bi}) - 0.29041$$

ASL recommended additional work to improve the capabilities of the multiple regression analyses including treating samples with assays greater than 0.5 gpt Au as a second sample population and by obtaining additional arsenic data on samples with over 10,000 ppm As.

1.5 Gold Recovery Curve

Field gold recovery curves were generated by lift based on the column leach test results on the composite sample crushed to 5 mm. The field curves were generated based on a combination of laboratory T_s/T_o and leach time data, a 10-meter lift height and a 10 L/hr/m^2 leach solution application rate. Gold recovery will be delayed an incremental amount as the total heap height increases. Maximum heap height above the liner is approximately 80 meters. Field recovery curves modeling heap heights at 10, 40 and 70 meters were made. These curves are shown in Figure 4.

Figure 4



1.6 Cyanide Neutralization

Cyanide neutralization and detoxification testing was completed on coarser crushed column leach tailings and barren solutions in 1996 and 1997. Neutralization tests on a fine crushed column leach tailing (5 mm) and barren solution were conducted in 2010.

Eight separate neutralization tests on six column tests conducted on individual ore types and on two column tests conducted on composite samples were conducted using a copper catalyzed hydrogen peroxide process. These results are presented in Table 8. Less than 1 tonne solution per tonne of ore was required to reach the cyanide levels shown in the table. In this series of tests, WAD cyanide was utilized as the primary indicator upon which final detoxification was based.

Table 8.
Summary of Hydrogen Peroxide Detoxification Test Results

Ore Type	Crush Size, mm	WAD CN, ppm (1)	Total CN, ppm (1)	Reagent Usages		
				30% H_2O_2, kg/t	Lime, kg/t	Copper, kg/t (2)
A	-50	<0.10	1.82	0.15	0.05	0.007
A	-12.5	<0.10	0.17	0.28	0.12	0.008
A	-50	0.03	0.08	0.15	0.09	0.009
A	-12.5	0.03	0.05	0.35	0.03	0.05
B	-12.5	<0.10	1.82	0.17	0.00	0.00
C	-12.5	<0.10	0.78	0.42	0.03	0.003
A,B,C,D	-12.5	<0.10	1.3	0.12	0.00	0.00
A,B,C	-5	0.16	2.1	1.8*	0.00	0.016

(1) Level in column effluent.
(2) Copper added as copper sulfate pentahydrate
*Added as 35% H_2O_2

Fish toxicity testing was completed on the cyanide neutralized barren solutions from the 1996 and 1997 test program. Various other metals and other constituents had to be removed for the solutions to pass the fish toxicity tests. Additional treatment included cyanate hydrolysis with dilute sulfuric acid, metal removal with iron chloride, pH adjustment with caustic and air stripping to remove ammonia. A total of three different solutions were tested, with the third solution resulting in a 100% fish survival rate after 96 hours. These fish toxicity tests were conducted by EVS Environmental Consultants.

Full details on the testing are presented in the 1996 KCA laboratory report, in a letter report dated 25 April 1997 and in an interim KCA laboratory report dated November 2010.

1.7 Heap Closure Summary

It is anticipated that after completion of stacking there will be period of time when cyanide will continue to be added and residual gold leached out of the ore. This time period will probably be on the order of 6 months to a year.

After this initial time period, cyanide addition will cease and solutions will be recycled without any chemical additions until all economically recovered gold is removed from the heap. Levels of cyanide in and pH values of process solutions will slowly be reduced during this recirculation period. This time period could vary somewhat, but is estimated to last between one and two years.

During the first couple of years after stacking is completed, but prior to chemical neutralization, the heap should be re-contoured as required to establish long term stable slopes as outlined in the reclamation plan.

When no new ore is being stacked onto the heap, the water balance calculations (discussed elsewhere) indicate that some 200,000 m^3 of solution will have to be discharged to the environment on an annual basis to maintain solution storage levels at an acceptable level. The treatment method for this solution prior to discharge has not been finalized, but based on available test work results, a possible scenario is as follows:

- Copper catalyzed hydrogen peroxide followed by cyanate hydrolysis with dilute sulfuric acid; then metals removal with iron chloride and pH adjustment with caustic; followed by air stripping to remove ammonia. Dilution would also be utilized whenever allowable.

After all economical gold has been recovered, it is estimated that the cyanide level in the process solutions being recirculated will be reduced down to the 5 to 20 ppm range, mainly due to natural degradation. The heap will then be rinsed with a combination of fresh water and solutions detoxified by the addition of copper catalyzed hydrogen peroxide. The rate of solution discharged to the environment will increase and fresh water addition to the heap will also be increased to facilitate cyanide destruction and metals removal from the heap. At the end of this period, heap effluent pH values should be in the 7 to 9 range with cyanide levels less than 0.1 ppm (WAD). It is anticipated that this time period of fresh water rinsing supplemented with chemical neutralization would take about two years.

The heap will then be capped, re-vegetated and heap effluent stored and treated as required.

Several examples of past heap leach operations that have utilized a combination of fresh water rinsing and hydrogen peroxide detoxification of recycled solutions during the closure phase include: Timberline in Utah, Brohm in South Dakota and Summitville in Colorado.