

**APPENDIX A**  
**FIELD REPORTS**

**From:** David Keller  
**To:** WACHT  
**Date:** 10/2/97 6:01pm  
**Subject:** Carmacks Bulk Sampling

Tony,

Just a short note. Production today on trench 20 is stalled because of excavator break down. However trench 18 was loaded and blasted this morning.

Due to this delay I expect that work will be finished around the middle of next week.

Dave

**From:** David Keller  
**To:** WACHT  
**Date:** 10/5/97 2:39pm  
**Subject:** Carnacks Bulk Sampling

Tony,

More delays with regard to the air track drill. Replacement parts for the drill were broken. A new drill had to be arranged and transported to site. Drilling resumed at noon on Saturday. We have lost 2.5 days due to drilling problems. Trench 19 (not 18) has been sampled (chip and bulk) and mixed. Digging of trench 20 was completed Saturday.

Since equipment work is completed as far as possible, I have sent the operators home until drilling and blasting is near completion. Taking the bulk sample from a trench and mixing the sample takes about four hours. I expect drilling to continue until Wednesday. Operators are scheduled to be back Tues.

I have changed my flight to Thurs morning but I think that may be a bit optimistic.

Attached is my final estimate of costs up to the end of September. Jim has charged us the transport costs for the camp and is charging \$78.00/day/man room and board.

Jim has also sent out an invoice for September to the client. There are some errors which Jim needs to fix.

**From:** David Keller  
**To:** WACHT  
**Date:** 9/30/97 8:02pm  
**Subject:** Carmacks Bulk Sampling -Reply -Reply

Tony,

I have talked to Jim Coyne about leaving the Cat (D7) at site for the next program. Jim is quite happy to leave the Cat until the next program starts up.

Trenches 19, 68 and 22 are ready for blasting and removing the sample. Work on trench 20 is progressing. Trench 20 needs to be cleaned out and widened for equipment. As this was a previous bulk sample trench the trench has to be deepened. Rock can be only removed using dump trucks. Benching of trench sides is necessary to reduce slumping of trench sides. I expect this trench to be completed in about two days.

Two dump trucks arrived at site yesterday afternoon with the air-track drill and compressor for drill. Blasting\Drilling was delayed today for about 8 hours today because the drill was broken. Late in the afternoon the drill was fixed and drilling on trench 19 started.

I expect bulk sampling to be completed early next week.

Jim Coyne has organized a camp for his men just off of the main road. He will give the cost per man shortly.

Last weekend Access Mining Consultants from Whitehorse did piezometer testing. The brushing crew started about Wednesday last week.

The 500kg sample of the previous bulk sample needs some clarification. The only material in one of the trenches appears to be leached ore. Ken and one or two other people have indicated that the material is from the leach pad set up in Carmacks. I concur with this as plastic sheets and plastic pipes are buried with this material. It was my understanding that the material wanted was weathered crushed ore not weathered crushed and leached material. There does not appear to be any crushed unleached ore available. Please confirm if a sample of this material should be sampled.

I seem to have misplaced the address for Process Research Associates (PRA). Could you please send me their address and phone number.

Jim Coyne has made preliminary inquiries concerning shipping about 20 tonnes to Vancouver. The cost will be around \$1000.00.

Are the trench channel samples to be sent to PRA also or to another lab such as Chemex?

Regards,

Dave

**From:** David Keller  
**To:** WACHT  
**Date:** 9/27/97 10:11am  
**Subject:** Carmacks Bulk Sampling

Carmacks Bulk Sampling

Tony,

Trench 18 is completed ready for blasting and sampling. A good portion of the trench won't need blasting as the rock is very friable.

Work on trench 68 is still in progress. A large amount of ground has to be moved to get access for excavator and mini-air track. At the moment this is holding up progress. This trench should be completed by tomorrow.

Trench 22 has been enlarged by the bulldozer and will need only minor work before blasting/sampling.

Trench 20 will need dump trucks to clean out trench. The trench (including muck piles beside trench) is 5-6m deep.

Bulk sample bags were in Whitehorse the same day I arrived.

Contractor recommends some minor road work so that dump trucks can access site and take out bulk samples. I will try to minimize road work as much as possible.

Please find attached a summary of men and equipment hours up to the 24. Further update Sunday evening.

Dave

**From:** David Keller  
**To:** WACHT  
**Date:** 9/24/97 6:20pm  
**Subject:** Hi Tony.

Hi Tony,

The trenching is progressing. The first trench number 18 will probably be complete tonight. Initial work on trench 68 has started today. Ken Roberts equipment is was working on another site so he arranged for another contractor to do the work. The contractor is Jim Coyne, he is based out of Whitehorse. Jim's equipment is essentially the same as Ken's, possibly newer. The blaster was at site and advised of what was needed. I will get him to start blasting when at least three trenches have been cleaned out.

Trenches may need more work than I expected because equipment about six feet wide and trench sides are piled high from previous work. So far progress is good. Operators were at site yesterday afternoon.

Otherwise things are okay. The equipment operators seem to be quite competent.

Dave

**APPENDIX B**  
**SAMPLE DESCRIPTION MEMO**



**KILBORN  
SNC-LAVALIN**

**KILBORN ENGINEERING PACIFIC LTD.**  
Suite 400, 1380 Burrard Street  
Vancouver, B.C.  
Canada V6Z 2B7

Telephone: (604) 669-8811

**FAX  
(604) 669-0847**

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**TO:** Morris Beattie  
**COMPANY:** Beattie Consulting Ltd.  
**FAX NO.:** (604) 263-0895  
**FROM:** Dave Keller  
**DATE:** October 19, 1997  
**SUBJECT:** Carmacks Samples  
**PROJECT #:** 8555-25  
**NUMBER OF PAGES SENT:** 3 (INCLUDING TRANSMITTAL PAGE)

**COPY TO:**

**COPY TO:**

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**MESSAGE:**

Morris Beattie:

Samples from the Carmacks bulk sampling program should arrive in Vancouver this week.

There are 18 bulk sample bags numbered 1-18 containing a blended ore from four trenches. Each bag weighs about 1 tonne. Also there is 1 bulk sample bag containing the previously leached ore which was left to weather in one of the trenches. This bag is marked as L1 and weighs approximately 800lbs.

Additionally each trench was sampled by channel-chip sampling along each trench wall. Nineteen samples are in one bulk sample bag, sample numbers 588801 to 588819. Additionally 109 samples are in another bulk sample bag, sample numbers 588820 to 588850 and 586251 to 586279.

I have attached a list of channel-chip samples indicating trench number and distance from the footwall contact.

G. David Keller



## CARMACKS CHANNEL-CHIP SAMPLES

SAMPLE NO.	F/W CONTACT DISTANCE		TRENCH
	FROM	TO	
588801	0.0	2.0	91-18
588802	2.0	4.0	91-18
588803	4.0	6.0	91-18
588804	6.0	8.0	91-18
588805	8.0	10.0	91-18
588806	10.0	12.0	91-18
588807	12.0	14.0	91-18
588808	14.0	16.0	91-18
588809	16.0	18.0	91-18
588810	18.0	20.0	91-18
588811	20.0	22.0	91-18
588812	22.0	24.0	91-18
588813	24.0	26.0	91-18
588814	26.0	28.0	91-18
588815	28.0	30.0	91-18
588816	30.0	32.0	91-18
588817	32.0	34.0	91-18
588818	34.0	36.0	91-18
588819	36.0	39.3	91-18
588820	0.0	2.0	92-68
588821	2.0	4.0	92-68
588822	4.0	6.0	92-68
588823	6.0	8.0	92-68
588824	8.0	10.0	92-68
588825	10.0	12.0	92-68
588826	12.0	14.0	92-68
588827	14.0	16.0	92-68
588828	16.0	18.0	92-68
588829	18.0	20.0	92-68
588830	20.0	22.0	92-68
588831	22.0	24.0	92-68
588832	24.0	26.9	92-68
588833	26.9	31.4	92-68
588834	31.4	34.0	92-68
588835	34.0	36.0	92-68
588836	36.0	38.0	92-68
588837	38.0	40.0	92-68
588838	40.0	42.0	92-68
588839	42.0	44.0	92-68
588840	44.0	46.0	92-68
588841	46.0	48.0	92-68
588842	48.0	50.0	92-68

588843	50.0	52.0	92-68
588844	52.0	54.0	92-68
588845	54.0	56.0	92-68
588846	56.0	58.0	92-68
588847	58.0	60.0	92-68
588848	60.0	62.0	92-68
588849	62.0	64.0	92-68
588850	64.0	66.1	92-68
586251	0.0	2.0	91-20
586252	2.0	4.0	91-20
586253	4.0	6.0	91-20
586254	6.0	8.0	91-20
586255	8.0	10.0	91-20
586256	10.0	12.0	91-20
586257	12.0	14.0	91-20
586258	14.0	16.0	91-20
586259	16.0	18.0	91-20
586260	18.0	20.0	91-20
586261	20.0	22.0	91-20
586262	22.0	24.0	91-20
586263	24.0	26.0	91-20
586264	26.0	28.0	91-20
586265	28.0	30.0	91-20
586266	30.0	32.0	91-20
586267	32.0	33.9	91-20
586268	0.0	2.0	91-22
586269	2.0	4.0	91-22
586270	4.0	6.0	91-22
586271	6.0	8.0	91-22
586272	8.0	10.0	91-22
586273	10.0	12.0	91-22
586274	12.0	14.0	91-22
586275	14.0	16.0	91-22
586276	16.0	18.0	91-22
586277	18.0	20.0	91-22
586278	20.0	22.0	91-22
586279	22.0	23.9	91-22

**APPENDIX C**

**DRAWINGS**

## **Appendix 2**

### **Leach Column Test Details**

# COPPER COLUMN LEACH TEST DATA

Carmacks Project

Project: 97-064

Column: C

Column Size: 6"x216"

Initial Charge Height: 214 inch

Final Charge Height: inch

Sample Weight: 164.2 kg

Bulk Density: 1.656 tonne/m<sup>3</sup>

Starting Date: February 18, 1998

Ore Sample: Carmacks ROM crushed to -3/4"

Head Assay Cu<sub>up</sub>: 1.02 %

Head Assay Cu<sub>feed solution</sub>: 0.80 %

Calculated Cu<sub>up</sub>: 0.99 %

Calculated Cu<sub>feed solution</sub>: %

Hold up Volume: 23.15 Litre

Drain Volume: 5.46 Litre

Report Date: February 19, 2001

Curing Period: 5 days

Curing Water Addition: 19.9 kg/tonne

Curing Acid Concentration: 95 % H<sub>2</sub>SO<sub>4</sub>

Curing Acid Consumption: 15.00 kg/tonne

Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 10.0 g/L

Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 14.0 L/m<sup>2</sup>/h

Initial Sample Moisture: 1.77 % by weight

Final Residue Moisture: 10.8 % by weight

Day	COLUMN										PLS				SX Raffinate				Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption						
	H <sub>2</sub> SO <sub>4</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Extraction (%)	Cum. vs. feed (kg/ore)	Cum. (kg/ore)							
0	57.26	15.00	9.24	1.0060	5.73	1.12	0.00	0.00	10.00																		
1	81.38	15.00	8.83	1.0060	6.14	1.12			10.00								0.0	0.0	0.0	15.72							
2	60.31	15.00	8.93	1.0060	6.03	1.12			10.00								0.0	0.0	0.0	16.09							
3	65.21	15.00	8.44	1.0060	6.52	1.12			10.00	5.57	1.2332	4.51	2.94	240	56.0	6.13	27.30	3.45	1.1466	3.00	0.83	1.49	105.60	252.7	15.1	16.49	10,712.6
4	59.89	15.00	8.98	1.0060	5.99	1.12			10.00	6.69	1.1111	6.02	3.47	221	30.0	1.07	19.55	4.78	1.0680	4.48	0.77	0.61	62.50	433.3	25.9	16.85	6,385.4
5	60.69	14.00	7.90	1.0060	6.07	1.12			10.00	5.99	1.0601	5.85	3.63	212	16.00	0.53	13.90	5.91	1.0384	5.69	0.80	0.23	36.70	523.7	31.3	17.22	5,399.0
6		15.00	9.06	1.0132	5.97	1.34	0.11	3.76	13.05	6.06	1.0385	5.83	3.71	214	10.50	3.76	9.93	6.00	1.0247	5.85	1.05	0.045	22.90	584.3	34.9	17.22	4,839.3
7		15.00	8.96	1.0141	5.96	1.31	0.14	0.49	12.90	5.75	1.0274	5.60	4.19	155	7.70	0.30	6.03	5.13	1.0174	5.04	1.04	0.018	16.90	626.6	37.4	17.22	4,512.9
8		15.00	8.90	1.0156	6.01	1.25	0.16	0.05	13.05	5.85	1.0213	5.72	3.70	295	6.00	0.03	5.00	5.92	1.0136	5.74	0.99	0.011	14.30	660.0	39.4	17.22	4,284.5
9		25.00	17.90	1.0145	7.00	1.32	0.13	0.36	12.66	5.80	1.0204	5.68	3.65	298	5.90	0.35	4.82	5.66	1.0126	5.59	1.04	0.008	12.70	690.3	41.2	17.22	4,086.2
10		17.90	11.80	1.0145	6.01	1.32			12.66	6.53	1.0217	6.39	3.60	304	5.50	0.47		6.31	1.0140	6.22	1.26	0.010		725.5	43.3	17.22	3,897.7
11		11.80	6.55	1.0145	5.17	1.32			12.66	6.07	1.0233	5.93	3.66	299	5.40	0.61		5.93	1.0165	5.83	1.23	0.008		757.5	45.2	17.22	3,753.0
12		23.00	16.88	1.0131	6.05	1.45	0.09	0.24	11.77	5.35	1.0237	5.22	3.72	306	4.80	0.65	4.76	5.04	1.0167	4.96	1.25	0.004	12.42	782.0	46.7	17.22	3,616.0
13		25.00	16.81	1.0126	6.11	1.25	0.07	0.24	12.91	6.11	1.0226	5.97	3.76	315	4.30	0.67	4.61	5.87	1.0168	5.77	1.26	0.004	11.11	807.3	48.2	17.22	3,502.9
14		18.81	12.67	1.0126	6.07	1.25	0.07	0.24	12.91	6.01	1.0219	5.88	3.82	309	3.90	0.72	4.02	5.92	1.0160	5.83	1.39	0.016	8.43	825.7	49.5	17.22	3,408.0
15		12.67	6.55	1.0126	6.04	1.25	0.07	0.24	12.91	6.04	1.0214	5.91	3.83	297	3.50	0.71	4.07	5.93	1.0160	5.83	1.48	0.013	7.72	850.0	50.8	17.22	3,326.7
16		27.00	20.52	1.0140	6.40	1.26	0.03	0.34	16.80	6.19	1.0210	6.06	3.76	308	3.10	0.67	3.75	6.00	1.0155	5.80	1.44	0.014	7.81	868.6	51.9	17.22	3,255.4
17		21.00	14.74	1.0170	6.15	1.12	0.03	0.34	16.80	6.38	1.0199	6.25	3.60	322	2.90	0.69	6.10	6.24	1.0158	6.14	1.45	0.012	9.09	886.6	52.9	17.65	3,268.4
18		14.74	9.35	1.0170	5.30	1.12	0.03	0.34	16.80	5.88	1.0199	5.77	3.63	321	2.75	0.70	6.17	5.74	1.0151	5.65	1.49	0.012	8.86	902.3	53.9	17.65	3,211.5
19		50.00	21.45	16.45	1.0175	5.90	1.14	0.02	16.71	5.23	1.0207	5.12	3.74	310	2.75	0.72	6.28	5.08	1.0161	5.00	1.39	0.009	9.65	916.3	54.7	17.95	3,217.1
20		15.45	9.56	1.0175	5.79	1.14	0.02	0.44	16.71	5.90	1.0216	5.77	3.76	305	2.75	0.79	5.87	5.81	1.0176	5.70	1.60	0.009	9.27	932.0	55.7	17.95	3,162.6
21		47.13	27.60	20.84	1.0178	6.64	1.19	0.01	14.47	5.89	1.0235	5.75	3.68	306	2.70	0.92	6.32	5.74	1.0193	5.63	1.46	0.012	9.49	947.5	56.6	18.24	3,180.8
22		20.84	14.76	1.0178	5.97	1.19	0.01	0.59	14.47	6.24	1.0240	6.09	3.65	306	1.35	1.0		6.14	1.0200	6.01	1.60	0.008		955.7	57.1	18.24	3,133.8
23		130.00	32.10	24.90	1.0198	7.06	1.23	0.01	14.56	6.00	1.0241	5.86	3.70	307	2.60	0.96	6.22	5.91	1.0204	5.79	1.60	0.012	9.09	970.8	58.0	19.03	3,218.9

# COPPER COLUMN LEACH TEST DATA

Carmacks Project

Project: 97-004  
 Column: C  
 Column Size: 6"x216"  
 Initial Charge Height: 214 inch  
 Final Charge Height: 172 inch  
 Sample Weight: 164.2 kg  
 Bulk Density: 1.656 tonne/m<sup>3</sup>

Ore Sample: Carmacks ROM crushed to -3/4"  
 Head Assay Cu<sub>feed</sub>: 1.02 %  
 Head Assay Cu<sub>leach</sub>: 0.90 %  
 Calculated Cu<sub>feed</sub>: 0.99 %  
 Calculated Cu<sub>leach</sub>: 0.99 %  
 Hold up Volume: 23.15 Litre  
 Drain Volume: 5.46 Litre

Curing Period: 5 days  
 Curing Water Addition: 19.9 kg/tonne  
 Curing Acid Concentration: 95 % H<sub>2</sub>SO<sub>4</sub>  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 15.00 kg/l  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 14.0 L/m<sup>2</sup>/h  
 Initial Sample Moisture: 1.77 % by weight  
 Final Residue Moisture: 10.8 % by weight

Report Date: February 19, 2001

Starting Date: February 18, 1998

Day	COLUMN										SX					Cu		H <sub>2</sub> SO <sub>4</sub>										
	H <sub>2</sub> SO <sub>4</sub> added* (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Leached Extr. (%)	Cum. vs. Cu (kg/ore)	Consumption (kg/ore)								
24		24.90	20.19	1.0198	4.62	1.23	0.01	0.65	14.56	6.55	1.0247	6.39	3.69	305	2.40	1.01	6.17	6.37	1.0216	6.24	1.59	0.010	8.75	986.1	58.9	19.03	3,169.0	
25		20.19	14.81	1.0198	5.28	1.23	0.01	0.65	14.56	5.93	1.0240	5.79	3.69	304	2.25	1.05	6.04	5.81	1.0205	5.69	1.58	0.008	8.63	999.0	59.6	19.03	3,127.9	
26		14.81	8.82	1.0198	5.87	1.23	0.01	0.65	14.56	5.16	1.0244	5.06	3.70	302	2.20	1.11	6.22	5.07	1.0214	4.96	1.52	0.007	9.18	1,010.1	60.3	19.03	3,093.7	
27	137.00	31.46	25.25	1.0221	6.08	1.29	0.01	0.78	14.18	5.94	1.0257	5.69	3.70	304	2.00	1.15	5.96	5.70	1.0221	5.57	1.54	0.008	7.79	1,021.4	61.0	19.87	3,193.6	
28		25.25	18.94	1.0221	6.17	1.29	0.01	0.78	14.18	6.08	1.0254	5.93	3.69	304	1.90	1.18	5.96	6.00	1.0226	5.86	1.61	0.006	7.59	1,032.6	61.7	19.87	3,158.9	
29	18.94	12.80	12.80	1.0221	6.00	1.29	0.01	0.78	14.18	6.17	1.0256	6.01	3.69	303	1.85	1.18	6.04	6.08	1.0231	5.94	1.65	0.007	7.50	1,043.6	62.3	19.87	3,125.5	
30	175.40	35.83	29.49	1.0248	6.19	1.28	0.01	0.85	15.11	6.02	1.0265	5.86	3.63	303	1.85	1.18	6.20	5.94	1.0241	5.80	1.67	0.006	7.64	1,054.4	63.0	20.95	3,262.7	
31		29.49	24.39	1.0248	4.96	1.28	0.01	0.85	15.11	6.28	1.0276	6.11	3.64	303	1.85	1.33		6.12	1.0246	5.97	1.66	0.007	7.55	1,065.7	63.6	20.95	3,228.3	
32		24.39	23.13	1.0248	1.22	1.28	0.01	0.85	15.11	5.00	1.0274	4.86	3.63	305	1.80	1.34		4.89	1.0257	4.77	1.67	0.006	7.98	1,074.4	64.1	20.95	3,202.0	
33		23.13	17.35	1.0248	5.65	1.28	0.01	0.85	15.11	3.48	1.0286	3.38	3.66	304	1.80	1.39		3.35	1.0258	3.27	1.80	0.010	8.84	1,080.4	64.5	20.95	3,184.1	
34		17.35	11.36	1.0248	5.85	1.28	0.01	0.85	15.11	3.43	1.0288	3.33	3.61	302	1.90	1.39	5.47	3.31	1.0264	3.22	1.57	0.008	8.61	1,086.7	64.9	20.95	3,165.8	
35		11.36	5.16	1.0248	6.05	1.28	0.01	0.85	15.11	5.87	1.0289	5.69	3.59	304	1.90	1.45	5.39	5.74	1.0270	5.58	1.67	0.007	7.85	1,097.5	65.5	20.95	3,134.7	
36	285.40	39.59	33.35	1.0283	6.07	1.27	0.01	1.20	15.32	6.27	1.0308	6.08	3.64	306	1.60	1.54	5.95	6.23	1.0287	6.05	1.74	0.005	7.80	1,107.1	66.1	22.69	3,365.1	
37		33.35	27.30	1.0283	5.88	1.27	0.01	1.20	15.32	6.05	1.0307	5.87	3.67	305	1.45	1.63	5.88	5.94	1.0295	5.75	1.77	0.006	7.37	1,115.6	66.6	22.69	3,339.6	
38		27.30	20.30	1.0283	6.81	1.27	0.01	1.20	15.32	6.34	1.0310	6.15	3.48	315	1.32	1.60	5.87	6.24	1.0280	6.06	1.70	0.004	7.71	1,123.7	67.1	22.69	3,315.6	
39		20.30	14.73	1.0283	5.41	1.27	0.01	1.20	15.32	6.43	1.0319	6.23	3.42	323	1.31	1.67	6.33	6.34	1.0310	6.14	1.71	0.002	7.71	1,131.8	67.6	22.69	3,291.8	
40		14.73	8.22	1.0283	6.33	1.27	0.01	1.20	15.32	5.43	1.0334	5.25	3.30	342	1.30	1.74	6.56	5.33	1.0320	5.16	1.63	0.003	7.82	1,138.6	68.0	22.69	3,272.2	
41	157.60	26.60	24.06	1.0315	2.47	1.16	0.008	1.39	14.94	6.32	1.0348	6.11	3.19	351	1.28	1.78	7.18	6.20	1.0321	6.00	1.66	0.004	7.22	1,146.4	68.4	23.65	3,387.5	
42		24.06	13.08	1.0315	10.64	1.16	0.008	1.39	14.94	3.37	1.0339	3.26	3.14	358	1.24	1.89	6.75		#DIV/0!					1,150.3	68.7	23.65	3,375.8	
43		13.08	0.00	1.0315	12.68	1.16	0.008	1.39	14.94	10.04	1.0344	9.70	3.16	358	1.19	1.94	6.99	13.22	1.0321	12.80	1.81		6.91	1,161.8	69.4	23.65	3,342.6	
44	315.70	40.90	30.70	1.0345	9.86	1.32	0.003	1.73	13.89	13.37	1.0370	12.89	2.83	381	0.86	2.82	6.99		#DIV/0!		0.002				1,173.1	70.0	25.57	3,579.4
45		30.70	17.20	1.0345	13.05	1.32	0.003	1.73	13.89	10.18	1.0393	9.80	2.74	383	0.93	3.02	6.39		#DIV/0!						1,182.1	70.6	25.57	3,552.0
46		17.20	5.95	1.0345	10.88	1.32	0.003	1.73	13.89	13.56	1.0408	13.02	2.68	385	0.87	3.36	6.68		#DIV/0!						1,193.4	71.3	25.57	3,518.4
47	174.40	49.00	38.10	1.0410	10.47	1.30	0.035	2.72	13.51	10.13	1.0419	9.72	2.65	384	0.79	3.52	6.90	47.01	1.0383	45.28	1.90	0.002		1,200.8	71.7	26.63	3,642.2	

# LEACH TEST DATA

ks Project

Project: 97-084

Column: C

Column Size: 6"x216"

Initial Charge Height: 214 inch

Final Charge Height: 173 inch

Sample Weight: 164.2 kg

Bulk Density: 1.656 tonne/m<sup>3</sup>

Ore Sample: Carmacks ROM crushed to -3/4"

Head Assay Cu: 1.02 %

Head Assay Cu (leach residue): 0.90 %

Calculated Cu: 0.99 %

Calculated Cu (leach residue): %

Hold up Volume: 23.15 Litre

Drain Volume: 5.48 Litre

Curing Period: 5 days

19.9 kg/tonne

95 % H<sub>2</sub>SO<sub>4</sub>

15.00 kg/tonne

10.0 g/L

14.0 L/m<sup>2</sup>/h

1.77 % by weight

10.8 % by weight

Curing Acid Concentration:

Curing Acid Concentration:

Curing Acid Consumption:

Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration:

Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate:

Initial Sample Moisture:

Final Residue Moisture:

Report Date: February 19, 2001

Starting Date: February 18, 1998

## COLUMN

Day	Feed										PLS										SX Raffinate				Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption		
	H <sub>2</sub> SO <sub>4</sub> added* (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	ORP (mV <sup>vs</sup> )	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Cum. Extraction (%)	Cum. vs. feed (kg/tonne)	Cum. vs. Cu (kg/Cu)	
48		38.10	25.80	1.0410	11.82	1.30	0.035	2.72	13.51	11.70	1.0421	11.23	2.61	385	0.75	3.52	5.93			#DIV/0!						1,208.8	72.2	26.63	3,618.0
49		25.80	13.40	1.0410	11.91	1.30	0.035	2.72	13.51	11.80	1.0439	11.11	2.50	405	0.72	3.71	6.18			#DIV/0!						1,216.3	72.6	26.63	3,595.5
50	315.00	45.80	33.20	1.0468	12.04	1.23	0.011	3.25	15.80	11.90	1.0463	11.37	2.48	409	0.74	4.05	7.61			33.24		0.002		8.04	1,224.6	73.1	28.56	3,825.2	
51		33.20	21.10	1.0468	11.56	1.23	0.011	3.25	15.80	12.70	1.0483	12.11	2.51	412	0.71	4.05	7.14			#DIV/0!						1,233.1	73.6	28.56	3,802.9
52		21.10	19.50	1.0468	10.51	1.23	0.011	3.25	15.80	11.90	1.0514	11.32	2.47	412	0.70	4.45	7.52			#DIV/0!						1,241.0	74.1	28.56	3,778.7
53		19.50	8.50	1.0468	10.51	1.23	0.011	3.25	15.80	4.50	1.0539	4.27	2.45	413	0.72	5.35	7.90			#DIV/0!						1,244.0	74.3	28.56	3,769.7
54	210.00	37.40	26.80	1.0527	10.07	1.30	0.005	4.10	15.08	8.00	1.0553	7.58	2.54	406	0.95	4.75	8.28			35.03		0.003		8.56	1,251.1	74.7	29.84	3,916.0	
55		26.80	14.40	1.0527	11.78	1.30	0.005	4.10	15.08	10.20	1.0547	9.87	2.29	413	0.65	5.00	7.96			#DIV/0!						1,257.3	75.1	29.84	3,896.6
56		14.40	2.20	1.0527	11.59	1.30	0.005	4.10	15.08	12.10	1.0559	11.46	2.24	416	0.84	5.34	8.13			#DIV/0!						1,264.6	75.5	29.84	3,874.2
57		52.90	40.10	1.0379	12.93	1.23	0.003	2.92	14.73	11.90	1.0584	11.24	2.19	418	0.82	5.84	8.00			32.44		0.003		9.32	1,271.6	75.9	29.84	3,853.0	
58		40.10	26.50	1.0379	13.10	1.23	0.003	2.92	14.73	12.40	1.0589	11.71	2.26	416	0.60	5.89	8.85			#DIV/0!						1,278.5	76.3	29.84	3,832.0
59		26.50	15.10	1.0379	10.98	1.23	0.003	2.92	14.73	14.50	1.0529	13.77	2.16	415	0.57	5.34	8.16			#DIV/0!						1,286.4	76.8	29.84	3,808.7
60		15.10	4.40	1.0379	10.31	1.23	0.003	2.92	14.73	11.20	1.0470	10.70	2.28	418	0.52	4.64	7.09			#DIV/0!						1,291.9	77.1	29.84	3,792.4
61	333.00	49.40	36.40	1.0532	12.34	1.40	0.005	4.59	14.63	10.60	1.0460	10.13	2.23	419	0.51	4.79	5.97			46.48		0.040		7.53	1,297.0	77.4	31.87	4,034.2	
62		36.40	23.40	1.0532	12.34	1.40	0.005	4.59	14.63	11.80	1.0459	11.28	2.16	418	0.48	4.64	5.44			#DIV/0!						1,302.4	77.8	31.87	4,017.6
63		23.40	11.30	1.0532	11.49	1.40	0.005	4.59	14.63	12.30	1.0509	11.70	2.18	417	0.48	4.98	8.38			#DIV/0!						1,307.9	78.1	31.87	4,000.5
64		11.30	0.00	1.0532	10.73	1.40	0.005	4.59	14.63	11.70	1.0576	11.06	2.20	415	0.47	5.69	8.77			#DIV/0!						1,313.1	78.4	31.87	3,984.9
65	70.00	43.50	30.60	1.0531	12.25	1.63	0.002	5.20	9.87	11.70	1.0592	11.05	2.21	419	0.43	5.95	8.75			45.17		1.83		8.80	1,317.8	78.7	32.29	4,023.7	
66		30.60	16.40	1.0531	13.48	1.63	0.002	5.20	9.87	12.10	1.0598	11.42	2.12	416	0.42	5.90	8.70			#DIV/0!						1,322.6	79.0	32.29	4,009.2
67		16.40	7.50	1.0531	8.45	1.63	0.002	5.20	9.87	13.80	1.0601	13.02	2.12	412	0.38	5.50	8.65			#DIV/0!						1,327.5	79.3	32.29	3,984.3
68	241.00	58.30	46.40	1.0377	11.47	1.51	0.002	3.30	8.99	8.10	1.0566	7.67	2.13	405	0.32	5.25	7.97			32.16		1.74	0.002	8.84	1,329.9	79.4	33.76	4,166.2	
69		46.40	34.50	1.0377	11.47	1.51	0.002	3.30	8.99	11.80	1.0565	11.18	2.14	403	0.29	5.30	8.65			#DIV/0!						1,333.1	79.6	33.76	4,156.1
70		34.50	21.90	1.0377	12.14	1.51	0.002	3.30	8.99	12.70	1.0511	12.08	2.20	413	0.26	4.70			#DIV/0!							1,338.2	79.8	33.76	4,148.4
71		21.90	9.00	1.0377	12.43	1.51	0.002	3.30	8.99	12.40	1.0494	11.88	2.15	410	0.26	4.85			#DIV/0!							1,339.3	80.0	33.76	4,139.0

**COPPER COLUMN LEACH TEST DATA**  
Carmacks Project

Project: 97-064  
Column: C  
Column Size: 6"x216"  
Initial Charge Height: 214 inch  
Final Charge Height: inch  
Sample Weight: 164.2 kg  
Bulk Density: 1.656 tonne/m<sup>3</sup>

Ore Sample: Carmacks ROM crushed to -3/4"  
Head Assay Cum: 1.02 %  
Head Assay Cu<sub>leached solution</sub>: 0.90 %  
Calculated Cum: 0.99 %  
Calculated Cu<sub>leached solution</sub>: %  
Hold up Volume: 23.15 Litre  
Drain Volume: 5.46 Litre

Curing Period: 5 days  
Curing Water Addition: 19.9 kg/tonne  
Curing Acid Concentration: 95 % H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Consumption: 15.00 kg/tonne  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 10.0 g/L  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 14.0 L/m<sup>2</sup>/h  
Initial Sample Moisture: 1.77 % by weight  
Final Residue Moisture: 10.9 % by weight

Starting Date: February 18, 1998

Report Date: February 19, 2001

Day	COLUMN											PLS				SX				Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption				
	H <sub>2</sub> SO <sub>4</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	Extraction (%)	Cum. Weight (g)	Cum. vs. feed (kg/tonne)	Cum. vs. Cu (kg/tonne)					
72	104.50	55.30	40.80	1.0461	13.86	1.52	0.002	4.00	12.80	1.0418	12.29	2.18	4.14	0.26	4.05		49.70	1.0462	47.51	1.82	0.001		1,342.5	80.2	34.40	4,207.0
73		40.80	28.30	1.0461	11.95	1.52	0.002	4.00	13.50	1.0423	12.95	2.15	4.08	0.28	3.96	5.70			#DIV/0!				1,346.0	80.4	34.40	4,196.0
74		28.30	18.00	1.0461	9.85	1.52			12.00	1.0450	11.48	2.21	4.05	0.27	4.12	6.23			#DIV/0!				1,348.1	80.5	34.40	4,166.5
75		0.00	0.00	1.0000	0.00				10.00	1.0485	9.54	2.21	4.08	0.25	4.32	6.43			#DIV/0!				1,351.4	80.7	34.40	4,179.1
76		0.00	0.00	1.0000	0.00				4.70	1.0495	4.48	2.28	4.02	0.26	4.32	6.20			#DIV/0!				1,352.6	80.8	34.40	4,175.6
77		0.00	0.00	1.0000	0.00				0.90	1.0509	0.86	2.27	3.97	0.37	4.15	6.45			#DIV/0!				1,352.9	80.8	34.40	4,174.6
78		0.00	0.00	1.0000	0.00				0.50	1.0522	0.48	2.28	3.97	0.47	4.30	6.80			#DIV/0!				1,353.1	80.8	34.40	4,173.9
79		0.00	0.00	1.0000	0.00				0.35	1.0517	0.33	2.42	3.95	0.52	4.10	6.37			#DIV/0!				1,353.3	80.8	34.40	4,173.4
82		0.00	0.00	1.0000	0.00				0.52	1.0512	0.49	2.56	4.15	0.80	3.35	6.70	42.50	1.0454	40.65	1.78	0.006	7.65	1,353.6	80.8	34.40	4,172.5
83		60.10	19.20	1.0460	39.10	1.78	0.005	3.55								8.92			#DIV/0!				1,353.4	80.8	34.40	4,173.1
90		54.10	27.40	1.0469	25.50	1.89	0.245	3.30	34.90	1.0476	33.31	2.28	4.13	0.80	3.20	6.02			#DIV/0!				1,373.8	82.0	34.40	4,111.1
96		52.60	16.70	1.0462	34.31	2.38	0.285	2.95	25.20	1.0449	24.12	2.38	5.49	0.31	2.23				#DIV/0!				1,371.4	81.9	34.40	4,118.4
103		51.90	10.80	1.0435	39.39	2.40	0.380	1.90	35.20	1.0423	33.77	2.44	5.36	0.44	1.50	7.45			#DIV/0!				1,371.3	81.9	34.40	4,118.7
110		50.10	28.60	1.0416	20.64	2.37	0.470	1.27	39.30	1.0413	37.74	2.39	5.54	0.49	1.12	7.99			#DIV/0!				1,379.9	82.4	34.40	4,093.0
114		48.60	30.50	1.0460	17.30	1.76	0.002	0.65	21.50	1.0418	20.64	2.45	5.55	0.54	0.83	8.18	50.10	1.0460	47.90	1.76	0.003	9.56	1,391.0	83.1	34.40	4,060.3
117		48.00	7.40	1.0419	36.97	1.87	0.196	0.67	17.50	1.0424	16.79	2.48	5.50	0.55	0.69	8.19			#DIV/0!				1,392.6	83.1	34.40	4,055.7
124		46.30	6.70	1.0420	38.00	2.30	0.275	0.63	38.80	1.0421	37.33	2.42	5.44	0.30	0.61	8.56			#DIV/0!				1,393.1	83.2	34.40	4,054.1
131		42.30	8.40	1.0422	32.53	2.49	0.330	0.47	35.60	1.0422	34.16	2.51	5.54	0.35	0.46	8.39			#DIV/0!				1,394.4	83.3	34.40	4,050.5
138		44.10	1.10	1.0432	41.22	2.57	0.365	0.38	35.70	1.0432	34.22	2.59	5.52	0.42	0.37	8.20			#DIV/0!				1,392.7	83.2	34.40	4,055.4
145		42.30	2.00	1.0441	36.60	2.60	0.440	0.26	41.20	1.0440	39.46	2.60	5.48	0.45	0.26	0.31			#DIV/0!				1,393.3	83.2	34.40	4,053.7
152		40.20	0.00	1.0443	38.49	2.66	0.465	0.20	38.20	1.0442	36.58	2.66	5.40	0.49	0.20	0.28	41.30	1.0419	39.64	2.00	0.003	1.86	1,392.3	83.1	34.40	4,056.4
159		51.30	1.90	1.0350	47.73	2.09	0.003	0.08	41.50	1.0434	39.77	2.64	5.46	0.53	0.17	0.28			#DIV/0!				1,413.3	84.4	34.40	3,996.3
167		46.10	9.00	1.0417	35.61	2.79	0.320	0.14	44.20	1.0415	42.44	2.82	5.37	0.34	0.16	0.23			#DIV/0!				1,416.1	84.6	34.40	3,988.3
173		43.80	0.70	1.0403	41.43	2.79	0.225	0.14	34.80	1.0399	33.46	2.79	5.17	0.22	0.14	0.23			#DIV/0!				1,414.0	84.4	34.40	3,994.3



# COPPER COLUMN LEACH TEST DATA

Carmacks Project

Project: 97-084  
 Column: C  
 Column Size: 6"x216"  
 Initial Charge Height: 214 inch  
 Final Charge Height: 164.2 inch  
 Sample Weight: 164.2 kg  
 Bulk Density: 1.656 tonne/m<sup>3</sup>

Ore Sample: Carmacks ROM crushed to -3/4"  
 Head Assay Cu<sub>feed</sub>: 1.02 %  
 Head Assay Cu<sub>leach solution</sub>: 0.90 %  
 Calculated Cu<sub>feed</sub>: 0.99 %  
 Calculated Cu<sub>leach solution</sub>: %  
 Hold up Volume: 23.15 Litre  
 Drain Volume: 5.46 Litre

5 days  
 19.9 kg/tonne  
 95 % H<sub>2</sub>SO<sub>4</sub>  
 15.00 kg/tonne  
 10.0 g/L  
 14.0 L/m<sup>2</sup>/h  
 1.77 % by weight  
 10.8 % by weight

Starting Date: February 18, 1998

Report Date: February 19, 2001

Day	COLUMN										SX					Cu		H <sub>2</sub> SO <sub>4</sub>			
	H <sub>2</sub> SO <sub>4</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Leached (%)	Cum. vs. feed (kg/fore)	Cum. (kg)	
180		42.20	0.00	1.0435	40.44	2.72	0.317	0.14	0.22	41.50	1.0421	39.82	2.71	0.33	0.13	0.22					
187		49.50	43.60	1.0350	5.70	2.87	0.250	0.08		39.50	1.0443	37.82	2.82	0.33	0.10		1,425.2	85.1	34.40	3,963.0	
188										6.80	1.0434	6.52	2.79	0.36	0.09		1,427.5	85.2	34.40	3,956.5	
189										3.10	2.92						1,427.5		34.40	3,956.5	
190										0.80	0.74										
191										0.41	0.40										
192										0.21	0.20										
193										0.22	0.13										
194										0.09	0.09										
195										0.04	0.04										
196										0.01	0.05										
197										0.00	0.03										
198										0.00	0.00										
199																					
200																					
201																					
202																					
203																					
204																					

## SIZE-ASSAY ANALYSIS REPORT

Client: Western Copper  
Project: 97-084

Date: 30-Jan-98

Sample: Carmacks Column C Head Sample

Size Fraction	Weight (%)	Assay (%)		Distribution (%)	
		Cu <sub>(T)</sub>	Cu* <sub>(a.s.)</sub>	Cu <sub>(T)</sub>	Cu <sub>(a.s.)</sub>
-3/4 +1/2"	8.0	0.60	0.50	4.7	4.3
-1/2 +3/8"	17.0	0.72	0.66	12.1	12.2
-3/8 +1/4"	18.0	0.76	0.72	13.5	14.1
-1/4 +6 mesh	15.9	0.86	0.76	13.5	13.1
-6 mesh	41.1	1.38	1.26	56.1	56.3
<b>Total</b>	<b>100.0</b>	<b>1.01</b>	<b>0.92</b>	<b>100.0</b>	<b>100.0</b>

Sample: Carmacks Column C Final Residue

Size Fraction	Weight (%)	Assay (%)		Distribution (%)	
		Cu <sub>(T)</sub>	Cu* <sub>(a.s.)</sub>	Cu <sub>(T)</sub>	Cu <sub>(a.s.)</sub>
-3/4 +1/2"	5.5	0.18	0.17	8.3	8.5
-1/2 +3/8"	13.5	0.12	0.12	13.6	14.9
-3/8 +1/4"	14.7	0.11	0.09	13.5	12.1
-1/4 +6 mesh	14.1	0.10	0.09	11.8	11.6
-6 mesh	52.3	0.12	0.11	52.7	52.8
<b>Total</b>	<b>100.0</b>	<b>0.12</b>	<b>0.11</b>	<b>100.0</b>	<b>100.0</b>

\* Acid soluble (a.s.) copper assays were obtained by digesting 1 g sample in 50mL 10% H<sub>2</sub>SO<sub>4</sub> at room temperature for 2 hours.

## SIZE-ASSAY ANALYSIS REPORT

Test: SA3  
Sample: Carmacks Column C Top Residue

Date: May 14, 1998  
Project: 97-084

Size Fraction	Weight (%)	Assay (%)		Distribution (%)	
		Cu	Fe	Cu	Fe
-3/4 +1/2"	4.1	0.080	3.45	4.9	5.0
-1/2" + 4 mesh	25.6	0.036	2.19	13.8	19.6
-4 +10 mesh	13.5	0.036	2.15	7.3	10.2
-10 +20 mesh	8.0	0.044	2.23	5.3	6.3
-20 mesh	48.8	0.094	3.45	68.7	59.0
<b>Total</b>	<b>100.0</b>	<b>0.067</b>	<b>2.85</b>	<b>100.0</b>	<b>100.0</b>

## SIZE-ASSAY ANALYSIS REPORT

**Test:** SA1  
**Sample:** Carmacks Head Sample

**Date:** December 24, 1997  
**Project:** 97-084

Size Fraction	Weight (%)	Assay (%)		Distribution (%)	
		Cu <sub>(T)</sub>	Cu* <sub>(acid soluble)</sub>	Cu <sub>(T)</sub>	Cu <sub>(acid soluble)</sub>
...					
+12"	0.37	0.78	0.72	0.3	0.3
-12 +8"	0.53	0.78	0.72	0.4	0.4
-8 +6"	1.21	0.78	0.72	0.9	0.9
-6 +4"	4.40	0.780	0.720	3.3	3.4
-4 +2"	16.38	0.800	0.740	12.5	12.8
-2 +1"	14.33	0.820	0.740	11.2	11.2
-1 +1/2"	9.07	0.820	0.740	7.1	7.1
-1/2" +4 mesh	16.23	0.940	0.840	14.6	14.4
-4 +6 mesh	5.87	1.04	0.960	5.8	6.0
-6 +10 mesh	3.46	0.820	0.760	2.7	2.8
-10 +20 mesh	5.41	1.14	1.06	5.9	6.1
-20 mesh	22.75	1.62	1.50	35.2	36.2
<b>Total</b>	<b>100.00</b>	<b>1.05</b>	<b>0.94</b>	<b>100.0</b>	<b>101.6</b>

\* Acid soluble copper assays were obtained by digesting 1 g sample in 50 mL 10% H<sub>2</sub>SO<sub>4</sub> at room temperature for 2 hours.

\*\* These fractions were not sampled for assay due to difficulties in sampling.

# COLUMN AB LEACH TEST DATA

Cannacks Project

Project: 97-084      Column: A      B  
 Column Size: 36"x154"  
 Initial Charge Height: 137    138    inch  
 Final Charge Height: 4405.5    4389.5    kg  
 Sample Weight: 1.916    1.923    tonne/m<sup>3</sup>  
 Bulk Density: 1.916    1.923    tonne/m<sup>3</sup>

One Sample: Cannacks ROM  
 Head Assay Cup: 1.01 %  
 Head Assay Cup: 0.83 %  
 Calculated Cup: %  
 Calculated Cup: %  
 Hold up Volume: Litre  
 Drain Volume: Litre

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
 Curing Acid Volume: 472.1 L  
 Curing Period: 7 days  
 Curing Acid Consumption: 12.58 kg/tonne  
 8.0 g/L  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 7.0 L/m<sup>2</sup>/h  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 1.77 % by weight  
 Initial Sample Moisture: % by weight  
 Final Residue Moisture: % by weight

Report Date: February 9, 1998

Date	Day	COLUMN A										COLUMN B										SX Raffinate										Cu		H <sub>2</sub> SO <sub>4</sub> Consumption	
		Feed					PLS					PLS					PLS					Raffinate					Leached		Cum.						
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	e.g. (g/mL)	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	e.g. (g/mL)	Volume (L)	pH	ORP (mV)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	e.g. (g/mL)	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (g)	vs. Cu (%)	Cum. (kg/tonne)	Cum. (kg/tonne)						
9-Feb-98	0	0.87	201.10	87.30	1.0053	113.2	1.35	0.00	0.00	7.70																									
10-Feb-98	1	0.79	286.40	184.70	1.0053	103.2	1.35	0.00	0.00	7.70																									
11-Feb-98	2	0.70	184.70	93.10	1.0053	91.1	1.35	0.00	0.00	7.70																									
12-Feb-98	3	0.79	103.20	0.00	1.0053	102.7	1.35	0.00	0.00	7.70																									
13-Feb-98	4		205.30	72.60	1.0209	130.0	1.39	0.83	2.87	7.85																									
14-Feb-98	5		205.30	116.50	1.0263	86.5	1.42			7.55																									
15-Feb-98	6		116.50	22.10	1.0263	92.0	1.42			7.55																									
16-Feb-98	7		205.60	81.00	1.0278	111.5	1.47	0.87	2.47	7.65																									
17-Feb-98	8		204.90	153.10	1.0246	50.6	1.68	0.70	1.98	7.45																									
18-Feb-98	9		153.70	55.50	1.0246	95.8	1.68			7.45																									
19-Feb-98	10		205.30	94.20	1.0283	108.3	1.37	0.87	2.00	8.63																									
20-Feb-98	11		205.10	101.70	1.0225	101.1	1.44	0.56	1.70	8.92																									
21-Feb-98	12	0.60	212.60	95.70	1.0256	114.0	1.35	0.81	1.80	11.47																									
22-Feb-98	13		204.60	78.80	1.0258	124.6	1.41	0.64	1.40	10.69																									
23-Feb-98	14		205.10	105.40	1.0254	97.2	1.32	0.51	1.39	10.54																									
24-Feb-98	15		105.40	0.00	1.0254	102.8	1.32			10.54																									
25-Feb-98	16		205.20	92.70	1.0260	109.6		0.52	1.19	11.32																									
26-Feb-98	17		205.20	88.90	1.0230	103.9	1.21	0.42	0.89	11.56																									
27-Feb-98	18		204.30	90.60	1.0273	109.5	1.22	0.36	0.92	11.81																									
28-Feb-98	19		204.50	95.20	1.0288	106.2	1.22	0.46	0.87	11.40																									
1-Mar-98	20		95.20	2.00	1.0229	91.1	1.22	0.00	0.00	11.40																									
2-Mar-98	21		205.00	81.10	1.0227	121.1	1.21	0.50	0.88	10.78																									
3-Mar-98	22		204.30	102.40	1.0218	99.7	1.18	0.28	0.90	11.47																									
4-Mar-98	23		204.10	79.20	1.0204	122.4	1.32	0.22	0.80	11.25																									
5-Mar-98	24		203.70	95.60	1.0181	106.0	1.24	0.23	0.69	9.96																									
6-Mar-98	25		205.40	85.90	1.0271	116.6	1.14	0.29	0.81	14.60																									
7-Mar-98	26		205.30	90.40	1.0264	111.9	1.20	0.32	0.82	14.44																									
8-Mar-98	27		205.50	76.90	1.0273	125.2	1.33	0.22	0.96	14.21																									
9-Mar-98	28		205.40	88.40	1.0280	113.8	1.21	0.14	0.97	15.45																									

# OLJMN AB LEACH TEST DATA

Carmacks Project

One Sample: Carmacks ROM

Head Assay Cu: 1.01 %

Head Assay Cu<sub>leach</sub>: 0.93 %

Calculated Cum: %

Calculated Cu<sub>leach</sub>: %

Hold up Volume: Litre

Drain Volume: Litre

Curing Acid Concentration: 285 g/L H<sub>2</sub>SO<sub>4</sub>

Curing Acid Volume: 472.1 L

Curing Period: 7 days

Curing Acid Consumption: 12.56 kg/tonne

Leach H<sub>2</sub>O<sub>4</sub> Solution Concentration: 8.0 g/L

Leach H<sub>2</sub>O<sub>4</sub> Solution Feed Rate: 7.0 Lit/min

Initial Sample Moisture: 1.77 % by weight

Final Residue Moisture: % by weight

Project: 97-084

Column: A B

Column Size: 38" x 154"

Initial Charge Height: 137 inch

Final Charge Height: 136 inch

Sample Weight: 4405.5 kg

Bulk Density: 1.916 g/cm<sup>3</sup>

Starting Date: February 9, 1998

Report Date: February 23, 2001

Date	Day	COLUMN A								COLUMN B								SX Refinate			Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption		
		H <sub>2</sub> O <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> O <sub>4</sub> (g/L)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> O <sub>4</sub> (g/L)	ORP (mV)	pH	Volume (L)	s.g.	Weight (kg)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> O <sub>4</sub> (g/L)	Cum. Weight (g)	Cum. Extraction (%)	Cum. vs. Cu (kg/tonne)	Cum. (kg/tonne)
10-Mar-98	28	205.30	117.70	2.20	1.0267	85.3	1.29	0.15	0.95	14.85	2.10	1.59	1.85	3.76	307	110.70	1.0266	107.9	1.44	0.13	11.24	25,940.7	28.2	13.05	4,425.5
11-Mar-98	30	117.70	2.20	1.0267	112.5	1.23	0.06	1.05	16.67	14.85	2.05	1.87	1.87	3.48	340	128.50	1.0266	125.3	1.53	0.087	10.88	26,438.5	29.8	13.05	4,342.2
12-Mar-98	31	201.90	90.40	1.0308	117.9	1.23	0.06	1.05	16.67	14.85	2.10	1.59	1.85	3.76	307	110.70	1.0266	107.1	1.51	0.085	10.59	26,886.1	30.3	13.05	4,269.9
13-Mar-98	32	176.00	29.90	1.0310	141.7	1.36	0.06	1.09	16.06	14.85	2.35	1.86	2.18	3.50	341	104.70	1.0328	101.4	1.58	0.077	10.42	27,323.7	30.8	13.05	4,201.5
14-Mar-98	33	205.70	106.60	1.0284	94.4	1.30	0.06	1.00	15.01	14.85	2.10	1.87	1.83	3.35	343	95.70	1.0338	92.8	1.49	0.075	10.47	27,725.3	31.2	13.05	4,140.7
15-Mar-98	34	106.80	31.50	1.0284	75.0	1.30	0.06	1.00	15.01	14.85	1.85	1.73	1.91	3.36	343	95.70	1.0338	92.8	1.41	0.086	10.90	28,122.3	31.7	13.05	4,082.2
16-Mar-98	35	0.34	211.30	110.80	1.0277	97.8	1.25	0.18	0.99	14.82	1.85	1.74	1.87	3.59	324	72.80	1.0350	70.3	1.44	0.088	11.57	28,428.3	32.0	13.09	4,050.0
17-Mar-98	36	0.21	202.08	91.20	1.0279	107.9	1.18	0.21	0.98	14.19	1.80	1.74	1.78	3.29	358	140.50	1.0354	135.6	1.43	0.086	10.48	28,807.2	32.5	13.11	3,990.0
18-Mar-98	37	0.37	205.60	125.80	1.0278	77.8	1.28	0.21	0.97	14.54	1.85	1.72	2.00	3.48	348	101.50	1.0356	97.9	1.44	0.084	10.10	29,272.8	33.0	13.10	3,952.7
19-Mar-98	38	125.60	37.60	1.0278	85.4	1.28	0.21	0.97	14.54	14.54	2.45	1.66	2.19	3.40	341	85.50	1.0359	82.0	1.42	0.083	10.19	29,622.8	33.3	13.16	3,908.0
20-Mar-98	39	0.63	198.08	87.20	1.0270	108.0	1.29	0.20	0.92	14.90	2.40	1.83	2.23	3.47	330	81.20	1.0358	59.0	1.46	0.086	10.77	29,849.2	33.5	13.23	3,897.6
21-Mar-98	40	0.58	203.74	102.10	1.0287	99.0	1.27	0.19	0.97	15.26	1.90	1.88	1.87	3.48	323	4.70	1.17	6.93	1.34	0.039	11.23	30,074.2	33.9	13.29	3,887.9
22-Mar-98	41	0.52	200.00	134.80	1.0288	92.2	1.29	0.17	0.98	15.22	1.75	1.86	1.79	3.56	317	4.50	1.21	7.09	1.45	0.056	10.77	30,382.2	34.2	13.35	3,865.5
23-Mar-98	42	134.80	40.10	1.0288	96.4	1.21	0.11	1.10	15.28	15.22	2.20	1.74	1.86	3.55	320	4.10	1.27	7.15	1.47	0.051	10.39	30,765.8	34.6	13.35	3,817.3
24-Mar-98	43	0.93	200.00	98.80	1.0286	105.3	1.37	0.09	1.08	14.55	1.80	1.85	1.86	3.52	316	4.10	1.24	6.78	1.41	0.040	10.26	31,070.8	35.0	13.46	3,809.8
25-Mar-98	44	0.24	160.00	49.40	1.0283	107.6	1.23	0.10	1.09	14.84	1.80	1.85	1.86	3.52	316	4.10	1.24	6.78	1.41	0.038	10.18	31,381.7	35.3	13.49	3,776.6
26-Mar-98	45	0.51	160.00	51.60	1.0290	105.3	1.37	0.09	1.08	14.55	1.70	1.89	2.01	3.56	317	3.80	1.24	7.42	1.54	0.040	9.89	31,724.3	35.7	13.54	3,753.7
27-Mar-98	46	0.81	160.00	39.90	1.0290	116.7	1.36	0.09	1.12	15.12	1.70	2.01	1.99	3.49	321	3.90	1.29	7.58	1.57	0.04	9.81	32,047.7	36.1	13.61	3,736.0
28-Mar-98	47	0.68	208.80	105.60	1.0286	100.3	1.36	0.08	1.10	14.41	1.50	1.84	1.90	3.43	372	3.40	1.34	6.07	1.59	0.036	8.84	32,368.1	36.5	13.69	3,717.9
29-Mar-98	48	105.60	5.00	1.0286	97.2	1.38	0.08	1.10	14.41	14.41	1.50	1.89	1.83	3.39	335	3.50	1.37	6.21	1.42	0.036	9.06	32,724.2	36.8	13.69	3,679.7
30-Mar-98	49	0.82	160.00	48.50	1.0315	108.1	1.34	0.08	1.25	14.52	1.50	1.80	1.74	3.33	333	3.40	1.37	6.29	1.39	0.028	8.54	33,030.0	37.2	13.78	3,671.7
31-Mar-98	50	0.66	160.00	57.70	1.0340	98.9	1.12	0.06	1.24	15.15	1.40	1.95	1.75	3.33	330	3.30	1.36	6.34	1.42	0.028	8.96	33,350.1	37.5	13.86	3,655.2
1-Apr-98	51	0.62	206.40	12.90	1.0321	187.5	1.13	0.05	1.19	14.42	1.40	1.98	1.76	3.28	338	3.20	1.36	6.54	1.41	0.030	8.98	33,660.8	37.9	13.93	3,639.9
2-Apr-98	52	0.91	212.30	20.50	1.0324	165.8	1.32	0.05	1.16	14.10	0.85	1.78	1.60	3.02	360	2.70	1.45	6.35	1.58	0.031	8.47	33,963.2	38.2	14.03	3,634.3
3-Apr-98	53	1.03	218.10	22.10	1.0331	167.8	1.21	0.04	1.21	14.37	0.90	1.88	1.68	2.85	370	2.50	1.60	6.01	1.59	0.021	8.53	34,265.5	38.6	14.15	3,630.3
4-Apr-98	54	1.08	218.80	0.00	1.0328	211.9	1.19	0.04	1.25	14.86	0.60	1.75	1.41	2.50	391	2.20	1.73	7.65	1.54	0.016	8.45	34,592.2	39.0	14.27	3,625.1
5-Apr-98	55	1.38	216.10	3.00	1.0330	206.3	1.25	0.04	1.32	15.34	0.80	1.96	1.66	2.45	386	2.00	1.86	8.01	1.62	0.010	8.09	35,107.7	39.5	14.43	3,615.4
6-Apr-98	56	1.33	211.00	1.00	1.0355	202.8	1.24	0.03	1.32	14.70	0.68	1.81	1.47	2.30	364	1.85	2.03	6.52	1.54	0.008	8.09	35,494.9	40.0	14.56	3,613.5
7-Apr-98	57	1.24	221.90	28.30	1.0344	180.1	1.25	0.02	1.48	13.65	0.78	2.03	1.51	2.23	363	2.00	2.09	6.90	1.70	1.53	8.28	35,842.9	40.3	14.72	3,613.0
8-Apr-98	58	1.59	225.40	0.00	1.0372	217.3	1.25	0.02	1.56	14.96	0.71	1.94	1.51	2.28	403	1.85	2.08	6.95	1.83	1.68	8.66	36,178.4	40.7	14.91	3,623.4







**COLUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 97-084  
Column: A B  
Column Size: 36"x154"  
Initial Charge Height: 137 inch  
Final Charge Height: 136 inch  
Sample Weight: 4405.5 4389.5 kg  
Bulk Density: 1.918 1.923 tonne/m<sup>3</sup>

Ore Sample: Carmacks ROM  
Head Assay Cu: 1.01 %  
Head Assay Cu (adjusted): 0.93 %  
Calculated Cu: %  
Hold up Volume: Litre  
Drain Volume: Litre

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Volume: 472.1 L  
Curing Period: 7 days  
Curing Temperature: 12.58 kphome  
Curing Acid Consumption: 8.0 g/L  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 7.0 Lm/h  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 1.77 % by weight  
Initial Sample Moisture: % by weight  
Final Residue Moisture: % by weight

Report Date: February 23, 2001

Date	COLUMN A										COLUMN B										SX				Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption	
	H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	pH	ORP (mV)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (g)	Cum. Weight (g)	Cum. Extraction (%)	Cum. vs. feed (kg/ore)	Cum. (kg/ore)				
10-Jun-98	224.40	103.10	0.30	1.0451	116.1	1.78	0.003	0.15	10.49	0.42	0.27	2.20	2.34	8.64	126.30	1.0468	120.7	1.87	0.002	10.44	48,411.5	54.5	16.46	2,980.5				
11-Jun-98	415.20	306.20	0.30	1.0451	104.3	1.80	0.003	0.13	10.43	0.38	0.25	2.17	2.79	8.60	83.60	1.0469	76.9	1.88	0.002	10.35	48,487.6	54.6	16.46	2,985.8				
12-Jun-98	306.20	195.20	0.30	1.0454	106.2	1.80	0.003	0.13	10.43	0.53	0.27	2.16	2.77	8.60	93.50	1.0471	89.3	1.89	0.003	10.43	48,570.5	54.7	16.46	2,980.7				
13-Jun-98	195.20	88.00	0.30	1.0454	102.5	1.80	0.003	0.13	10.43	0.53	0.26	2.38	2.71	8.84	89.20	1.0487	85.1	1.90	0.003	10.34	48,645.2	54.8	16.46	2,976.0				
14-Jun-98	482.30	369.90	0.30	1.0488	88.3	1.82	0.002	0.10	10.46	0.45	0.23	2.33	2.69	8.71	90.90	1.0485	86.7	1.90	0.002	10.29	48,716.7	54.8	16.46	2,971.7				
15-Jun-98	369.90	258.90	0.30	1.0488	106.0	1.82	0.002	0.10	10.46	0.43	0.22	2.45	2.86	8.68	103.70	1.0490	99.0	1.87	0.002	10.30	48,797.1	54.9	16.46	2,968.8				
16-Jun-98	258.90	128.90	0.30	1.0488	124.2	1.82	0.002	0.10	10.46	0.40	0.22	2.38	2.87	8.53	106.00	1.0473	101.2	1.88	0.002	10.01	48,891.6	55.0	16.46	2,961.1				
17-Jun-98	128.90	50.00	0.30	1.0488	75.4	1.82	0.002	0.10	10.46	0.40	0.22	2.38	2.87	8.49	96.90	1.0482	92.4	1.89	0.002	9.66	48,981.4	55.1	16.46	2,955.7				
18-Jun-98	442.80	273.80	0.30	1.0478	161.1	1.88	0.002	0.09	10.88	0.38	0.21	2.40	2.84	8.49	109.60	1.0481	104.6	1.91	0.002	10.21	49,077.9	55.2	16.46	2,949.9				
19-Jun-98	273.80	150.00	0.30	1.0478	118.2	2.28	0.002	0.09	10.89	0.38	0.21	2.40	2.84	8.34	116.80	1.0489	111.4	1.89	0.001	10.11	49,174.7	55.4	16.46	2,944.1				
20-Jun-98	150.00	59.30	0.30	1.0478	86.6	2.34	0.002	0.09	10.89	0.37	0.20	2.29	2.76	8.52	107.30	1.0482	102.4	1.93	0.002	10.26	49,268.8	55.5	16.46	2,938.9				
21-Jun-98	466.80	368.70	0.30	1.0474	84.1	1.88	0.002	0.07	10.81	0.35	0.19	2.34	2.75	8.32	140.20	1.0479	133.9	1.96	0.002	10.40	49,367.7	55.6	16.46	2,932.5				
22-Jun-98	368.70	260.10	0.30	1.0474	103.7	1.89	0.002	0.07	10.81	0.38	0.19	2.37	2.75	8.12	108.80	1.0483	103.5	1.85	0.002	10.15	49,444.2	55.7	16.46	2,928.0				
23-Jun-98	260.10	147.10	0.30	1.0474	107.9	1.88	0.004	0.18	10.81	0.37	0.18	2.35	2.81	8.24	80.70	1.0488	76.9	1.90	0.002	9.95	49,502.4	55.7	16.46	2,924.6				
24-Jun-98	147.10	37.90	0.30	1.0474	104.3	1.88	0.002	0.17	10.81	0.37	0.17	2.52	2.86	8.24	84.10	1.0499	80.1	1.89	0.002	11.45	49,667.3	55.8	16.46	2,920.7				
25-Jun-98	482.30	357.80	0.30	1.0485	90.3	2.02	0.002	0.17	10.50	0.34	0.17	2.57	2.81	8.21	92.10	1.0494	87.8	2.03	0.002	9.92	49,629.8	55.9	16.46	2,917.1				
26-Jun-98	357.80	172.80	0.30	1.0485	176.3	2.02	0.001	0.17	10.50	0.43	0.22	2.38	2.83	8.21	91.30	1.0492	87.0	2.03	0.002	9.94	49,691.6	55.9	16.46	2,913.4				
27-Jun-98	172.80	108.50	0.30	1.0485	63.2	2.02	0.002	0.17	10.50	0.34	0.17	2.46	2.83	8.75	93.90	1.0492	89.5	2.04	0.002	10.31	49,759.8	56.0	16.46	2,909.4				
28-Jun-98	108.50	17.60	0.30	1.0485	84.8	2.02	0.002	0.17	10.50	0.33	0.17	2.44	2.88	8.78	90.50	1.0493	86.2	2.02	0.002	10.01	49,827.8	56.1	16.46	2,905.5				
29-Jun-98	442.90	327.00	0.30	1.0481	110.2	1.90	0.002	0.07	10.72	0.33	0.17	2.47	2.88	8.64	94.50	1.0490	90.1	2.02	0.002	9.97	49,893.3	56.2	16.46	2,901.7				
30-Jun-98	327.00	232.30	0.30	1.0481	90.4	1.90	0.002	0.07	10.72	0.37	0.16	2.47	3.13	8.64	56.80	1.0486	54.2	1.99	0.002	10.22	49,943.2	56.2	16.46	2,898.8				
1-Jul-98	232.30	133.00	0.30	1.0481	94.7	1.90	0.002	0.07	10.72	0.34	0.17	2.49	3.06	8.64	109.80	1.0493	104.7	2.07	0.002	8.70	50,034.8	56.3	16.46	2,893.4				
2-Jul-98	408.70	288.70	0.30	1.0490	114.4	2.00	0.002	0.06	10.22	0.36	0.17	2.51	3.08	8.64	89.30	1.0496	85.1	2.00	0.002	8.93	50,108.1	56.4	16.46	2,889.2				
3-Jul-98	288.70	243.70	0.30	1.0490	42.9	2.00	0.002	0.06	10.22	0.44	0.18	2.53	3.16	8.69	97.00	1.0485	92.9	2.02	0.002	9.98	50,186.4	56.5	16.46	2,884.7				
4-Jul-98	243.70	121.30	0.30	1.0490	116.7	2.00	0.002	0.06	10.22	0.40	0.18	2.62	3.24	8.89	99.10	1.0506	94.3	2.06	0.001	10.08	50,269.8	56.6	16.46	2,879.9				
5-Jul-98	121.30	26.80	0.30	1.0490	90.3	2.00	0.002	0.06	10.22	0.40	0.16	2.62	3.19	8.79	58.20	1.0511	55.4	2.06	0.001	10.17	50,320.6	56.6	16.46	2,877.0				
6-Jul-98	474.10	367.60	0.30	1.0487	101.3	2.04	0.002	0.04	10.12	0.34	0.14	2.57	3.19	8.79	62.70	1.0523	59.8	2.07	0.002	10.22	50,373.6	56.7	16.46	2,874.0				
7-Jul-98	367.60	256.80	0.30	1.0487	105.7	2.04	0.002	0.04	10.12	0.33	0.14	2.54	2.96	8.99	112.80	1.0509	107.3	2.08	0.002	9.83	50,451.1	56.8	16.46	2,869.6				
8-Jul-98	256.80	145.60	0.30	1.0487	105.7	2.04	0.002	0.04	10.12	0.30	0.15	2.51	2.98	9.00	129.30	1.0498	123.6	2.08	0.001	1.21	50,537.1	56.9	16.46	2,864.7				
9-Jul-98	145.60	145.60	0.30	1.0487	105.7	2.04	0.002	0.04	10.12	0.30	0.15	2.51	2.95	9.00	129.90	1.0507	123.6	2.07	0.001	1.26	50,623.2	57.0	16.46	2,859.8				

**COLUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 87-084  
Column: A B  
Column Size: 36"x154"  
Initial Charge Height: 137 inch  
Final Charge Height: 136 inch  
Sample Weight: 4405.5 4389.5 kg  
Bulk Density: 1.916 1.923 tonne/m<sup>3</sup>  
Starting Date: February 9, 1988

One Sample: Carmacks ROM  
Head Assay Cu: 1.01 %  
Head Assay Cu: 0.93 %  
Calculated Cu: %  
Calculated Cu: %  
Hold up Volume: Litre  
Drain Volume: Litre  
Report Date: February 23, 2001

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Volume: 472.1 L  
Curing Period: 7 days  
Curing Acid Consumption: 12.68 kg/tonne  
8.0 g/L  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 7.0 L/m<sup>2</sup>/h  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 1.77 % by weight  
Initial Sample Moisture: % by weight  
Final Residue Moisture: % by weight

Date	Day	COLUMN A										COLUMN B										SX										Cu		H <sub>2</sub> SO <sub>4</sub>	
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Volume (L)	pH	ORP (mV)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight Extraction (g)	(%)	Cum.	Consumption (kg/t Cu)	Cum.		
10-Jul-88	151	478.60	358.60	1.0501	114.3	2.05	0.002	0.04	2.89	0.34	0.14	2.58	123.60	1.0521	117.5	3.02	458	0.75	0.03	0.00	111.90	1.0508	106.5	2.06	0.001	1.26	50,711.1	57.1	16.48	2,854.9					
11-Jul-88	152	358.60	247.60	1.0501	105.7	2.05	0.002	0.04	2.89	0.39	0.16	2.54	121.80	1.0538	115.6	3.12	489	0.74	0.03	0.00	121.80	1.0521	115.6	2.12	0.001	1.21	50,796.4	57.2	16.46	2,850.1					
12-Jul-88	153	247.60	117.60	1.0501	123.8	2.05	0.002	0.04	2.89	0.35	0.14	2.83	84.10	1.0536	89.3	3.15	455	0.76	0.03	0.00	93.30	1.0521	88.7	2.10	0.001	1.26	50,864.0	57.3	16.46	2,846.3					
13-Jul-88	154	117.60	17.60	1.0501	101.2	2.05	0.002	0.04	2.89	0.34	0.13	2.62	97.30	1.0537	92.3	3.14	458	0.76	0.07	0.00	96.80	1.0527	92.0	2.16	0.001	1.26	50,933.6	57.3	16.48	2,842.4					
14-Jul-88	155	362.90	295.10	1.0508	85.5	2.13	0.002	0.04	1.40	0.28	0.13	2.65	208.50	1.0525	197.9	3.11	461	0.69	0.08	0.00	106.00	1.0524	102.6	2.15	0.001	1.21	51,069.0	57.5	16.46	2,834.9					
15-Jul-88	156	295.10	181.90	1.0509	107.7	2.13	0.002	0.04	1.40	0.30	0.13	2.69	86.00	1.0532	83.0	3.12	461	0.66	0.06	0.00	97.40	1.0525	92.5	2.16	0.001	1.21	51,130.2	57.6	16.46	2,831.5					
16-Jul-88	157	181.90	64.10	1.0509	112.1	2.13	0.002	0.04	1.40	0.25	0.11	2.56	110.00	1.0536	104.4	3.06	454	0.62	0.08	0.00	107.00	1.0520	101.7	2.15	0.001	1.16	51,194.1	57.8	16.46	2,827.9					
17-Jul-88	158	64.10	368.30	1.0515	108.8	2.15	0.002	0.04	1.35	0.24	0.12	2.54	104.00	1.0533	98.7	3.03	460	0.60	0.09	0.00	103.10	1.0524	99.0	2.22	0.001	1.07	51,253.2	57.7	16.46	2,824.7					
18-Jul-88	159	368.30	257.30	1.0515	105.8	2.15	0.002	0.04	1.35	0.31	0.14	2.51	130.00	1.0544	123.3	2.91	483	0.51	0.09	0.05	128.10	1.0529	121.7	2.22	0.001	1.02	51,315.8	57.8	16.46	2,821.2					
19-Jul-88	160	257.30	144.30	1.0515	107.5	2.15	0.002	0.04	1.35	0.29	0.13	2.53	108.90	1.0545	103.3	2.87	517	0.46	0.09	0.11	108.10	1.0534	102.6	2.15	0.001	1.12	51,384.7	57.8	16.46	2,818.5					
20-Jul-88	161	144.30	42.30	1.0515	97.0	2.15	0.002	0.03	1.10	0.25	0.11	2.55	96.30	1.0542	91.3	2.83	470	0.46	0.09	0.18	106.30	1.0535	102.8	2.16	0.001	1.10	51,413.3	57.9	16.46	2,815.9					
21-Jul-88	162	42.30	365.50	1.0520	87.8	2.16	0.001	0.03	1.10	0.25	0.11	2.56	116.30	1.0538	112.3	2.86	498	0.49	0.09	0.10	117.30	1.0529	111.4	2.24	0.001	1.15	51,454.3	57.9	16.46	2,813.6					
22-Jul-88	163	365.50	267.70	1.0520	112.0	2.16	0.001	0.03	1.10	0.28	0.11	2.58	96.30	1.0539	91.4	2.89	473	0.53	0.09	0.07	95.10	1.0527	90.3	2.18	0.001	1.27	51,556.9	58.0	16.66	2,816.6					
23-Jul-88	164	267.70	399.80	1.0577	92.7	1.39	0.002	0.03	9.18	0.28	0.11	2.58	112.00	1.0540	106.3	2.85	477	0.49	0.08	0.11	111.30	1.0533	105.7	2.16	0.001	1.40	51,608.5	58.1	16.66	2,813.7					
24-Jul-88	165	399.80	264.50	1.0577	118.5	1.39	0.002	0.03	9.18	0.35	0.20	2.38	99.90	1.0553	94.7	2.86	473	0.61	0.06	0.00	99.20	1.0536	94.2	2.17	0.001	1.26	51,666.0	58.2	16.66	2,810.5					
25-Jul-88	166	264.50	120.50	1.0577	136.1	1.39	0.002	0.03	9.18	0.35	0.20	2.38	109.30	1.0550	103.8	2.97	468	0.62	0.07	0.00	106.80	1.0537	103.3	2.21	0.001	1.21	51,730.1	58.2	16.66	2,807.0					
26-Jul-88	167	120.50	0.00	1.0577	113.9	1.39	0.002	0.03	9.18	0.29	0.34	2.15	119.90	1.0653	112.6	2.89	472	0.81	0.09	0.05	119.30	1.0547	113.1	2.19	0.001	1.40	51,796.4	58.3	17.38	2,950.7					
27-Jul-88	168	467.07	360.77	1.0597	100.3	1.34	0.001	0.02	11.37	0.30	0.47	2.04	109.80	1.0571	103.9	2.84	482	0.62	0.14	0.09	108.70	1.0555	103.0	2.15	0.001	1.49	51,862.2	58.4	17.38	2,947.0					
28-Jul-88	169	360.77	270.70	1.0597	85.0	1.34	0.001	0.02	11.37	0.30	0.47	2.04	109.80	1.0571	103.9	2.84	482	0.62	0.14	0.09	108.70	1.0555	103.0	2.15	0.001	1.40	51,928.7	58.5	17.38	2,943.4					
29-Jul-88	170	270.70	159.70	1.0597	104.7	1.34	0.001	0.02	11.37	0.30	0.50	1.85	101.90	1.0578	96.3	2.83	460	0.66	0.13	0.05	101.50	1.0594	96.1	2.15	0.002	1.40	51,995.7	58.5	17.38	2,940.0					
30-Jul-88	171	159.70	48.50	1.0597	104.7	1.34	0.001	0.02	11.37	0.35	0.54	2.11	81.10	1.0594	86.0	2.87	472	0.70	0.14	0.00	91.00	1.0594	85.9	2.12	0.002	1.54	51,965.8	58.5	17.38	2,936.6					
31-Jul-88	172	3.32	508.00	1.0602	88.1	1.34	0.002	0.04	8.67	0.39	0.35	2.15	105.90	1.0623	99.7	2.88	478	0.72	0.15	0.07	105.60	1.0613	89.5	2.08	0.002	1.68	52,056.9	58.6	17.76	2,999.6					
1-Aug-88	173	404.00	288.50	1.0602	108.9	1.34	0.002	0.04	8.67	0.50	0.69	1.94	53.10	1.0630	87.6	2.95	541	0.73	0.15	0.05	92.00	1.0622	86.6	2.16	0.003	1.68	52,120.3	58.7	17.76	2,996.1					
2-Aug-88	174	288.50	173.00	1.0602	108.9	1.34	0.002	0.04	8.67	0.58	0.69	2.09	64.60	1.0671	79.3	2.95	516	0.76	0.18	0.06	83.90	1.0642	78.8	2.37	0.002	1.56	52,180.3	58.7	17.76	2,992.7					
3-Aug-88	175	173.00	45.00	1.0602	119.9	1.34	0.002	0.04	8.67	0.48	0.81	2.21	91.00	1.0669	85.3	2.91	535	0.75	0.18	0.10	80.20	1.0654	84.7	2.18	0.002	1.96	52,244.1	58.8	17.76	2,989.0					
4-Aug-88	176	45.00	278.80	1.0660	168.6	1.70	0.002	0.05	9.69	0.38	0.48	2.29	91.40	1.0665	85.7	2.92	496	0.77	0.18	0.06	90.30	1.0664	84.7	2.21	0.002	1.75	52,308.6	58.9	18.12	3,043.5					
5-Aug-88	177	278.80	273.00	1.0660	96.2	1.70	0.002	0.05	9.69	0.38	0.46	2.28	94.50	1.0673	88.5	2.74	513	0.67	0.26	0.33	92.10	1.0665	86.4	2.17	0.003	1.74	52,368.0	59.0	18.12	3,040.0					
6-Aug-88	178	273.00	162.00	1.0660	104.1	1.70	0.002	0.05	9.69	0.38	0.47	1.93	91.80	1.0682	85.9	2.60	530	0.72	0.27	0.31	91.20	1.0670	85.5	1.98	0.003	2.08	52,430.6	59.0	18.12	3,040.0					
7-Aug-88	179	2.38	471.40	1.0687	103.9	1.29	0.003	0.08	9.55	0.43	0.44	2.20	85.20	1.0687	79.7	2.92	438	0.81	0.19	0.06	64.70	1.0677	79.3	2.12	0.003	1.68	52,494.5	59.1	18.39	3,081.3					
8-Aug-88	180	360.40	237.90	1.0687	114.6	1.29	0.003	0.08	9.55	0.51	0.74	2.12	88.80	1.0719	82.8	2.75	523	0.81	0.21	0.17	87.20	1.0694	81.5	2.13	0.002	1.90	52,561.3	59.2	18.39	3,077.4					

**LUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 97-084  
Column: A B  
Column Size: 36"x154"  
Initial Charge Height: 137 136 inch  
Final Charge Height: 4405.5 4389.5 kg  
Sample Weight: 1.916 1.923 tonne/m<sup>3</sup>  
Bulk Density:

Ore Sample: Carmacks ROM  
Head Assay Cu<sub>2</sub>: 1.01 %  
Head Assay Cu<sub>1</sub>: 0.93 %  
Calculated Cu<sub>2</sub>: %  
Calculated Cu<sub>1</sub>: %  
Hold up Volume: Litre  
Drain Volume: Litre

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Volume: 472.1 L  
Curing Period: 7 days  
Curing Acid Consumption: 12.58 kg/tonne  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 8.0 g/L  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 7.0 Litre/h  
Initial Sample Moisture: 1.77 % by weight  
Final Residue Moisture: % by weight

Report Date: February 23, 2001

Date	Day	COLUMN A										COLUMN B										SX				Cu		H <sub>2</sub> SO <sub>4</sub>	
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	e.g. Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Cu (g/L)	Fe (g/L)	pH	Volume (L)	ORP (mV)	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	e.g. Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Cum. Extraction (%)	Cum. vs. feed (kg/ore)	Cum. vs. Cu (kg/Cu)	
9-Aug-98	181	237.90	120.10	7.00	1.0687	110.2	1.29	0.003	0.08	0.55	0.42	0.72	2.07	87.3	2.82	510	0.80	0.22	0.12	91.60	1.0708	65.5	2.19	0.002	1.71	52,630.9	59.2	18.39	3,073.3
10-Aug-98	182	120.10	7.00	1.0687	105.8	1.29	0.003	0.08	0.55	0.35	0.64	2.16	86.80	2.96	494	0.81	0.20	0.05	96.20	1.0689	90.0	2.16	0.002	1.75	52,696.2	59.3	18.39	3,069.5	
11-Aug-98	183	424.40	332.00	1.0718	86.2	1.43	0.002	0.09	0.92	0.35	0.64	2.08	102.80	2.72	506	0.75	0.28	0.11	102.20	1.0687	95.5	2.05	0.002	1.71	52,768.0	59.4	18.77	3,129.3	
12-Aug-98	184	332.00	218.90	1.0718	105.6	1.43	0.002	0.09	0.92	0.38	0.69	2.05	134.00	2.56	524	0.71	0.34	0.28	132.80	1.0717	123.7	1.93	0.002	2.05	52,856.4	59.5	18.77	3,123.1	
13-Aug-98	185	218.90	117.20	1.0718	94.8	1.43	0.002	0.09	0.92	0.33	0.68	1.95	105.60	2.82	530	0.87	0.22	0.07	105.10	1.0711	98.1	2.10	0.004	1.68	52,941.3	59.6	18.77	3,118.1	
14-Aug-98	186	459.90	321.20	1.0748	129.0	1.33	0.002	0.10	0.78	0.32	0.69	1.89	104.30	2.75	538	0.78	0.25	0.11	103.40	1.0729	96.4	2.00	0.002	2.32	53,016.3	59.7	19.08	3,165.1	
15-Aug-98	187	321.20	208.00	1.0748	105.3	1.33	0.002	0.10	0.78	0.36	0.79	1.87	119.70	2.68	524	0.78	0.28	0.15	118.00	1.0755	109.7	2.01	0.003	1.72	53,102.1	59.8	19.08	3,160.0	
16-Aug-98	188	208.00	108.80	1.0748	82.5	1.33	0.002	0.10	0.78	0.33	0.69	1.70	110.00	2.85	541	0.76	0.30	0.22	107.00	1.0770	99.4	2.03	0.003	1.71	53,179.5	59.9	19.08	3,155.4	
17-Aug-98	189	108.80	0.00	1.0748	101.0	1.33	0.002	0.10	0.78	0.38	0.66	1.75	111.00	2.83	533	0.73	0.32	0.22	107.00	1.0770	99.4	2.03	0.003	2.05	53,253.8	60.0	19.08	3,151.0	
18-Aug-98	190	438.80	332.70	1.0818	86.1	1.30	0.002	0.10	0.90	0.33	0.71	1.93	96.40	2.88	524	0.71	0.33	0.20	110.40	1.0771	102.5	1.99	0.003	1.88	53,317.0	60.0	19.47	3,211.7	
19-Aug-98	191	332.70	208.00	1.0818	115.3	1.30	0.002	0.10	0.90	0.32	0.70	1.81	91.50	2.69	537	0.70	0.33	0.20	91.00	1.0788	84.4	2.09	0.003	2.05	53,376.0	60.1	19.47	3,208.1	
20-Aug-98	192	208.00	106.40	1.0918	93.9	1.30	0.002	0.10	0.90	0.30	0.68	1.87	75.70	2.76	534	0.69	0.33	0.21	74.00	1.0812	68.4	2.02	0.003	2.23	53,424.0	60.1	19.47	3,205.3	
21-Aug-98	193	489.20	371.40	1.0943	108.6	1.31	0.003	0.20	10.46	0.29	0.70	1.87	142.30	2.47	554	0.61	0.46	0.81	138.20	1.0806	127.9	2.02	0.003	2.28	53,503.9	60.2	19.85	3,283.4	
22-Aug-98	194	371.40	260.40	1.0943	102.4	1.31	0.003	0.20	10.46	0.37	0.68	1.81	119.70	2.43	546	0.65	0.45	0.70	119.60	1.0842	110.3	1.96	0.003	2.45	53,574.8	60.3	19.85	3,258.1	
23-Aug-98	195	260.40	148.40	1.0943	102.4	1.31	0.003	0.20	10.46	0.35	0.67	1.85	114.20	2.38	555	0.61	0.50	0.84	111.80	1.0840	103.1	1.99	0.004	2.33	53,639.7	60.4	19.85	3,255.2	
24-Aug-98	196	148.40	38.00	1.0943	102.7	1.31	0.003	0.20	10.46	0.33	0.76	1.85	103.90	2.26	554	0.54	0.57	1.14	112.50	1.0849	103.7	1.88	0.003	2.85	53,694.5	60.4	19.85	3,251.8	
25-Aug-98	197	3.31	488.70	378.20	1.0879	101.8	1.31	0.003	0.35	0.11	0.32	0.75	1.88	107.50	2.22	548	0.53	0.61	1.30	106.80	1.0867	98.3	1.93	0.003	2.79	53,746.6	60.5	20.23	3,310.2
26-Aug-98	198	378.20	282.80	1.0879	106.3	1.31	0.003	0.35	10.11	0.28	0.79	1.89	109.00	2.16	555	0.53	0.68	1.53	104.70	1.0870	96.3	1.85	0.003	3.49	53,797.8	60.6	20.23	3,307.1	
27-Aug-98	199	282.80	141.80	1.0879	111.0	1.31	0.003	0.35	10.11	0.26	0.77	1.87	97.10	2.17	558	0.60	0.59	1.86	97.00	1.0887	89.1	1.87	0.003	3.49	53,851.0	60.6	20.23	3,303.8	
28-Aug-98	200	2.97	531.30	434.30	1.0771	90.1	1.33	0.003	0.32	0.15	0.34	0.82	1.88	108.10	2.26	558	0.67	0.55	1.58	107.80	1.0875	99.1	1.87	0.002	3.20	53,917.2	60.7	20.57	3,354.9
29-Aug-98	201	434.30	294.80	1.0771	129.5	1.33	0.003	0.32	10.15	0.40	1.06	1.90	80.30	2.46	558	0.72	0.52	0.45	87.30	1.0906	80.0	1.92	0.025	2.58	53,974.3	60.8	20.57	3,351.3	
30-Aug-98	202	294.80	160.30	1.0771	106.3	1.33	0.003	0.32	10.15	0.44	0.93	2.03	87.60	2.59	554	0.77	0.50	0.33	84.80	1.0917	86.8	2.04	0.002	2.11	54,042.3	60.8	20.57	3,347.1	
31-Aug-98	203	160.30	31.00	1.0771	138.6	1.33	0.003	0.32	10.15	0.35	0.83	1.94	81.90	2.61	564	0.80	0.48	0.31	80.50	1.0932	55.3	1.91	0.003	2.80	54,087.0	60.9	20.57	3,344.3	
1-Sep-98	204	1.18	224.80	122.90	1.0808	93.6	1.38	0.003	0.32	8.90	0.33	0.90	1.82	76.50	2.64	552	0.82	0.45	0.30	74.80	1.0904	68.6	2.01	0.003	2.36	54,144.1	61.0	20.70	3,367.5
2-Sep-98	205	122.80	0.00	1.0908	112.7	1.38	0.003	0.32	8.90	0.36	0.89	2.02	129.90	2.40	574	0.88	0.64	0.62	124.80	1.0892	114.7	1.99	0.004	2.18	54,224.2	61.0	20.70	3,357.6	
3-Sep-98	206	1.76	281.80	160.20	1.0951	92.9	1.36	0.005	0.34	9.22	0.36	0.87	2.02	93.60	2.52	548	0.76	0.52	0.40	91.20	1.0886	83.8	1.94	0.003	2.54	54,288.7	61.1	20.90	3,386.4
4-Sep-98	207	2.33	488.70	387.10	1.0891	95.0	1.31	0.003	0.23	11.13	0.38	0.86	2.04	88.20	2.58	547	0.73	0.53	0.39	85.00	1.0905	87.1	1.92	0.004	2.50	54,353.6	61.2	21.17	3,435.2
5-Sep-98	208	387.10	276.10	1.0891	103.8	1.31	0.003	0.23	11.13	0.41	0.99	1.73	78.00	2.47	542	0.73	0.53	0.49	77.90	1.0924	71.3	1.86	0.004	2.74	54,405.1	61.2	21.17	3,422.0	
6-Sep-98	209	276.10	132.90	1.0891	133.9	1.31	0.003	0.23	11.13	0.36	0.94	1.72	84.30	2.52	565	0.77	0.49	0.50	80.60	1.0944	82.8	1.98	0.003	2.14	54,471.1	61.3	21.17	3,417.8	
7-Sep-98	210	132.90	48.90	1.0691	78.6	1.31	0.003	0.23	11.13	0.33	0.76	1.82	103.10	2.48	566	0.69	0.49	0.59	95.90	1.0924	91.5	1.86	0.004	2.66	54,535.5	61.4	21.17	3,413.8	

**LUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 97-084  
Column: A B  
Column Size: 36"x154"  
Initial Charge Height: 137 136 inch  
Final Charge Height: inch  
Sample Weight: 4405.5 4385.5 kg  
Bulk Density: 1.916 1.923 tonne/m<sup>3</sup>

One Sample: Carmacks ROM  
Head Assay Cup: 1.01 %  
Head Assay Cu: 0.83 %  
Calculated Cup: %  
Hold up Volume: Litre  
Drain Volume: Litre

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Volume: 472.1 L  
Curing Period: 7 days  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 12.58 kg/mole  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 7.0 L/m<sup>2</sup>/h  
Initial Sample Moisture: 1.77 % by weight  
Final Residue Moisture: % by weight

Starting Date: February 9, 1998  
Report Date: February 23, 2001

Date	COLUMN A										COLUMN B										SX										Cu		H <sub>2</sub> SO <sub>4</sub>	
	H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	Volume (L)	pH	Fe (g/L)	Cu (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Fe (g/L)	Cu (g/L)	PLS	Volume (L)	Weight (kg)	s.g. (g/mL)	pH	ORP (mV)	Fe (g/L)	Cu (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g. (g/mL)	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Cum. Extraction (%)	Cum. vs. Cu (kg/Cu)					
8-Sep-98	211	0.55	128.80	39.10	1.0900	80.5	1.48	0.004	0.27	8.71	0.28	0.83	1.79	100.00	1.0981	91.9	2.29	485	0.57	0.57	0.75	103.80	1.0891	95.3	1.88	0.003	2.14	54,595.0	61.5	21.23	3,420.1			
9-Sep-98	212	0.55	128.70	41.00	1.0937	81.1	1.51	0.004	0.27	8.71	0.28	0.83	1.79	100.00	1.0981	91.9	2.29	485	0.57	0.57	0.75	95.00	1.0880	87.3	1.81	0.004	2.52	54,647.1	61.5	21.29	3,428.9			
10-Sep-98	213	3.38	469.10	376.60	1.0948	84.5	1.31	0.004	0.36	9.32	0.28	0.71	1.81	86.30	1.0889	78.3	2.41	535	0.60	0.61	0.61	82.00	1.0872	75.4	1.96	0.004	2.18	54,694.4	61.6	21.68	3,485.8			
11-Sep-98	214		376.60	284.40	1.0946	102.5	1.31	0.004	0.36	9.32	0.30	0.87	1.82	92.10	1.0906	84.4	2.36	568	0.61	0.59	0.56	89.80	1.0901	82.4	1.88	0.005	2.55	54,745.1	61.6	21.68	3,482.6			
12-Sep-98	215		284.40	174.20	1.0946	85.4	1.31	0.004	0.36	9.32	0.28	0.90	1.81	97.80	1.0936	89.5	2.29	539	0.58	0.68	0.79	97.70	1.0935	80.3	1.91	0.004	2.42	54,796.7	61.7	21.68	3,479.3			
12-Sep-98	216		174.20	50.00	1.0946	113.5	1.31	0.004	0.36	9.32	0.30	0.68	1.59	97.60	1.0933	89.5	2.23	599	0.55	0.78	0.97	93.80	1.0943	85.6	1.86	0.004	2.68	54,845.5	61.7	21.68	3,476.2			
14-Sep-98	217	0.65	138.80	15.50	1.0980	113.2	1.35	0.005	0.36	10.65	0.28	0.68	1.66	94.20	1.0952	86.0	2.23	602	0.58	0.75	1.19	91.80	1.0940	83.9	1.92	0.004	2.70	54,892.6	61.8	21.75	3,485.0			
15-Sep-98	218		398.00	287.00	1.0925	101.6	1.86	0.005	0.54	2.73	0.24	0.77	1.65	103.90	1.0935	95.0	2.22	569	0.53	0.79	1.16	98.10	1.0924	90.7	1.85	0.004	2.82	54,942.5	61.9	21.75	3,481.9			
16-Sep-98	219		287.00	249.80	1.0925	34.1	1.86	0.005	0.54	2.73	0.21	0.71	1.75	105.00	1.0927	96.1	2.18	574	0.63	0.60	1.30	102.10	1.0920	93.5	1.82	0.003	3.07	54,992.8	61.9	21.75	3,478.7			
17-Sep-98	220		249.80	133.70	1.0925	106.3	1.86	0.005	0.54	2.73	0.27	0.63	1.99	106.60	1.0956	97.3	2.18	585	0.52	0.78	1.27	100.50	1.0948	91.8	1.83	0.003	2.85	55,042.8	62.0	21.75	3,475.5			
18-Sep-98	221	0.81	403.20	264.50	1.0961	126.5	1.51	0.004	0.49	5.28	0.21	0.66	2.00	87.30	1.0954	61.4	2.58	584	0.79	0.48	0.56	66.80	1.0927	61.2	1.88	0.003	2.80	55,090.7	62.0	21.85	3,480.1			
19-Sep-98	222		264.50	187.50	1.0961	88.5	1.51	0.004	0.48	5.28	0.24	0.74	1.80	95.20	1.0962	86.8	2.56	573	0.74	0.44	0.59	92.20	1.0954	84.2	1.91	0.003	2.81	55,154.8	62.1	21.85	3,485.0			
20-Sep-98	223		187.50	49.00	1.0961	108.1	1.51	0.004	0.49	5.28	0.22	0.68	1.77	101.30	1.0963	92.4	2.56	580	0.69	0.44	0.73	97.80	1.0958	89.2	2.01	0.002	2.17	55,217.5	62.2	21.85	3,481.0			
21-Sep-98	224	0.27	141.20	48.80	1.0965	84.3	1.55	0.004	0.37	5.44	0.20	0.66	1.81	93.60	1.0964	85.4	2.51	548	0.62	0.48	0.87	92.60	1.0960	84.5	1.92	0.002	2.61	55,289.7	62.2	21.69	3,482.7			
22-Sep-98	225	0.72	349.20	242.90	1.0974	96.9	1.59	0.004	0.33	4.92	0.20	0.82	1.75	104.50	1.0965	95.3	2.46	570	0.57	0.50	0.84	103.00	1.0961	94.0	1.98	0.003	2.32	55,323.6	62.3	21.97	3,493.4			
23-Sep-98	226		242.90	137.80	1.0974	95.7	1.59	0.004	0.33	4.92	0.20	0.57	1.83	92.30	1.0974	84.1	2.50	563	0.56	0.51	0.89	89.40	1.0974	80.6	1.92	0.002	2.46	55,369.9	62.3	21.97	3,489.5			
24-Sep-98	227		137.80	35.60	1.0974	93.2	1.59	0.004	0.33	4.92	0.19	0.54	1.83	88.70	1.0981	80.8	2.52	564	0.58	0.50	0.87	86.80	1.0980	79.1	1.93	0.003	2.53	55,416.0	62.4	21.97	3,486.6			
25-Sep-98	228	0.90	322.00	211.00	1.1016	100.8	1.56	0.173	0.35	5.20	0.20	0.54	1.85	102.20	1.0995	93.0	2.54	562	0.54	0.49	0.79			#DIV/0!				55,448.3	62.4	22.07	3,500.7			
26-Sep-98	229		211.00	100.00	1.1016	100.8	1.56	0.173	0.35	5.20	0.28	0.62	1.78	102.60	1.1017	93.1	2.51	516	0.51	0.53	0.91			#DIV/0!				55,478.4	62.5	22.07	3,498.8			
27-Sep-98	230		100.00	0.00	1.1016	90.8	1.56	0.173	0.35	5.20	0.31	0.58	1.82	97.00	1.1035	87.9	2.45	524	0.50	0.54	1.12			#DIV/0!				55,506.2	62.5	22.07	3,497.1			
28-Sep-98	231	1.40	298.70	177.60	1.1082	109.1	1.55	0.535	0.51	5.50	0.34	0.60	1.81	88.10	1.1078	88.5	2.45	531	0.53	0.57	0.96			#DIV/0!				55,604.3	62.5	22.23	3,523.1			
29-Sep-98	232		177.60	38.80	1.1082	125.4	1.55	0.535	0.51	5.50	0.44	0.61	1.76	96.60	1.1037	87.5	2.54	524	0.52	0.55	0.93			#DIV/0!				55,672.3	62.4	22.23	3,524.5			
30-Sep-98	233	0.80	237.60	128.60	1.1089	88.5	1.61	0.530	0.51	5.50	0.51	0.66	1.79	102.20	1.1047	92.5	2.51	542	0.56	0.57	0.98			#DIV/0!				55,671.4	62.4	22.32	3,538.9			
1-Oct-98	234		128.60	0.00	1.1089	116.2	1.61	0.530	0.51	5.18	0.53	0.65	1.80	113.60	1.1041	102.9	2.46	514	0.59	0.50	0.95			#DIV/0!				55,670.0	62.4	22.32	3,539.0			
2-Oct-98	235	1.52	338.00	227.00	1.0745	103.3	1.41	0.410	0.41	5.10	0.57	0.65	1.56	124.40	1.1056	112.5	2.19	549	0.61	0.52	0.89			#DIV/0!				55,683.3	62.5	22.49	3,564.7			
3-Oct-98	236		227.00	118.00	1.0745	103.3	1.41	0.410	0.41	5.10	0.58	0.67	1.48	120.10	1.1076	108.4	2.13	587	0.68	0.64	1.12			#DIV/0!				55,527.2	62.5	22.49	3,562.8			
4-Oct-98	237		118.00	12.00	1.0745	96.8	1.41	0.410	0.41	5.10	0.55	0.62	1.50	106.10	1.1087	95.7	2.13	579	0.70	0.66	1.10			#DIV/0!				55,554.5	62.5	22.49	3,561.0			
5-Oct-98	238	0.84	246.20	125.20	1.1075	109.3	1.45	0.669	0.58	4.95	0.54	0.61	1.70	104.20	1.1038	94.4	2.28	557	0.71	0.64	0.97			#DIV/0!				55,546.4	62.5	22.59	3,576.6			
6-Oct-98	239		125.20	0.00	1.1075	113.0	1.45	0.669	0.58	4.95	0.61	0.63	1.65	107.10	1.0987	97.5	2.28	537	0.69	0.61	0.63			#DIV/0!				55,539.6	62.5	22.59	3,577.2			
7-Oct-98	240	1.28	319.00	215.00	1.1026	94.3	1.52	0.720	0.54	4.68	0.65	0.67	1.95	106.70	1.1028	96.8	2.43	498	0.78	0.54	0.49			#DIV/0!				55,547.1	62.5	22.73	3,599.4			

**LUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 97-084

Column: A B

36"x154" 136 inch

Initial Charge Height: 137 inch

Final Charge Height: 137 inch

Sample Weight: 4405.5 4389.5 kg

Bulk Density: 1.916 1.923 tonne/m<sup>3</sup>

Starting Date: February 9, 1998

One Sample: Carmacks ROM

Head Assay Cu: 1.01 %

Head Assay Cu: 0.93 %

Calculated Cu: %

Hold up Volume: %

Drain Volume: %

Report Date: February 23, 2001

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>

Curing Acid Volume: 472.1 L

Curing Period: 7 days

Curing Acid Concentration: 12.58 kg/tonne

Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 8.0 g/L

Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 7.0 Lm<sup>3</sup>/h

Initial Sample Moisture: 1.77 % by weight

Final Residue Moisture: % by weight

Date	Day	COLUMN A										COLUMN B										SX Raffinate				Cu Leached		H <sub>2</sub> SO <sub>4</sub> Consumption	
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Volume (L)	s.g.	Weight (kg)	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Ext. (%)	Cum. vs. leach (kg/ore)	Cum. (kg/ore)		
8-Oct-98	241	215.00	104.00	0.00	1.1026	100.7	1.52	0.720	0.54	4.68	0.88	0.78	1.87	1.81	104.30	1.001	101.1	2.18	548	0.75	0.60	0.75		55,549.9	62.5	22.73	3,599.2		
9-Oct-98	242	104.00	0.00	1.1026	94.3	1.52	0.720	0.54	4.68	0.72	0.77	1.81	1.81	104.30	1.024	94.6	2.23	541	0.75	0.62	0.91		55,552.5	62.5	22.73	3,599.1			
10-Oct-98	243	0.41	104.80	0.00	1.1097	94.4	1.45	0.815	0.69	5.00	0.80	0.82	1.80	1.80	1.091	94.5	2.22	554	0.83	0.69	0.89		55,554.0	62.5	22.78	3,606.4			
11-Oct-98	244	0.84	215.50	210.30	1.1035	4.7	1.41	0.750	0.62	4.98	0.84	0.81	1.74	1.0270	1.084	92.8	2.18	581	0.83	0.68	0.83		55,627.5	62.8	22.87	3,616.6			
12-Oct-98	245		210.30	106.30	1.1035	94.2	1.41	0.750	0.62	4.98	0.84	0.78	1.88	96.20	1.089	77.7	2.23	589	0.88	0.69	1.06		55,624.8	62.8	22.87	3,616.8			
13-Oct-98	246		106.30	0.00	1.1035	96.3	1.41	0.750	0.62	4.98	0.82	0.80	1.82	51.20	1.079	48.2	2.32	585	0.93	0.64	0.81		55,595.3	62.59	22.87	3,618.7			
14-Oct-98	247	0.84	240.10	122.10	1.1133	99.7	1.31	0.895	0.69	5.00	0.88	0.81	1.78	88.20	1.107	79.7	2.25	563	0.91	0.68	0.93		55,576.2	62.57	22.98	3,636.7			
15-Oct-98	248		129.10	15.90	1.1133	101.7	1.31	0.895	0.69	5.00	0.89	0.82	1.76	83.60	1.071	75.5	2.20	543	0.95	0.69	0.96		55,558.9	62.55	22.98	3,637.9			
16-Oct-98	249	1.81	339.80	241.20	1.0860	90.8	1.48	0.730	0.47	5.02	0.82	0.72	1.81	86.70	1.075	78.3	2.25	542	0.95	0.59	0.92		55,567.0	62.55	23.18	3,666.3			
17-Oct-98	250		241.20	130.20	1.0860	102.2	1.48	0.730	0.47	5.02	0.88	0.77	1.69	89.80	1.107	89.9	2.25	559	1.01	0.56	0.97		55,583.1	62.57	23.16	3,665.3			
18-Oct-98	251		130.20	26.30	1.0860	93.8	1.48	0.730	0.47	5.02	0.81	0.70	1.63	99.80	1.091	90.1	2.18	574	1.01	0.58	0.99		55,605.6	62.60	23.16	3,683.8			
19-Oct-98	252	0.74	235.00	118.70	1.1077	105.0	1.47	0.965	0.56	4.83	0.86	0.87	1.64	105.80	1.088	95.6	2.13	569	1.00	0.60	0.98		55,599.9	62.59	23.25	3,677.5			
20-Oct-98	253		118.70	6.00	1.1077	101.7	1.47	0.965	0.56	4.83	0.80	0.70	1.63	108.20	1.043	98.0	2.12	539	0.98	0.60	0.91		55,597.7	62.59	23.25	3,677.7			
21-Oct-98	254	0.77	220.00	114.00	1.1078	95.7	1.47	0.980	0.60	4.75	0.86	0.70	1.73	115.40	1.024	104.7	2.10	519	0.97	0.60	1.01		55,605.0	62.6	23.34	3,691.0			
22-Oct-98	255		114.00	0.00	1.1078	102.9	1.47	0.980	0.60	4.75	0.98	0.71	1.81	111.40	1.040	100.9	2.17	513	1.00	0.63	1.09		55,604.8	62.6	23.34	3,691.1			
23-Oct-98	256	1.28	332.00	214.20	1.1062	106.5	1.52	0.990	0.62	4.99	1.01	0.72	1.91	103.90	1.037	94.0	2.31	568	1.04	0.63	0.99		55,596.9	62.6	23.48	3,714.6			
24-Oct-98	257		214.20	110.20	1.1062	94.0	1.52	0.990	0.62	4.99	1.15	0.91	1.84	111.80	1.083	100.7	2.42	608	1.10	0.71	1.06		55,614.5	62.6	23.48	3,713.4			
25-Oct-98	258		110.20	0.00	1.1062	99.8	1.52	0.990	0.62	4.99	1.16	0.81	1.85	101.50	1.083	91.5	2.43	811	1.15	0.76	1.16		55,621.1	62.6	23.48	3,713.0			
26-Oct-98	259	0.94	234.00	116.00	1.1044	105.0	1.53	1.070	0.70	5.03	1.10	0.80	1.84	80.50	1.085	81.6	2.32	530	1.16	0.78	1.16		55,603.5	62.6	23.59	3,731.1			
27-Oct-98	260		116.00	0.00	1.1044	108.8	1.53	1.070	0.70	5.03	1.10	0.80	1.78	102.50	1.084	92.4	2.33	526	1.20	0.79	1.20		55,600.0	62.6	23.59	3,731.3			
28-Oct-98	261	0.77	208.70	101.00	1.1057	87.4	1.48	1.110	0.75	4.83	1.12	0.82	1.78	103.20	1.093	93.0	2.31	548	1.21	0.79	1.21		55,604.5	62.6	23.68	3,744.8			
29-Oct-98	262		101.00	0.00	1.1057	91.3	1.48	1.110	0.75	4.83	1.16	0.84	1.82	104.70	1.091	84.4	2.37	539	1.23	0.78	1.13		55,619.2	62.6	23.68	3,743.8			
30-Oct-98	263	1.22	326.10	213.10	1.1079	96.8	1.59	1.160	0.77	4.89	1.16	0.86	1.83	101.00	1.102	91.0	2.36	519	1.27	0.78	1.23		55,622.7	62.6	23.81	3,765.4			
31-Oct-98	264		213.10	99.80	1.1079	102.3	1.59	1.160	0.77	4.89	1.27	0.84	1.91	105.50	1.103	95.0	2.30	559	1.26	0.83	1.17		55,623.8	62.6	23.81	3,765.3			
1-Nov-98	265		99.80	0.00	1.1079	90.1	1.59	1.160	0.77	4.89	1.35	0.87	2.07	105.60	1.106	95.1	2.33	562	1.30	0.84	1.19		55,642.9	62.6	23.81	3,764.0			
2-Nov-98	266	0.65	221.90	110.90	1.1069	100.3	1.62	1.210	0.79	5.12	1.22	0.87	1.79	108.60	1.105	97.8	2.36	559	1.31	0.82	1.23		55,649.7	62.6	23.91	3,776.9			
3-Nov-98	267		110.90	0.00	1.1069	100.2	1.62	1.210	0.79	5.12	1.27	0.86	1.78	103.80	1.107	93.5	2.18	574	1.31	0.85	1.57		55,650.9	62.6	23.91	3,778.8			
4-Nov-98	268	0.68	224.40	111.40	1.1069	100.3	1.59	1.240	0.74	5.09	1.28	0.81	1.80	113.50	1.108	102.2	2.23	567	1.35	0.78	1.56		55,694.4	62.7	24.01	3,793.7			
5-Nov-98	269		111.40	0.00	1.1068	100.7	1.59	1.240	0.74	5.06	1.28	0.83	1.78	111.70	1.107	100.6	2.31	562	1.38	0.79	1.76		55,678.4	62.7	24.01	3,792.7			
6-Nov-98	270	1.30	345.70	228.90	1.1065	105.6	1.54	1.240	0.75	4.95	1.28	0.86	1.73	109.20	1.110	96.3	2.26	554	1.35	0.81	1.56		55,680.2	62.7	24.16	3,815.9			

**ALUMINUM AB LEACH TEST DATA**  
Carmacks Project

Project: 87-084  
Ore Sample: Carmacks ROM  
Head Assay Cup: 1.01 %  
Head Assay Cup (wet): 0.85 %  
Calculated Cup: %  
Hold up Volume: Litre  
Drain Volume: Litre

Column: A B  
Column Size: 36"x154"  
Initial Charge Height: 137 136 inch  
Final Charge Height: inch  
Sample Weight: 4405.5 4389.5 kg  
Bulk Density: 1.916 1.823 tonne/m<sup>3</sup>

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
Curing Acid Volume: 472.1 L  
Curing Period: 7 days  
Curing Acid Concentration: 12.58 g/l  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 8.0 g/L  
Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 7.0 Lm<sup>3</sup>/h  
Initial Sample Moisture: 1.77 % by weight  
Final Residue Moisture: % by weight

Starting Date: February 9, 1958  
Report Date: February 23, 2001

Date	Day	COLUMN A										COLUMN B										SX				Cu		H <sub>2</sub> SO <sub>4</sub>		
		Feed					PLS					Free H <sub>2</sub> SO <sub>4</sub>					PLS					Free H <sub>2</sub> SO <sub>4</sub>					Raffinate		Leached	
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	ORP (mV <sup>+</sup> )	pH	Volume (L)	Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Cum. Weight (g)	Extraction (%)	Cum. vs. leed (kg/ore)	Cum. vs. Cu (kg/Cu)		
7-Nov-98	271	228.90	106.50	110.6	1.065	110.6	1.54	1.240	0.75	4.95	1.38	0.89	1.68	103.60	1115	99.5	2.15	572	1.36	0.85	1.99						55,978.4	62.7	24.16	3,816.0
8-Nov-98	272	108.50	0.00	110.6	1.065	96.2	1.54	1.240	0.75	4.95	1.38	0.89	1.68	103.60	1115	95.1	2.15	592	1.37	0.82	1.85						55,993.3	62.7	24.16	3,815.3
9-Nov-98	273	341.00	200.00	1117	1.117	99.8	1.55	1.360	0.83	4.89	1.30	0.83	1.67	119.70	1117	107.7	2.08	578	1.38	0.85	1.70						55,702.1	62.7	24.28	3,833.4
10-Nov-98	274	230.00	100.80	1117	1.117	116.4	1.55	1.360	0.83	4.89	1.36	0.86	1.78	119.70	1115	102.3	2.18	540	1.43	0.87	1.85			4.08			55,690.1	62.7	24.28	3,834.3
11-Nov-98	275	100.60	0.00	1117	1.117	90.5	1.55	1.360	0.83	4.89	1.46	0.92	1.77	114.90	1123	103.3	2.26	564	1.47	0.87	1.71			4.23			55,716.9	82.7	24.28	3,832.3
12-Nov-98	276	0.12	111.90	0.00	1.045	101.3	1.57	0.014	0.81	4.95	1.44	0.80	1.74	112.90	1134	101.4	2.28	571	1.48	0.83	2.14			4.19			55,867.5	62.9	24.29	3,824.2
13-Nov-98	277	0.31	358.90	323.00	1.041	32.5	1.61	0.015	0.78	4.76	0.65	0.87	1.81	115.90	1135	103.8	2.24	557	1.51	0.80	1.81			4.59			56,023.8	63.1	24.33	3,819.0
14-Nov-98	278	323.00	212.00	1041	1.041	100.5	1.61	0.015	0.78	4.76	0.89	0.95	1.80	107.90	1132	96.9	2.23	574	1.35	0.86	2.10						56,153.1	63.2	24.33	3,810.2
15-Nov-98	279	212.00	101.00	1041	1.041	100.5	1.61	0.015	0.78	4.76	0.51	0.89	1.72	55.40	1136	49.7	2.28	591	1.35	0.85	1.80						56,216.8	63.3	24.33	3,805.8
16-Nov-98	280	101.00	0.00	1041	1.041	81.5	1.61	0.015	0.78	4.76	0.40	0.85	1.72	100.30	1127	90.1	2.17	577	1.12	0.88	2.00						56,318.4	63.4	24.33	3,799.0
17-Nov-98	281	1.32	377.50	250.30	1.112	114.5	1.63	1.150	0.98	5.17	0.40	0.88	1.86	102.60	1111	92.3	2.23	564	1.00	1.01	1.20						56,276.1	63.4	24.48	3,825.1
18-Nov-98	282	250.30	122.00	1112	1.112	115.5	1.63	1.150	0.98	5.17	0.80	1.01	1.84	103.10	1111	92.8	2.24	557	0.95	1.01	1.16						56,234.5	63.3	24.48	3,828.1
19-Nov-98	283	122.00	0.00	1112	1.112	109.8	1.63	1.150	0.98	5.17	1.15	1.04	1.64	115.90	1120	104.1	2.19	551	1.05	1.04	1.49						56,217.5	63.3	24.48	3,829.3
20-Nov-98	284	1.02	343.50	230.30	1.096	111.0	1.64	1.010	0.99	5.29	1.21	1.03	1.74	113.60	1127	102.1	2.10	548	1.18	1.02	1.31						56,225.9	63.3	24.59	3,846.9
21-Nov-98	285	220.30	122.80	1096	1.096	88.1	1.64	1.010	0.99	5.29	1.21	1.08	1.77	132.70	1145	119.1	2.13	551	1.25	1.04	1.57						56,285.7	63.4	24.59	3,842.8
22-Nov-98	286	122.50	0.00	1096	1.096	110.4	1.64	1.010	0.99	5.29	1.21	1.08	1.81	104.30	1147	93.9	2.16	607	1.24	1.05	1.38						56,290.2	63.4	24.59	3,842.5
23-Nov-98	287	0.80	242.80	121.40	1.138	109.0	1.68	1.210	1.03	5.23	1.13	1.04	1.74	119.10	1139	106.9	2.12	568	1.24	1.05	1.71						56,296.9	63.4	24.88	3,856.6
24-Nov-98	288	121.40	0.00	1138	1.138	105.0	1.68	1.210	1.03	5.23	1.22	1.10	1.78	108.70	1136	97.6	2.10	547	1.26	1.05	1.74						56,282.0	63.4	24.88	3,857.2
25-Nov-98	289	0.72	233.50	116.80	1.128	105.0	1.67	1.210	1.03	5.10	1.24	1.10	1.79	122.10	1149	109.5	2.12	564	1.29	1.07	1.88						56,296.2	63.4	24.77	3,869.1
26-Nov-98	290	116.80	0.00	1128	1.128	105.0	1.67	1.210	1.03	5.10	1.27	1.10	1.72	119.40	1158	107.0	2.08	548	1.32	1.09	2.06						56,310.5	63.4	24.77	3,888.1
27-Nov-98	291	1.19	370.10	232.10	1.135	123.9	1.61	1.270	1.07	5.19	1.27	1.10	1.88	117.40	1156	106.2	2.10	553	1.32	1.10	2.20						56,292.0	63.4	24.80	3,890.5
28-Nov-98	292	232.10	104.10	1135	1.135	115.0	1.61	1.270	1.07	5.19	1.39	1.24	1.72	103.00	1176	92.2	2.02	566	1.37	1.10	2.21						56,272.3	63.3	24.80	3,891.9
29-Nov-98	293	104.10	0.00	1135	1.135	95.5	1.61	1.270	1.07	5.19	1.39	1.26	1.76	112.20	1166	100.5	2.07	584	1.37	1.11	2.19						56,291.2	63.4	24.80	3,890.6
30-Nov-98	294	1.07	363.80	241.00	1.152	101.1	1.59	1.320	1.06	4.97	1.35	1.16	1.77	117.60	1173	105.3	2.03	560	1.39	1.15	2.29						56,303.9	63.4	25.02	3,908.7
1-Dec-98	295	241.00	117.80	1152	1.152	110.4	1.59	1.320	1.06	4.97	1.35	1.16	1.85	108.60	1170	97.2	2.13	549	1.39	1.14	2.01						56,293.4	63.4	25.02	3,909.4
2-Dec-98	296	117.80	0.00	1152	1.152	105.7	1.59	1.320	1.06	4.97	1.36	1.16	1.83	106.30	1177	96.9	2.17	555	1.40	1.10	1.80			4.42			56,289.5	63.4	25.02	3,909.7
3-Dec-98	297	0.34	119.90	0.00	1.128	102.4	1.64	1.310	1.03	4.95	1.36	1.11	1.84	124.60	1179	111.6	2.22	544	1.44	1.10	1.80			4.12			56,316.2	63.4	25.06	3,913.8
4-Dec-98	298	0.57	361.60	241.10	1.098	106.6	1.61	0.031	1.00	4.83	1.35	1.11	1.72	109.60	1179	96.0	2.09	552	1.45	1.09	1.77			4.20			56,455.0	63.9	25.13	3,914.3
5-Dec-98	299	241.10	121.00	1098	1.098	109.2	1.61	0.031	1.00	4.93	1.01	1.19	1.79	105.00	1193	93.8	2.16	572	1.45	1.10	2.01			4.71			56,588.6	63.7	25.13	3,905.0
6-Dec-98	300	121.00	0.00	1098	1.098	109.0	1.61	0.031	1.00	4.83	0.88	1.21	1.88	105.30	1183	94.2	2.17	588	1.34	1.09	2.06			3.90			56,711.4	63.8	25.13	3,896.6

**CARMACKS COLUMN AB LEACH TEST DATA**  
Carmacks Project

Project: 97-084  
 Column: A B  
 Column Size: 36"x154"  
 Initial Charge Height: 137 138 inch  
 Final Charge Height: 4405.5 4399.5 kg  
 Sample Weight: 1.916 1.923 tonne/m<sup>3</sup>  
 Bulk Density: 1.916 1.923 tonne/m<sup>3</sup>  
 Starting Date: February 9, 1998

Ore Sample: Carmacks ROM  
 Head Assay Cu: 1.01 %  
 Head Assay Cu: 0.93 %  
 Calculated Cu: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Report Date: February 23, 2001

Curing Acid Concentration: 235 g/L H<sub>2</sub>SO<sub>4</sub>  
 Curing Acid Volume: 472.1 L  
 Curing Period: 7 days  
 Curing Acid Concentration: 12.58 kg/tonne  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Concentration: 8.0 g/L  
 Leach H<sub>2</sub>SO<sub>4</sub> Solution Feed Rate: 7.0 L/min  
 Initial Sample Moisture: 1.77 % by weight  
 Final Residue Moisture: % by weight

Date	Day	COLUMN A												COLUMN B												SX				Cu		H <sub>2</sub> SO <sub>4</sub>	
		H <sub>2</sub> SO <sub>4</sub> added (kg)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	PLS	Cu (g/L)	Fe (g/L)	pH	Volume (L)	ORP (mV)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	s.g.	Volume (L)	#DIV/0!	Weight (g)	Cum. Weight (g)	Extraction (%)	Cum. vs. feed (kg/ore)	Cum. vs. Cu (kg/ore)							
7-Dec-98	301	0.34	226.50	121.50	1.1069	94.9	1.55	0.019	0.94	5.03	0.61	1.14	1.80	123.90	1.1173	110.8	2.16	565	1.23	1.08	1.91		56,845.8	56,956.1	64.0	25.16	3,693.3						
8-Dec-98	302		121.50	0.00	1.1069	109.8	1.55	0.019	0.94	5.03	0.57	1.23	1.85	111.00	1.1166	99.4	2.20	543	1.15	1.22			56,939.6	56,907.0	64.1	25.16	3,685.7						
9-Dec-98	303	0.86	245.70	122.70	1.1145	110.4	1.57	1.140	1.14	5.11	0.47	1.22	1.85	113.00	1.1162	101.2	2.20	556	1.06	1.18			56,939.6	56,907.0	64.1	25.28	3,902.1						
10-Dec-98	304		122.70	0.00	1.1145	110.1	1.57	1.140	1.14	5.11	0.59	1.24	1.81	113.90	1.1154	102.1	2.12	553	0.91	1.21			56,907.0	56,907.0	64.1	25.28	3,904.3						
11-Dec-98	305		360.40	247.60	1.1091	101.7	2.13	0.890	1.13	5.11	0.90	1.24	1.81	113.50	1.1151	101.8	2.12	553	0.90	1.20			56,900.1	56,900.1	64.1	25.28	3,904.2						
12-Dec-98	306		247.60	108.80	1.1091	126.9	2.13	0.890	1.13		1.03	1.28	1.87	112.00	1.1160	100.4	2.13	562	0.98	1.23			56,993.4	56,993.4	64.0	25.28	3,905.2						
13-Dec-98	307		106.80	0.00	1.1091	96.3	2.13	0.890	1.13		0.89	1.10	2.00	28.40	1.1175	23.6	2.48	489	1.11	1.08			56,833.8	56,833.8	64.0	25.26	3,909.3						
14-Dec-98	308		255.40	134.90	1.1166	107.8	2.20	1.020	1.19		0.97	1.07	2.04	117.00	1.1183	104.6	2.19	596	1.07	1.19			56,835.8	56,835.8	64.0	25.26	3,909.2						
15-Dec-98	309		134.90								1.00	1.07	2.09	110.90	1.1156	99.4	2.22	527	1.09	1.13			56,844.2	56,844.2	64.1	25.28	3,901.8						
16-Dec-98	310		RECIRC.																				56,844.2	56,844.2	64.1	25.26	3,901.8						
22-Dec-98	316										1.20	0.95	2.43				2.54	540	1.22	0.96			56,944.2	56,944.2	64.1	25.26	3,901.8						
24-Dec-98	318													163.00	1.1174	145.9	2.55	555	1.27			156.00	1,1157	141.6	1.96	0.015	3,889.1						
29-Dec-98	323										1.15	2.30	2.78	278.90	1.1161	249.4	2.39	544	1.22			274.70	1,1161	246.1	1.78	0.059	3,868.5						
31-Dec-98	325										0.82	2.07	170.60	1.1173	152.7	2.02	544	0.89				163.10	1,1169	146.0	1.82	0.006	3,861.4						
5-Jan-99	330										0.87	2.44				2.60	548	1.00					57,539.1	57,539.1	64.8	25.26	3,861.4						
11-Jan-99	336										0.12	2.43	88.40	1.1217	78.8	2.49	558	0.12				87.00	1,1203	77.7	1.80	0.004	3,860.8						
12-Jan-99	337										0.97	2.28	103.10	1.1224	91.9	2.30	528	0.98				99.80	1,1204	89.1	1.78	0.004	3,854.8						
15-Jan-99	340										1.01	2.29				2.38	533	1.02					57,636.4	57,636.4	64.9	25.26	3,854.8						
18-Jan-99	343										1.14	2.41	125.40	1.1268	111.3	2.55	496	1.19				124.80	1,1224	111.2	1.83	0.006	3,845.9						
19-Jan-99	344										0.88	2.26	127.00	1.1229	113.1	2.30	532	0.77				124.60	1,1221	111.0	1.80	0.005	3,840.1						
22-Jan-99	347										0.95	2.32				2.43	539	0.96					57,857.9	57,857.9	65.1	25.26	3,840.1						
1-Feb-99	357										1.23	2.51				2.54	498	1.25					57,857.9	57,857.9	65.1	25.26	3,840.1						
4-Feb-99	360	STOP	COLUMN								2.50	127.90	1.1312	113.1	2.55	475							57,857.9	57,857.9	65.1	25.26	3,840.1						



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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Mar 05, 1998  
In : Mar 03, 1998

Page 1 of 1  
[021714:39:31:89030598]

**2 Samples**

2=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C PLS Day 12	Col C RAF Day 12		
SO4	G/L	16.46	19.42	0.01	1000.00
Al	mg/L	814.0	822.2	0.2	9999.0
Sb	mg/L	<0.1	<0.1	0.1	9999.0
As	mg/L	1.0	0.9	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.16	0.18	0.01	999.00
Ca	mg/L	466.4	466.8	0.1	9999.0
Cr	mg/L	<0.01	<0.01	0.01	9999.00
Co	mg/L	4.51	4.47	0.01	9999.00
Cu	mg/L	5083.31	6.55	0.01	9999.00
Fe	mg/L	667.70	678.84	0.03	9999.00
La	mg/L	1.50	1.49	0.05	999.00
Pb	mg/L	0.14	<0.05	0.05	9999.00
Mg	mg/L	765.1	756.9	0.1	9999.0
Mn	mg/L	153.19	152.11	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.17	0.08	0.02	9999.00
Ni	mg/L	1.04	1.06	0.02	9999.00
P	mg/L	59.4	0.3	0.1	9999.0
K	mg/L	11.	12.	2.	9999.
Sc	mg/L	0.27	0.22	0.01	100.00
Ag	mg/L	<0.02	<0.02	0.02	999.00
Na	mg/L	<1.	<1.	1.	9999.
Sr	mg/L	1.51	1.52	0.01	999.00
Th	mg/L	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.2	<0.1	0.1	999.0
W	mg/L	0.7	<0.1	0.1	9999.0
V	mg/L	0.03	<0.01	0.01	999.00
Zn	mg/L	19.68	13.38	0.01	9999.00
Zr	mg/L	0.02	<0.01	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu





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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Mar 11, 1998  
In : Mar 09, 1998

Page 2 of 2  
[023117:19:10:89031198]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col. C PLS Day 19	Col. C RAF Day 19		
SO4	G/L	16.22	17.60	0.01	1000.00
Al	mg/L	1175.7	1151.1	0.2	9999.0
Sb	mg/L	0.1	<0.1	0.1	9999.0
As	mg/L	1.5	1.1	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	0.1	0.1	9999.0
Cd	mg/L	0.20	0.19	0.01	999.00
Ca	mg/L	463.9	463.8	0.1	9999.0
Cr	mg/L	0.01	<0.01	0.01	9999.00
Co	mg/L	5.02	5.02	0.01	9999.00
Cu	mg/L	2720.73	12.70	0.01	9999.00
Fe	mg/L	740.58	740.20	0.03	9999.00
La	mg/L	1.30	1.32	0.05	999.00
Pb	mg/L	<0.05	<0.05	0.05	9999.00
Mg	mg/L	911.2	890.5	0.1	9999.0
Mn	mg/L	173.98	170.16	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.16	0.09	0.02	9999.00
Ni	mg/L	1.22	1.17	0.02	9999.00
P	mg/L	31.0	1.1	0.1	9999.0
K	mg/L	18.	20.	2.	9999.
Sc	mg/L	0.28	0.25	0.01	100.00
Ag	mg/L	<0.02	0.04	0.02	999.00
Na	mg/L	22.	21.	1.	9999.
Sr	mg/L	1.15	1.16	0.01	999.00
Th	mg/L	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.1	<0.1	0.1	999.0
W	mg/L	0.4	<0.1	0.1	9999.0
V	mg/L	0.02	<0.01	0.01	999.00
Zn	mg/L	18.91	15.34	0.01	9999.00
Zr	mg/L	<0.01	0.02	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Mar 20, 1998  
 In : Mar 17, 1998

Page 2 of 2  
 [025117:35:56:89032098]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Day 26		
SO4	G/L		20.77	0.01	1000.00
Al	mg/L		1532.4	0.2	9999.0
Sb	mg/L		<0.1	0.1	9999.0
As	mg/L		1.6	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.22	0.01	999.00
Ca	mg/L		472.5	0.1	9999.0
Cr	mg/L		0.24	0.01	9999.00
Co	mg/L		5.39	0.01	9999.00
Cu	mg/L		9.11	0.01	9999.00
Fe	mg/L		1213.93	0.03	9999.00
La	mg/L		1.20	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		1127.4	0.1	9999.0
Mn	mg/L		179.91	0.01	999.00
Hg	mg/L		0.17	0.05	9999.00
Mo	mg/L		0.07	0.02	9999.00
Ni	mg/L		1.55	0.02	9999.00
P	mg/L		1.4	0.1	9999.0
K	mg/L		15.	2.	9999.
Sc	mg/L		0.83	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		21.	1.	9999.
Sr	mg/L		0.83	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		<0.1	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		<0.01	0.01	999.00
Zn	mg/L		17.66	0.01	9999.00
Zr	mg/L		<0.01	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

**BC Certified Assayer: David Chiu**



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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Apr 01, 1998  
 In: Mar 23, 1998

Page 2 of 2  
 [027812:58:58:89040198]

**4 Samples**      4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Day 33		
SO4	G/L		24.62	0.01	1000.00
Al	mg/L		1937.1	0.2	9999.0
Sb	mg/L		<0.1	0.1	9999.0
As	mg/L		1.7	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.23	0.01	999.00
Ca	mg/L		463.2	0.1	9999.0
Cr	mg/L		0.52	0.01	9999.00
Co	mg/L		5.93	0.01	9999.00
Cu	mg/L		9.58	0.01	9999.00
Fe	mg/L		1426.50	0.03	9999.00
La	mg/L		1.31	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		1399.7	0.1	9999.0
Mn	mg/L		197.54	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		0.04	0.02	9999.00
Ni	mg/L		1.73	0.02	9999.00
P	mg/L		2.8	0.1	9999.0
K	mg/L		18.	2.	9999.
Sc	mg/L		1.28	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		16.	1.	9999.
Si	mg/L		108.75	0.05	9999.00
Sr	mg/L		0.58	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		<0.1	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		0.03	0.01	999.00
Zn	mg/L		19.83	0.01	9999.00
Zr	mg/L		0.03	0.01	999.00

—=No Test    Ins=Insufficient Sample    Del=Delay    Max=No Estimate    Rec=ReCheck    m=x1000    %=Estimate %    NS=No Sample

BC Certified Assayer: David Chiu



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**Process Research Associates Ltd**

INTERNATIONAL PLASMA LABORATORY LTD.

Project: 97-084

Out: Apr 01, 1998  
In : Mar 31, 1998

Page 2 of 2  
[030217:42:16:89040198]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		COL	C RAF Day 40		
SO4	G/L		27.68	0.01	1000.00
Al	mg/L		2402.0	0.2	9999.0
Sb	mg/L		0.2	0.1	9999.0
As	mg/L		2.3	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.27	0.01	999.00
Ca	mg/L		495.1	0.1	9999.0
Cr	mg/L		0.91	0.01	9999.00
Co	mg/L		6.67	0.01	9999.00
Cu	mg/L		7.42	0.01	9999.00
Fe	mg/L		1831.20	0.03	9999.00
La	mg/L		1.38	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		1563.7	0.1	9999.0
Mn	mg/L		205.64	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		0.15	0.02	9999.00
Ni	mg/L		2.08	0.02	9999.00
P	mg/L		8.0	0.1	9999.0
K	mg/L		5.	2.	9999.
Sc	mg/L		1.66	0.01	100.00
Ag	mg/L		0.05	0.02	999.00
Na	mg/L		16.	1.	9999.
Sr	mg/L		0.61	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		<0.1	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		1.01	0.01	999.00
Zn	mg/L		23.95	0.01	9999.00
Zr	mg/L		0.03	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Apr 09, 1998  
In : Apr 08, 1998

Page 2 of 2  
[032414:54:31:89040998]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Day 47		
SO4	G/L		32.07	0.01	1000.00
Al	mg/L		2765.7	0.2	9999.0
Sb	mg/L		<0.1	0.1	9999.0
As	mg/L		2.0	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.25	0.01	999.00
Ca	mg/L		503.4	0.1	9999.0
Cr	mg/L		1.32	0.01	9999.00
Co	mg/L		7.05	0.01	9999.00
Cu	mg/L		3.81	0.01	9999.00
Fe	mg/L		3061.59	0.03	9999.00
La	mg/L		1.46	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		1881.6	0.1	9999.0
Mn	mg/L		219.39	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		0.25	0.02	9999.00
Ni	mg/L		2.27	0.02	9999.00
P	mg/L		117.4	0.1	9999.0
K	mg/L		80.	2.	9999.
Sc	mg/L		1.83	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		9.	1.	9999.
Si	mg/L		259.23	0.05	9999.00
Sr	mg/L		0.97	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		0.2	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		7.05	0.01	999.00
Zn	mg/L		25.97	0.01	9999.00
Zr	mg/L		0.01	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 17, 1998  
In : Apr 14, 1998

Page 2 of 2  
[034212:10:03:89041798]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Comp 54		
SO4	G/L		40.53	0.01	1000.00
Al	mg/L	3426.5		0.2	9999.0
Sb	mg/L	<0.1		0.1	9999.0
As	mg/L	2.4		0.2	9999.0
Ba	mg/L	<0.01		0.01	999.00
Bi	mg/L	<0.1		0.1	9999.0
Cd	mg/L	0.33		0.01	999.00
Ca	mg/L	479.4		0.1	9999.0
Cr	mg/L	1.96		0.01	9999.00
Co	mg/L	7.80		0.01	9999.00
Cu	mg/L	4.98		0.01	9999.00
Fe	mg/L	4203.01		0.03	9999.00
La	mg/L	1.60		0.05	999.00
Pb	mg/L	<0.05		0.05	9999.00
Mg	mg/L	2252.7		0.1	9999.0
Mn	mg/L	254.99		0.01	999.00
Hg	mg/L	<0.05		0.05	9999.00
Mo	mg/L	0.70		0.02	9999.00
Ni	mg/L	2.92		0.02	9999.00
P	mg/L	207.8		0.1	9999.0
K	mg/L	87.		2.	9999.
Sc	mg/L	2.14		0.01	100.00
Ag	mg/L	<0.02		0.02	999.00
Na	mg/L	10.		1.	9999.
Si	mg/L	243.53		0.05	9999.00
Sr	mg/L	1.06		0.01	999.00
Th	mg/L	<0.1		0.1	9999.0
Ti	mg/L	0.5		0.1	999.0
W	mg/L	<0.1		0.1	9999.0
V	mg/L	11.34		0.01	999.00
Zn	mg/L	28.53		0.01	9999.00
Zr	mg/L	0.07		0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 22, 1998  
In : Apr 22, 1998

Page 2 of 2  
[037116:04:41:89042298]

**4 Samples**      4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Comp Day 61		
SO4	G/L		41.11	0.01	1000.00
Al	mg/L		3304.5	0.2	9999.0
Sb	mg/L		<0.1	0.1	9999.0
As	mg/L		1.6	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.28	0.01	999.00
Ca	mg/L		494.1	0.1	9999.0
Cr	mg/L		2.10	0.01	9999.00
Co	mg/L		7.07	0.01	9999.00
Cu	mg/L		6.09	0.01	9999.00
Fe	mg/L		4344.62	0.03	9999.00
La	mg/L		1.36	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		2197.9	0.1	9999.0
Mn	mg/L		209.25	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		1.50	0.02	9999.00
Ni	mg/L		2.37	0.02	9999.00
P	mg/L		232.1	0.1	9999.0
K	mg/L		147.	2.	9999.
Sc	mg/L		2.07	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		4.	1.	9999.
Si	mg/L		267.58	0.05	9999.00
Sr	mg/L		1.06	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		1.1	0.1	999.0
W	mg/L		0.5	0.1	9999.0
V	mg/L		13.17	0.01	999.00
Zn	mg/L		27.16	0.01	9999.00
Zr	mg/L		0.05	0.01	999.00

—=No Test    Ins=Insufficient Sample    Del=Delay    Max=No Estimate    Rec=ReCheck    m=x1000    %=Estimate %    NS=No Sample

BC Certified Assayer: David Chiu



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Process Research Associates Ltd

Project: 97-084

Out: Apr 30, 1998  
In : Apr 29, 1998

Page 2 of 2  
[038911:43:47:89043098]

4 Samples

4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col C	RAF Comp Day 68		
SO4	G/L		46.36	0.01	1000.00
Al	mg/L		3868.0	0.2	9999.0
Sb	mg/L		<0.1	0.1	9999.0
As	mg/L		1.7	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.28	0.01	999.00
Ca	mg/L		488.8	0.1	9999.0
Cr	mg/L		2.52	0.01	9999.00
Co	mg/L		7.18	0.01	9999.00
Cu	mg/L		2.67	0.01	9999.00
Fe	mg/L		4974.65	0.03	9999.00
La	mg/L		1.38	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		2615.2	0.1	9999.0
Mn	mg/L		224.90	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		0.64	0.02	9999.00
Ni	mg/L		2.91	0.02	9999.00
P	mg/L		241.7	0.1	9999.0
K	mg/L		241.	2.	9999.
Sc	mg/L		2.15	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		2.	1.	9999.
Si	mg/L		305.63	0.05	9999.00
Sr	mg/L		1.12	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		3.2	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		15.74	0.01	999.00
Zn	mg/L		29.75	0.01	9999.00
Zr	mg/L		0.09	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084 PO#043

Out: Jun 03, 1998  
In: Jun 02, 1998

Page 2 of 2  
[052114:56:34:89060398]

**3 Samples**

3=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col. C	PLS Day 103		
Al	mg/L		3424.8	0.2	9999.0
Sb	mg/L		0.2	0.1	9999.0
As	mg/L		6.6	0.2	9999.0
Ba	mg/L		<0.01	0.01	999.00
Bi	mg/L		<0.1	0.1	9999.0
Cd	mg/L		0.25	0.01	999.00
Ca	mg/L		497.5	0.1	9999.0
Cr	mg/L		2.19	0.01	9999.00
Co	mg/L		6.74	0.01	9999.00
Cu	mg/L		427.44	0.01	9999.00
Fe	mg/L		1608.21	0.03	9999.00
La	mg/L		0.60	0.05	999.00
Pb	mg/L		<0.05	0.05	9999.00
Mg	mg/L		2457.7	0.1	9999.0
Mn	mg/L		189.72	0.01	999.00
Hg	mg/L		<0.05	0.05	9999.00
Mo	mg/L		0.54	0.02	9999.00
Ni	mg/L		2.75	0.02	9999.00
P	mg/L		88.5	0.1	9999.0
K	mg/L		41.	2.	9999.
Sc	mg/L		1.76	0.01	100.00
Ag	mg/L		<0.02	0.02	999.00
Na	mg/L		16.	1.	9999.
Si	mg/L		211.91	0.05	9999.00
Sr	mg/L		0.29	0.01	999.00
Th	mg/L		<0.1	0.1	9999.0
Ti	mg/L		0.6	0.1	999.0
W	mg/L		<0.1	0.1	9999.0
V	mg/L		1.52	0.01	999.00
Zn	mg/L		31.43	0.01	9999.00
Zr	mg/L		<0.01	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

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**Process Research Associates Ltd**

Project: 97-084

Out: Feb 26, 1998  
In : Feb 24, 1998

Page 1 of 2  
[019217:03:54:89022698]

**6 Samples**

6=Solution

Symbol	Unit	Solution		Solution		Solution		Limit Low	Limit High
		Col B Day	7 PLS	Col B Day	7 Raf	Col B Day	14 PLS		
SO4	G/L		65.76		67.50		39.86	0.01	1000.00
Al	mg/L	3912.9		3879.9		2037.3		0.2	9999.0
Sb	mg/L	<0.1		<0.1		0.2		0.1	9999.0
As	mg/L	4.0		2.9		2.6		0.2	9999.0
Ba	mg/L	<0.01		<0.01		<0.01		0.01	999.00
Bi	mg/L	<0.1		<0.1		0.6		0.1	9999.0
Cd	mg/L	<0.01		0.50		0.32		0.01	999.00
Ca	mg/L	482.2		493.4		470.2		0.1	9999.0
Cr	mg/L	0.92		0.94		0.20		0.01	9999.00
Co	mg/L	13.34		13.54		9.86		0.01	9999.00
Cu	mg/L	15.69g		1561.49		10.04g		0.01	9999.00
Fe	mg/L	3075.71		3056.49		1493.27		0.03	9999.00
La	mg/L	2.01		2.05		1.32		0.05	999.00
Pb	mg/L	<0.05		<0.05		<0.05		0.05	9999.00
Mg	mg/L	3496.8		3531.4		2301.7		0.1	9999.0
Mn	mg/L	505.18		499.30		368.08		0.01	999.00
Hg	mg/L	<0.05		<0.05		<0.05		0.05	9999.00
Mo	mg/L	1.69		1.44		0.35		0.02	9999.00
Ni	mg/L	3.28		3.18		2.26		0.02	9999.00
P	mg/L	217.8		41.4		96.2		0.1	9999.0
K	mg/L	213.		227.		125.		2.	9999.
Sc	mg/L	1.49		1.38		0.77		0.01	100.00
Ag	mg/L	<0.02		<0.02		<0.02		0.02	999.00
Na	mg/L	29.		27.		26.		1.	9999.
Sr	mg/L	1.36		1.36		0.96		0.01	999.00
Th	mg/L	<0.1		<0.1		<0.1		0.1	9999.0
Ti	mg/L	1.7		1.2		0.5		0.1	999.0
W	mg/L	3.4		<0.1		2.2		0.1	9999.0
V	mg/L	3.85		3.85		0.69		0.01	999.00
Zn	mg/L	57.44		40.11		39.66		0.01	9999.00
Zr	mg/L	0.10		0.09		0.02		0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



INTERNATIONAL PLASMA LABORATORY LTD.

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Process Research Associates Ltd

Project: 97-084

Out: Mar 09, 1998  
In : Mar 05, 1998

Page 1 of 1  
[022315:01:04:89030998]

2 Samples

2=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Day 21 Col B PLS	Day 21 Col B RAF		
SO4	G/L	28.38	28.37	0.01	1000.00
Al	mg/L	1389.6	1420.7	0.2	9999.0
Sb	mg/L	<0.1	0.3	0.1	9999.0
As	mg/L	2.1	1.5	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.27	0.29	0.01	999.00
Ca	mg/L	459.3	463.0	0.1	9999.0
Cr	mg/L	0.04	0.07	0.01	9999.00
Co	mg/L	7.37	7.35	0.01	9999.00
Cu	mg/L	6734.65	49.27	0.01	9999.00
Fe	mg/L	1013.21	1067.34	0.03	9999.00
La	mg/L	1.08	1.00	0.05	999.00
Pb	mg/L	<0.05	<0.05	0.05	9999.00
Mg	mg/L	1748.2	1751.3	0.1	9999.0
Mn	mg/L	266.33	268.84	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.12	0.20	0.02	9999.00
Ni	mg/L	1.79	1.71	0.02	9999.00
P	mg/L	87.5	1.5	0.1	9999.0
K	mg/L	70.	59.	2.	9999.
Sc	mg/L	0.46	0.40	0.01	100.00
Ag	mg/L	<0.02	<0.02	0.02	999.00
Na	mg/L	14.	15.	1.	9999.
Sr	mg/L	0.77	0.78	0.01	999.00
Th	mg/L	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.3	<0.1	0.1	999.0
W	mg/L	1.0	<0.1	0.1	9999.0
V	mg/L	0.09	0.31	0.01	999.00
Zn	mg/L	29.39	20.71	0.01	9999.00
Zr	mg/L	0.03	0.01	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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Process Research Associates Ltd

Project: 97-084

Out: Mar 11, 1998  
In : Mar 09, 1998

Page 1 of 2  
[023117:19:10:89031198]

4 Samples 4=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col. B PLS Day 28	Col. B RAF Day 28		
SO4	G/L	23.38	23.73	0.01	1000.00
Al	mg/L	1299.3	1291.7	0.2	9999.0
Sb	mg/L	<0.1	0.1	0.1	9999.0
As	mg/L	1.6	1.5	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	0.6	<0.1	0.1	9999.0
Cd	mg/L	0.24	0.26	0.01	999.00
Ca	mg/L	455.9	462.6	0.1	9999.0
Cr	mg/L	0.03	0.03	0.01	9999.00
Co	mg/L	6.33	6.47	0.01	9999.00
Cu	mg/L	5005.51	184.54	0.01	9999.00
Fe	mg/L	1025.27	998.51	0.03	9999.00
La	mg/L	0.89	0.87	0.05	999.00
Pb	mg/L	0.24	<0.05	0.05	9999.00
Mg	mg/L	1616.6	1566.5	0.1	9999.0
Mn	mg/L	233.77	233.30	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.15	0.21	0.02	9999.00
Ni	mg/L	1.53	1.71	0.02	9999.00
P	mg/L	55.6	3.0	0.1	9999.0
K	mg/L	66.	59.	2.	9999.
Sc	mg/L	0.42	0.38	0.01	100.00
Ag	mg/L	<0.02	<0.02	0.02	999.00
Na	mg/L	23.	24.	1.	9999.
Sr	mg/L	0.69	0.70	0.01	999.00
Th	mg/L	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.2	<0.1	0.1	999.0
W	mg/L	0.7	<0.1	0.1	9999.0
V	mg/L	0.13	0.16	0.01	999.00
Zn	mg/L	25.19	19.12	0.01	9999.00
Zr	mg/L	0.03	0.03	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084

Out: Mar 20, 1998  
 In : Mar 17, 1998

Page 1 of 2  
 [025117:35:56:89032098]

**4 Samples**

4=Solution

Symbol	Unit	Solution			Limit Low	Limit High
		Col B PLS Day 35	Col B RAF Day 35	Col C PLS Day 26		
SO4	G/L	25.55	25.48	19.88	0.01	1000.00
Al	mg/L	1413.9	1391.1	1485.2	0.2	9999.0
Sb	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
As	mg/L	2.1	1.6	1.7	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	2.6	<0.1	0.9	0.1	9999.0
Cd	mg/L	0.26	0.29	0.21	0.01	999.00
Ca	mg/L	467.7	469.7	467.0	0.1	9999.0
Cr	mg/L	0.05	0.07	0.23	0.01	9999.00
Co	mg/L	7.33	7.32	5.42	0.01	9999.00
Cu	mg/L	4703.37	71.37	2194.03	0.01	9999.00
Fe	mg/L	1093.43	1078.72	1176.52	0.03	9999.00
La	mg/L	0.87	0.94	1.26	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	1775.9	1750.9	1171.8	0.1	9999.0
Mn	mg/L	260.13	256.84	175.80	0.01	999.00
Hg	mg/L	0.11	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.21	0.15	0.13	0.02	9999.00
Ni	mg/L	2.04	1.75	1.58	0.02	9999.00
P	mg/L	49.8	2.2	26.5	0.1	9999.0
K	mg/L	54.	132.	22.	2.	9999.
Sc	mg/L	0.48	0.44	0.84	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	30.	31.	21.	1.	9999.
Sr	mg/L	0.64	0.64	0.82	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.2	<0.1	<0.1	0.1	999.0
W	mg/L	1.6	<0.1	0.7	0.1	9999.0
V	mg/L	0.39	0.39	0.02	0.01	999.00
Zn	mg/L	27.10	21.24	20.34	0.01	9999.00
Zr	mg/L	<0.01	<0.01	<0.01	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate% NS=No Sample

BC Certified Assayer: David Chiu



**CERTIFICATE OF ANALYSIS**  
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**Process Research Associates Ltd**

INTERNATIONAL PLASMA LABORATORY LTD.

Project: 97-084

Out: Apr 01, 1998  
In : Mar 23, 1998

Page 1 of 2  
[027812:58:58:89040198]

**4 Samples**

4=Solution

Symbol	Unit	Solution			Limit Low	Limit High
		Col B PLS Day 42	Col B RAF Day 42	Col C PLS Day 33		
SO4	G/L	26.38	26.99	22.12	0.01	1000.00
Al	mg/L	1750.0	1775.8	1950.2	0.2	9999.0
Sb	mg/L	0.1	<0.1	<0.1	0.1	9999.0
As	mg/L	1.7	1.6	1.6	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	1.7	<0.1	0.2	0.1	9999.0
Cd	mg/L	0.31	0.31	0.24	0.01	999.00
Ca	mg/L	463.9	465.6	470.0	0.1	9999.0
Cr	mg/L	0.11	0.09	0.50	0.01	9999.00
Co	mg/L	7.96	8.02	5.98	0.01	9999.00
Cu	mg/L	3924.04	52.15	1722.71	0.01	9999.00
Fe	mg/L	1290.37	1284.69	1443.16	0.03	9999.00
La	mg/L	0.91	0.93	1.31	0.05	999.00
Pb	mg/L	0.10	<0.05	<0.05	0.05	9999.00
Mg	mg/L	2149.5	2052.7	1453.1	0.1	9999.0
Mn	mg/L	290.49	289.32	199.37	0.01	999.00
Hg	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.25	0.13	0.24	0.02	9999.00
Ni	mg/L	2.15	2.06	1.72	0.02	9999.00
P	mg/L	49.3	3.2	24.6	0.1	9999.0
K	mg/L	61.	61.	13.	2.	9999.
Sc	mg/L	0.65	0.63	1.31	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	26.	28.	17.	1.	9999.
Si	mg/L	85.66	87.16	107.61	0.05	9999.00
Sr	mg/L	0.57	0.58	0.59	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.2	<0.1	<0.1	0.1	999.0
W	mg/L	1.6	<0.1	0.5	0.1	9999.0
V	mg/L	0.47	0.44	0.03	0.01	999.00
Zn	mg/L	28.80	24.21	22.21	0.01	9999.00
Zr	mg/L	<0.01	<0.01	<0.01	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

**BC Certified Assayer: David Chiu**



# CERTIFICATE OF ANALYSIS

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INTERNATIONAL PLASMA LABORATORY LTD.

Process Research Associates Ltd

Project: 97-084

Out: Apr 01, 1998  
 In : Mar 31, 1998

Page 1 of 2  
 [030217:42:16:89040198]

4 Samples

4=Solution

Symbol	Unit	Solution			Limit Low	Limit High
		COL B PLS Day 49	COL B RAF Day 49	COL C PLS Day 40		
SO4	G/L	27.68	27.89	26.98	0.01	1000.00
Al	mg/L	1842.8	1850.7	2417.4	0.2	9999.0
Sb	mg/L	<0.1	<0.1	0.1	0.1	9999.0
As	mg/L	2.6	2.2	2.4	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	1.0	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.34	0.36	0.27	0.01	999.00
Ca	mg/L	500.9	497.0	496.1	0.1	9999.0
Cr	mg/L	0.15	0.16	0.83	0.01	9999.00
Co	mg/L	8.59	8.51	6.68	0.01	9999.00
Cu	mg/L	3207.61	36.02	1270.35	0.01	9999.00
Fe	mg/L	1391.77	1388.87	1787.69	0.03	9999.00
La	mg/L	0.88	0.92	1.38	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	2025.7	2049.9	1588.1	0.1	9999.0
Mn	mg/L	281.31	281.62	206.85	0.01	999.00
Hg	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.26	0.13	0.17	0.02	9999.00
Ni	mg/L	2.46	2.41	2.15	0.02	9999.00
P	mg/L	44.3	2.9	21.4	0.1	9999.0
K	mg/L	69.	67.	5.	2.	9999.
Sc	mg/L	0.68	0.75	1.60	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	26.	27.	15.	1.	9999.
Sr	mg/L	0.52	0.52	0.61	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.2	<0.1	<0.1	0.1	999.0
W	mg/L	0.9	<0.1	0.3	0.1	9999.0
V	mg/L	0.68	0.94	0.53	0.01	999.00
Zn	mg/L	31.56	26.86	25.70	0.01	9999.00
Zr	mg/L	<0.01	<0.01	0.06	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 09, 1998  
In : Apr 08, 1998

Page 1 of 2  
[032414:54:31:89040998]

INTERNATIONAL PLASMA LABORATORY LTD.

**4 Samples**

4=Solution

Symbol	Unit	Solution	Solution	Solution	Limit Low	Limit High
		Col B PLS Day 56	Col B RAF Day 56	Col C PLS Day 47		
SO4	G/L	30.94	30.92	33.06	0.01	1000.00
Al	mg/L	2274.4	2282.0	2935.3	0.2	9999.0
Sb	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
As	mg/L	2.3	2.3	1.7	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	0.2	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.34	0.34	0.26	0.01	999.00
Ca	mg/L	517.2	517.4	508.9	0.1	9999.0
Cr	mg/L	0.46	0.49	1.48	0.01	9999.00
Co	mg/L	9.02	9.05	7.26	0.01	9999.00
Cu	mg/L	1915.31	14.07	797.00	0.01	9999.00
Fe	mg/L	2044.03	2019.78	3537.02	0.03	9999.00
La	mg/L	1.13	1.11	1.54	0.05	999.00
Pb	mg/L	<0.05	0.21	<0.05	0.05	9999.00
Mg	mg/L	2354.4	2375.6	1966.0	0.1	9999.0
Mn	mg/L	299.20	301.58	224.68	0.01	999.00
Hg	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.91	0.21	0.94	0.02	9999.00
Ni	mg/L	2.45	2.54	2.36	0.02	9999.00
P	mg/L	80.0	54.9	160.7	0.1	9999.0
K	mg/L	152.	222.	106.	2.	9999.
Sc	mg/L	1.04	1.03	1.90	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	26.	27.	6.	1.	9999.
Si	mg/L	204.68	203.66	279.42	0.05	9999.00
Sr	mg/L	0.83	0.83	0.99	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	2.4	2.4	0.3	0.1	999.0
W	mg/L	1.1	<0.1	0.4	0.1	9999.0
V	mg/L	3.67	3.68	8.16	0.01	999.00
Zn	mg/L	31.22	29.10	27.97	0.01	9999.00
Zr	mg/L	<0.01	0.03	0.05	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu





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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 17, 1998  
In : Apr 14, 1998

Page 1 of 2  
[034212:10:03:89041798]

**4 Samples**

4=Solution

Symbol	Unit	Solution		Solution		Limit Low	Limit High
		Col B PLS Day 63	Col B RAF Day 63	Col C PLS Day 54	Col C PLS Day 54		
SO4	G/L	36.04	36.46	42.53	42.53	0.01	1000.00
Al	mg/L	2737.9	2797.4	3705.5	3705.5	0.2	9999.0
Sb	mg/L	0.3	0.2	<0.1	<0.1	0.1	9999.0
As	mg/L	2.4	3.0	2.2	2.2	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.38	0.39	0.34	0.34	0.01	999.00
Ca	mg/L	482.0	489.1	474.9	474.9	0.1	9999.0
Cr	mg/L	0.72	0.71	2.14	2.14	0.01	9999.00
Co	mg/L	9.01	9.15	8.09	8.09	0.01	9999.00
Cu	mg/L	1661.69	12.03	932.20	932.20	0.01	9999.00
Fe	mg/L	2576.85	2549.83	4616.31	4616.31	0.03	9999.00
La	mg/L	1.12	1.08	1.69	1.69	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	2589.1	2605.4	2449.8	2449.8	0.1	9999.0
Mn	mg/L	318.25	322.29	265.10	265.10	0.01	999.00
Hg	mg/L	<0.05	0.16	<0.05	<0.05	0.05	9999.00
Mo	mg/L	1.57	0.45	1.55	1.55	0.02	9999.00
Ni	mg/L	2.77	2.83	2.84	2.84	0.02	9999.00
P	mg/L	92.8	73.3	209.2	209.2	0.1	9999.0
K	mg/L	117.	107.	92.	92.	2.	9999.
Sc	mg/L	1.35	1.39	2.17	2.17	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	25.	27.	8.	8.	1.	9999.
Si	mg/L	177.90	183.59	261.05	261.05	0.05	9999.00
Sr	mg/L	0.80	0.84	1.04	1.04	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	4.4	4.3	0.5	0.5	0.1	999.0
W	mg/L	<0.1	<0.1	<0.1	<0.1	0.1	9999.0
V	mg/L	4.67	4.70	12.81	12.81	0.01	999.00
Zn	mg/L	31.09	29.72	31.46	31.46	0.01	9999.00
Zr	mg/L	0.04	0.02	0.09	0.09	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

**BC Certified Assayer: David Chiu**



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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 22, 1998  
In : Apr 22, 1998

Page 1 of 2  
[037116:04:41:89042298]

**4 Samples**

4=Solution

Symbol	Unit	Solution	Solution	Solution	Limit Low	Limit High
		Col B PLS Day 70	Col B RAF Day 70	Col C PLS Day 61		
SO4	G/L	38.58	38.72	36.47	0.01	1000.00
Al	mg/L	3120.1	3051.9	2935.4	0.2	9999.0
Sb	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
As	mg/L	3.0	2.8	1.0	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	1.2	0.1	<0.1	0.1	9999.0
Cd	mg/L	0.41	0.41	0.22	0.01	999.00
Ca	mg/L	491.1	487.8	481.9	0.1	9999.0
Cr	mg/L	0.79	0.78	1.84	0.01	9999.00
Co	mg/L	9.78	9.71	5.80	0.01	9999.00
Cu	mg/L	1442.53	11.89	484.80	0.01	9999.00
Fe	mg/L	2677.90	2580.55	4291.79	0.03	9999.00
La	mg/L	1.13	1.11	1.07	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	2772.0	2790.5	1952.5	0.1	9999.0
Mn	mg/L	321.35	317.63	167.52	0.01	999.00
Hg	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mo	mg/L	1.86	1.32	3.43	0.02	9999.00
Ni	mg/L	2.82	2.82	1.83	0.02	9999.00
P	mg/L	71.4	51.2	219.9	0.1	9999.0
K	mg/L	104.	102.	154.	2.	9999.
Sc	mg/L	1.55	1.51	1.68	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	26.	26.	<1.	1.	9999.
Si	mg/L	171.99	169.90	264.96	0.05	9999.00
Sr	mg/L	0.73	0.71	1.05	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	2.7	2.4	1.1	0.1	999.0
W	mg/L	0.4	0.2	0.6	0.1	9999.0
V	mg/L	4.71	4.48	12.37	0.01	999.00
Zn	mg/L	33.32	31.46	23.27	0.01	9999.00
Zr	mg/L	0.02	0.03	0.06	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



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**Process Research Associates Ltd**

Project: 97-084

Out: Apr 30, 1998  
In : Apr 29, 1998

Page 1 of 2  
[038911:43:47:89043098]

**4 Samples**

4=Solution

Symbol	Unit	Solution			Limit Low	Limit High
		Col B PLS Day 77	Col B RAF Day 77	Col C PLS Day 68		
SO4	G/L	39.75	39.33	44.42	0.01	1000.00
Al	mg/L	3319.9	3317.1	3778.7	0.2	9999.0
Sb	mg/L	0.3	<0.1	0.1	0.1	9999.0
As	mg/L	2.9	3.2	1.7	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.43	0.43	0.28	0.01	999.00
Ca	mg/L	479.8	485.5	491.2	0.1	9999.0
Cr	mg/L	0.82	0.84	2.50	0.01	9999.00
Co	mg/L	10.00	10.12	7.01	0.01	9999.00
Cu	mg/L	1222.32	6.00	323.90	0.01	9999.00
Fe	mg/L	2273.35	2131.68	5015.75	0.03	9999.00
La	mg/L	1.13	1.08	1.32	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	2917.8	2957.9	2574.1	0.1	9999.0
Mn	mg/L	350.77	351.93	217.77	0.01	999.00
Hg	mg/L	<0.05	0.11	<0.05	0.05	9999.00
Mo	mg/L	1.05	0.69	2.99	0.02	9999.00
Ni	mg/L	3.15	3.14	2.90	0.02	9999.00
P	mg/L	70.7	57.6	210.6	0.1	9999.0
K	mg/L	71.	63.	236.	2.	9999.
Sc	mg/L	1.66	1.67	2.12	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	28.	29.	<1.	1.	9999.
Si	mg/L	147.63	148.07	284.13	0.05	9999.00
Sr	mg/L	0.54	0.54	1.12	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	2.5	2.3	3.0	0.1	999.0
W	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
V	mg/L	3.46	3.35	16.05	0.01	999.00
Zn	mg/L	35.25	34.26	29.62	0.01	9999.00
Zr	mg/L	0.07	0.05	0.08	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

**BC Certified Assayer: David Chiu**



INTERNATIONAL PLASMA LABORATORY LTD.

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Process Research Associates Ltd

Project: 97-084

Out: May 06, 1998  
In : May 05, 1998

Page 1 of 1  
[040811:44:14:89050698]

3 Samples

3=Solution

Symbol	Unit	Solution			Limit Low	Limit High
		COL B PLS DAY 84	COL B RAF DAY 84	COL C PLS DAY 75		
SO4	G/L	40.38	40.86	39.24	0.01	1000.00
Al	mg/L	3667.6	3652.7	3353.2	0.2	9999.0
Sb	mg/L	0.3	0.2	0.5	0.1	9999.0
As	mg/L	4.3	4.4	2.3	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	0.7	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.54	0.54	0.29	0.01	999.00
Ca	mg/L	537.5	532.1	531.5	0.1	9999.0
Cr	mg/L	0.91	0.88	2.38	0.01	9999.00
Co	mg/L	11.56	11.50	6.41	0.01	9999.00
Cu	mg/L	1440.63	12.02	249.57	0.01	9999.00
Fe	mg/L	1430.71	1302.10	4247.16	0.03	9999.00
La	mg/L	0.93	1.01	1.06	0.05	999.00
Pb	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mg	mg/L	3116.0	3140.5	2334.6	0.1	9999.0
Mn	mg/L	378.88	378.83	183.88	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.11	0.05	9999.00
Mo	mg/L	0.76	0.86	1.67	0.02	9999.00
Ni	mg/L	3.66	3.64	2.92	0.02	9999.00
P	mg/L	69.7	51.9	136.4	0.1	9999.0
K	mg/L	17.	24.	171.	2.	9999.
Sc	mg/L	2.04	2.01	1.77	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	40.	41.	5.	1.	9999.
Si	mg/L	156.97	157.85	263.13	0.05	9999.00
Sr	mg/L	0.30	0.30	1.03	0.01	999.00
Th	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Ti	mg/L	1.5	1.3	1.8	0.1	999.0
W	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
V	mg/L	1.70	1.71	14.21	0.01	999.00
Zn	mg/L	42.26	40.17	28.60	0.01	9999.00
Zr	mg/L	0.04	0.02	0.08	0.01	999.00

—=No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assayer: David Chiu



**CERTIFICATE OF ANALYSIS**  
**iPL 98F0521**

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**Process Research Associates Ltd**

INTERNATIONAL PLASMA LABORATORY LTD.

Project: 97-084 PO#043

Out: Jun 03, 1998  
In : Jun 02, 1998

Page 1 of 2  
[052114:56:34:89060398]

**3 Samples**

3=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		Col. B PLS Day 112	Col. B RAF Day 112		
Al	mg/L	3782.9	3804.8	0.2	9999.0
Sb	mg/L	0.2	0.1	0.1	9999.0
As	mg/L	9.0	8.1	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.54	0.56	0.01	999.00
Ca	mg/L	515.2	509.5	0.1	9999.0
Cr	mg/L	0.52	0.56	0.01	9999.00
Co	mg/L	12.32	12.21	0.01	9999.00
Cu	mg/L	1080.05	3.39	0.01	9999.00
Fe	mg/L	267.30	170.22	0.03	9999.00
La	mg/L	0.52	0.59	0.05	999.00
Pb	mg/L	0.80	0.78	0.05	9999.00
Mg	mg/L	3320.4	3347.1	0.1	9999.0
Mn	mg/L	394.63	396.37	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.25	0.21	0.02	9999.00
Ni	mg/L	4.15	3.97	0.02	9999.00
P	mg/L	26.1	14.5	0.1	9999.0
K	mg/L	6.	15.	2.	9999.
Sc	mg/L	1.60	1.60	0.01	100.00
Ag	mg/L	<0.02	<0.02	0.02	999.00
Na	mg/L	37.	38.	1.	9999.
Si	mg/L	99.36	99.12	0.05	9999.00
Sr	mg/L	0.13	0.14	0.01	999.00
Th	mg/L	<0.1	<0.1	0.1	9999.0
Ti	mg/L	0.4	0.3	0.1	999.0
W	mg/L	0.2	<0.1	0.1	9999.0
V	mg/L	<0.01	<0.01	0.01	999.00
Zn	mg/L	45.48	43.69	0.01	9999.00
Zr	mg/L	<0.01	0.01	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

BC Certified Assay : David Chiu



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**Process Research Associates Ltd**

Project: 97-084

Out: Feb 26, 1998  
In : Feb 24, 1998

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[019217:03:54:89022698]

**6 Samples**

6=Solution

Symbol	Unit	Solution	Solution	Solution	Limit Low	Limit High
		Col B Day 14 Raf	Col C Day 5 PLS	Col C Day 5 Raf		
SO4	G/L	39.93	39.97	46.02	0.01	1000.00
Al	mg/L	2054.3	1502.2	1655.0	0.2	9999.0
Sb	mg/L	<0.1	0.1	0.3	0.1	9999.0
As	mg/L	2.3	2.7	2.3	0.2	9999.0
Ba	mg/L	<0.01	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.36	<0.01	0.42	0.01	999.00
Ca	mg/L	472.9	497.9	505.1	0.1	9999.0
Cr	mg/L	0.22	0.21	0.28	0.01	9999.00
Co	mg/L	9.93	9.80	10.71	0.01	9999.00
Cu	mg/L	2299.47	15.78g	235.70	0.01	9999.00
Fe	mg/L	1487.32	503.13	586.58	0.03	9999.00
La	mg/L	1.40	2.17	2.32	0.05	999.00
Pb	mg/L	<0.05	0.48	0.11	0.05	9999.00
Mg	mg/L	2321.5	1325.5	1413.6	0.1	9999.0
Mn	mg/L	368.77	359.61	385.20	0.01	999.00
Hg	mg/L	<0.05	<0.05	<0.05	0.05	9999.00
Mo	mg/L	1.22	0.33	0.09	0.02	9999.00
Ni	mg/L	2.38	2.03	2.33	0.02	9999.00
P	mg/L	29.1	187.9	15.4	0.1	9999.0
K	mg/L	99.	17.	19.	2.	9999.
Sc	mg/L	0.69	0.73	0.69	0.01	100.00
Ag	mg/L	<0.02	<0.02	<0.02	0.02	999.00
Na	mg/L	26.	39.	41.	1.	9999.
Sr	mg/L	0.96	2.28	2.36	0.01	999.00
Th	mg/L	<0.1	0.2	<0.1	0.1	9999.0
Ti	mg/L	0.2	0.6	0.1	0.1	999.0
W	mg/L	0.2	3.7	<0.1	0.1	9999.0
V	mg/L	0.53	0.10	0.10	0.01	999.00
Zn	mg/L	29.65	45.23	27.70	0.01	9999.00
Zr	mg/L	0.03	0.02	0.03	0.01	999.00

—No Test Ins=Insufficient Sample Del=Delay Max=No Estimate Rec=ReCheck m=x1000 %=Estimate % NS=No Sample

**BC Certified Assayer: David Chiu**

## **Appendix 3**

### **Waste Neutralization Batch Test Report**

**Carmacks Copper Project**  
**Waste Neutralization Testwork**

**WESTERN COPPER HOLDINGS**

**MAY 1998**

**BEATTIE CONSULTING LTD**  
**VANCOUVER, B. C. CANADA**



## 1.0 INTRODUCTION

Previous column testwork conducted on the neutralization of leached Carmacks composites achieved an effluent pH of about 4 with the addition of lime or sodium hydroxide solutions to the top of the column. The present testwork was an extension of that work and was intended to evaluate more completely the effectiveness of various neutralizing agents for achieving effluents having a neutral pH and low dissolved solids. The sample used for the testwork was residual waste from a crib test that had been conducted at the site several years ago. When that test was ended, the solids were emptied from the crib into trenches at the site and were left exposed to the environment until they were collected late in 1997 for the tests. The present report summarizes the results of testwork which was completed on the waste sample. All the testwork was conducted by Process Research Associates Ltd and the ICP analyses were carried out by International Plasma Laboratories in Vancouver.

## 2.0 SAMPLE DESCRIPTION

The sample used for the testwork was collected by representatives of Kilborn Engineering, late in 1997 and was shipped to the laboratory of Process Research Associates Ltd in Vancouver. The sample, weighing about 360 kg, was shipped to Vancouver in a single fibre bag. The sub samples which were used for the testwork were taken from the total waste sample by multiple point sampling since the moist condition of the sample precluded the use of other sample splitting techniques.

The sample was assayed to establish to what extent it had been leached and the results are summarized in Table 1. It is apparent from the analysis that the copper has been only partially leached from this sample.

**Table 1**  
**Assays of Waste Sample**

<b>Element</b>	<b>Assay, %</b>
Cu total	0.58
Cu soluble	0.42
Fe total	3.84
Fe soluble	1.20

The size analysis showing the sample to be minus  $\frac{3}{4}$  inch and an ICP analysis are included in Appendix A. The results of a whole rock analysis for the sample are summarized in Table 2. The rock is composed of aluminosilicates and the composition is consistent with a high biotite content.

**Table 2**  
**Whole Rock Analysis of Waste Sample**

<b>Compound</b>	<b>Analysis, %</b>
Al <sub>2</sub> O <sub>3</sub>	16.98
BaO	0.22
CaO	3.43
Fe <sub>2</sub> O <sub>3</sub>	6.21
K <sub>2</sub> O	2.43
MgO	2.24
MnO	0.07
Na <sub>2</sub> O	4.59
P <sub>2</sub> O <sub>5</sub>	0.30
SiO <sub>2</sub>	57.27
TiO <sub>2</sub>	0.68
LOI	5.64
<b>Total</b>	<b>100.06</b>

### 3.0 TEST PROCEDURES

The detailed test procedures and results for all the testwork conducted on the waste sample (identified as sample L1) are included as Appendix B.

A portion of the L1 sample was leached with deionized water for 24 hours. The pH of the solution was monitored over this period and the final solution was analyzed by ICP analysis. This test was designated as test WL1.

In order to remove some of the soluble copper from the waste sample and re-acidify it prior to the neutralization testwork, a sub sample of the waste was placed in a column and was flooded with a 15 gpl  $H_2SO_4$  solution. After 48 hours the solution was drained from the column and the column was re-flooded with a 2 gpl acid solution. After an additional 24 hours this rinse solution was also drained from the column although there was a high solution hold up in the solids. The solids at this point were removed from the column and were split into several portions for individual leaching tests. The column leaching of the L1 sample is identified as test AL1.

Four tests were conducted on the leached waste sample. In each case the test was conducted by mixing the waste sample with deionized water and titrating to target pH values with the selected base while agitating the sample. The pH was adjusted in several stages to observe the stability once a particular value was attained. In the first test (AL1-T1) the pH was adjusted to 4, 5.8 and then 7. The solution was sampled and analyzed by ICP after a pH of 5.8 and 7.1 was achieved. In subsequent tests, after a stable condition was achieved at pH 4, the target value was changed directly to pH 7. Only the final filtrates were analyzed by ICP for these tests. The test conditions are summarized in Table 3.

**Table 3**  
**Neutralization Tests on Carmacks Waste Samples**

Test No.	Neutralizing Agent
AL1 – T1	NaOH
AL1 – T2	Lime
AL1 – T3	$Na_2CO_3$
AL1 – T4	Water

### 4.0 RESULTS

The water leach test of the waste sample as received indicated that the pH of water in contact with this material would have a pH near pH 4, starting with deionized water having a pH of 4.66. The ICP analysis for the solution from this test, along with those from all the other tests, is included in Appendix B. In addition to the soluble copper, leaching of Al, Ca, Fe, Mg, Mn, K and Na is apparent. The solution also contained 2,750 mg/L sulphate, which together with the dissolved copper indicates that the solids had not been well washed when leaching was ended.

While the acid leach test removed some of the copper from the waste, significant copper remained in the solids used for the neutralization tests. The solids also did not become as acidic as those previously

produced by column leaching, (pH 2.2). The consumption of base in the subsequent neutralization tests on this material therefore likely is understated.

A graphical presentation of the pH as a function of time for each of the titration tests is included in Appendix B. While the solution with no base added again remained at about pH 4, with sodium hydroxide, sodium carbonate or lime the solution could readily be adjusted to pH 7 and was stable at this value in each case. It appears from these tests that when a basic solution is in free contact with the solids, they are readily neutralized. This result suggests that lime is likely not a good choice for neutralizing a spent heap due to its limited solubility in water.

The resulting filtrates from these tests show that effective neutralization results in a large drop in dissolved aluminum, iron and copper and a lesser decrease in the magnesium and potassium. Sodium carbonate appears to have been the most effective at neutralization.

**APPENDIX A**

**Waste Sample Characterization**

## Multielement ICP Analysis Results

Project: 97-084

Date: February 24, 1998

Element	Unit	Sample
		L1 (waste) Head
Al	ppm	15,089
Sb	ppm	< 5
As	ppm	< 5
Ba	ppm	104
Bi	ppm	< 2
Cd	ppm	0.7
Ca	ppm	5,388
Cr	ppm	35
Co	ppm	14
Cu	ppm	5,586
Fe	ppm	37,668
La	ppm	11
Pb	ppm	3
Mg	ppm	12,140
Mn	ppm	404
Hg	ppm	< 3
Mo	ppm	67
Ni	ppm	9
P	ppm	1,353
K	ppm	7,768
Sc	ppm	5
Ag	ppm	6.1
Na	ppm	< 100
Sr	ppm	25
Tl	ppm	< 10
Ti	ppm	1,406
W	ppm	< 5
V	ppm	91
Zn	ppm	82
Zr	ppm	3

# SIZE ANALYSIS REPORT

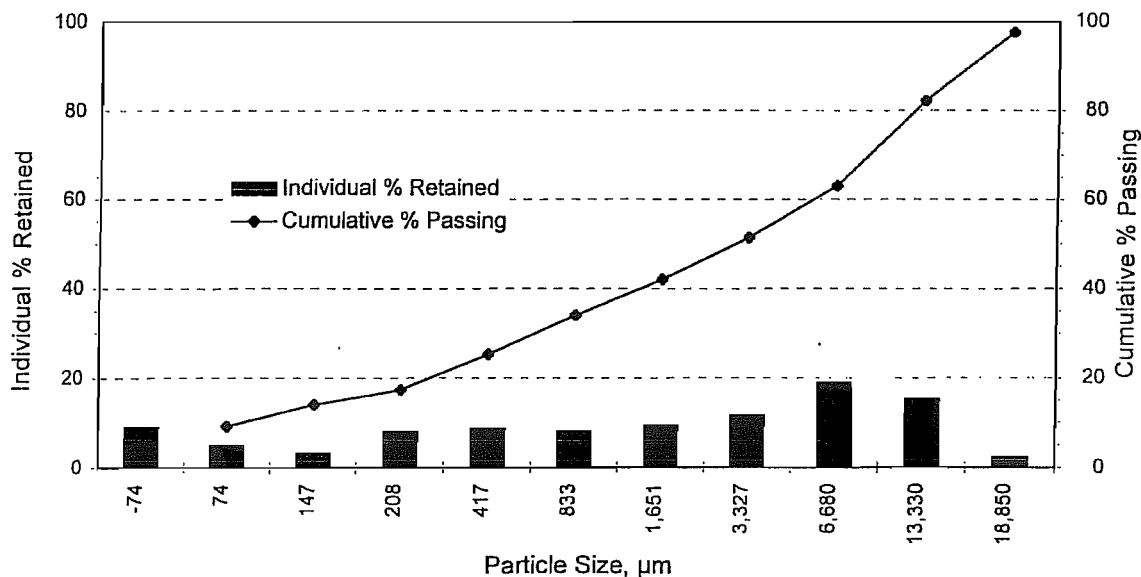
Test: S2  
 Sample: L1 (waste) sample head

Date: February 19, 1998  
 Project: 97-084

Sieve Size		Individual % Retained	Cumulative % Passing
Size range	Micrometers		
3/4"	18,850	2.4	97.6
1/2"	13,330	15.5	82.1
3	6,680	19.1	63.0
6	3,327	11.6	51.4
10	1,651	9.4	42.0
20	833	8.1	34.0
35	417	8.8	25.2
65	208	7.9	17.3
100	147	3.3	14.0
200	74	5.0	9.0
-200	-74	9.0	-
<b>TOTAL:</b>		100.0	

80 % Passing Size ( $\mu\text{m}$ ) = 12,471

## Size Distribution



Head Sample Moisture = 8.40% (by weight)

## **APPENDIX B**

### **Test Details**



# WATER LEACH TEST ON WASTE SAMPLE L1

Test: WL1  
Sample: Waste L1

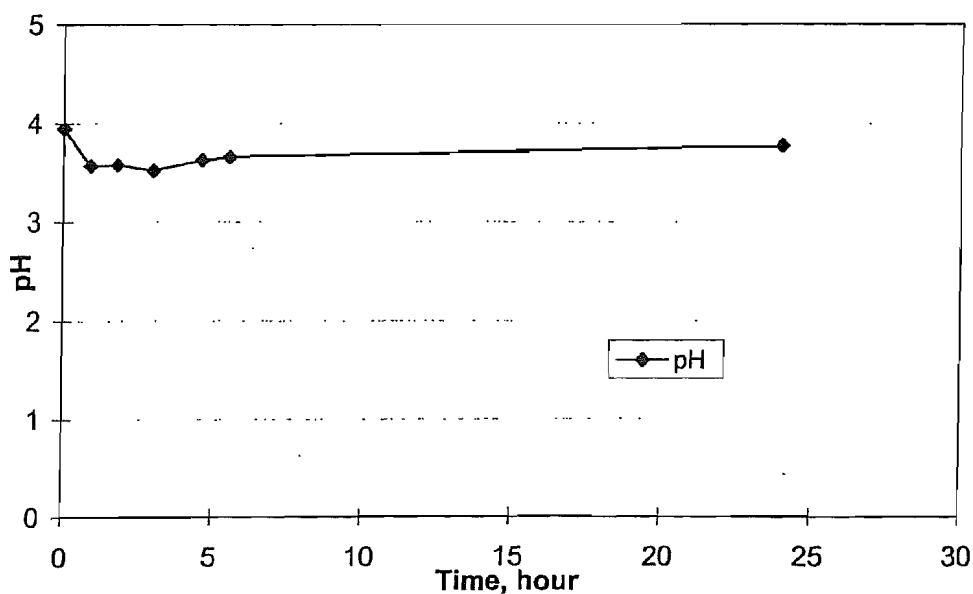
Date: February 26, 1998  
Project: 97-084

- Procedure:**
- added 500 mL of deionized water to a 1-liter conical flask;
  - recorded pH of the water;
  - added 100 g waste sample L1 to the flask and recorded pH; and sulphate determinations.
  - shook the slurry for 24 hours, recorded pH change;
  - sampled the slurry for ICP analysis as well as total acidity and sulphate determination.

Time (hour)	pH	SO <sub>4</sub> <sup>=</sup> (mg/L)	Total Acidity (mg CaCO <sub>3</sub> /L)	ICP Sample ID
0.0	3.95			
0.9	3.57			
1.8	3.58			
3.0	3.52			
4.6	3.63			
5.5	3.66			
24.0	3.78	2,750.0	777.4	WL1 Filtrate

pH of deionized water was 4.66.

### pH Change of the Residue Slurry



## ACID LEACH TEST ON WASTE SAMPLE L1

Test: AL1  
Sample: Waste L1

Date: February 26, 1998  
Project: 97-084

Procedure: - placed 8 kg L1 sample in a 4"x4' column;  
- added 15 g/L H<sub>2</sub>SO<sub>4</sub> solution to submerge the solids;  
- drained the column after 48 hours;  
- added 2 g/L H<sub>2</sub>SO<sub>4</sub> solution to submerge the solids;  
- drained the column after 24 hours;  
- drained solutions analysed by ICP;  
- wet residue was saved for titration tests.

Time (hour)	15 g/L H <sub>2</sub> SO <sub>4</sub> added (mL)	2 g/L H <sub>2</sub> SO <sub>4</sub> added (mL)	Total H <sub>2</sub> SO <sub>4</sub> added (kg/t)	Solution Drained			
				Volume (mL)	pH	Cu (g/L)	ICP Sample ID
0	945		1.77				
48				332.00	3.49	19.40	AL1 Solution 1
72		349.00	0.09				
96				347.00	3.56	12.8	AL1 Solution 2

# NEUTRALIZATION TEST ON WASTE SAMPLE L1

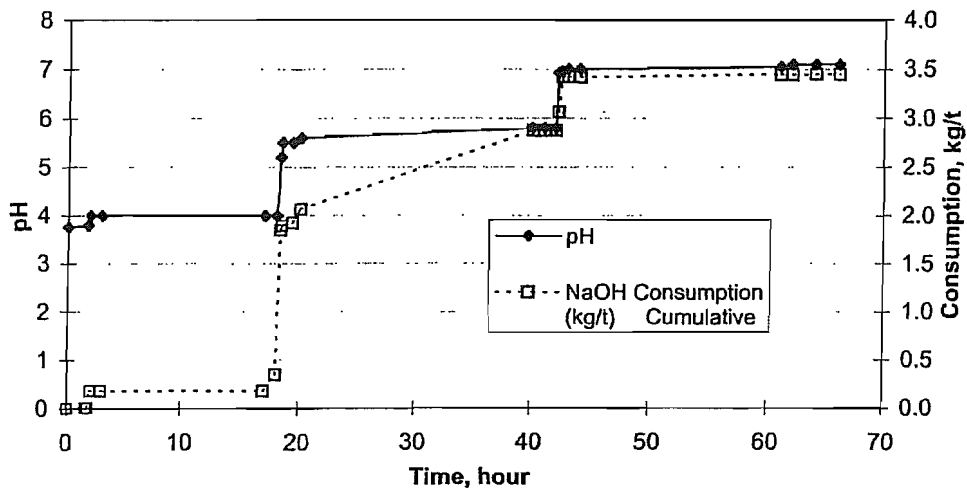
Test: AL1-T1  
 Sample: AL1 residue/NaOH

Date: February 26, 1998  
 Project: 97-084

Procedure: - mixed 1 kg wet residue with 5 kg deionized water;  
 - titrated with 0.893 N NaOH;  
 - sequentially increase the end points to pH 3.5, 4, 5.5 and 7.0;  
 - sampled the slurry for ICP analysis.

Time (hour)	pH	NaOH added (mL)	NaOH Consumption (kg/t)		ICP Sample ID
			Individual	Cumulative	
0.0	3.8			0.00	
1.7	3.8			0.00	
1.8	3.8			0.00	
2.0	4.0	5.1	0.18	0.18	
3.0	4.0			0.18	
17.0	4.0			0.18	
18.0	4.0	4.6	0.16	0.35	
18.3	5.2	42.0	1.50	1.85	
18.4	5.5	1.3	0.05	1.89	
19.3	5.5	0.8	0.03	1.92	
20.0	5.6	4.0	0.14	2.06	
40.0	5.8	22.7	0.81	2.88	
41.0	5.8			2.88	
42.0	5.8			2.88	AL1-T1 Filtrate1
42.2	6.9	5.3	0.19	3.06	
42.5	7.0	10.0	0.36	3.42	
43.0	7.0			3.42	
44.0	7.0			3.42	
61.0	7.1	0.8	0.03	3.45	
62.0	7.1			3.45	
64.0	7.1			3.45	
66.0	7.1			3.45	AL1-T1 Filtrate 2
<b>Total</b>		<b>96.6</b>	<b>3.45</b>		

**Titration of AL1 Residue with NaOH**



# NEUTRALIZATION TEST ON WASTE SAMPLE L1

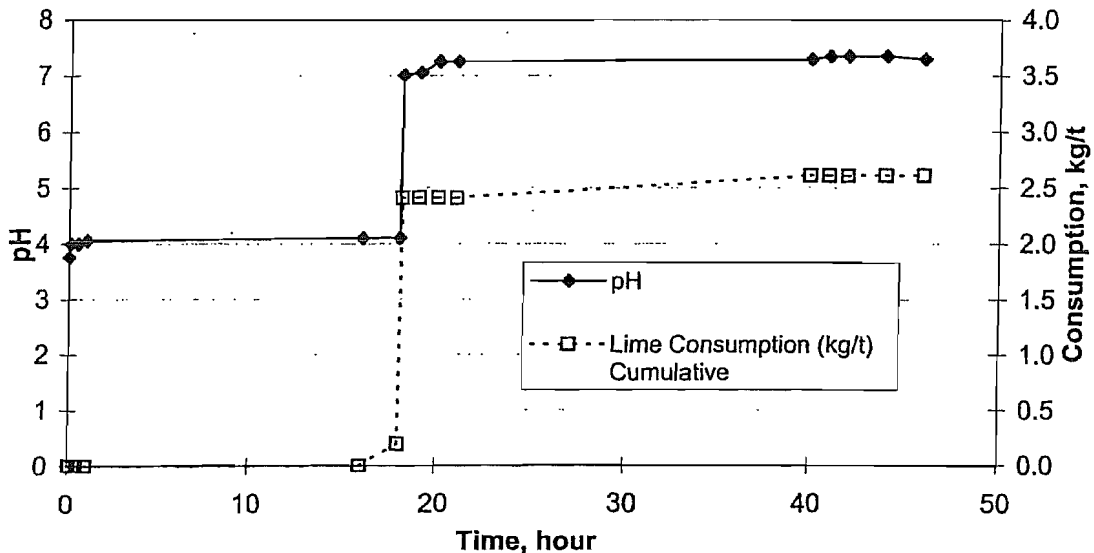
Test: AL1-T2  
 Sample: AL1 residue/Lime

Date: February 26, 1998  
 Project: 97-084

Procedure: - mixed 1 kg wet residue with 5 kg deionized water;  
 - titrated with 0.099 g/mL lime slurry;  
 - sequentially increased the end points to pH 3.5, 4.0 and 7.0;  
 - sampled the slurry for ICP analysis.

Time (hour)	pH	Lime added (mL)	Lime Consumption (kg/t)		ICP Sample ID
			Individual	Cumulative	
0.0	3.8		0.00	0.00	
0.1	4.0		0.00	0.00	
0.5	4.0		0.00	0.00	
1.0	4.1		0.00	0.00	
16.0	4.1		0.00	0.00	
18.0	4.1	2.0	0.20	0.20	
18.1	7.0	22.4	2.21	2.41	
19.0	7.1		0.00	2.41	
20.0	7.3		0.00	2.41	
21.0	7.3		0.00	2.41	
40.0	7.3	2.0	0.20	2.61	
41.0	7.4		0.00	2.61	
42.0	7.4		0.00	2.61	
44.0	7.4		0.00	2.61	
46.0	7.3		0.00	2.61	AL1-T2 Filtrate
<b>Total</b>		<b>26.4</b>	<b>2.61</b>		

**Titration of AL1 Residue with Lime**



# NEUTRALIZATION TEST ON WASTE SAMPLE L1

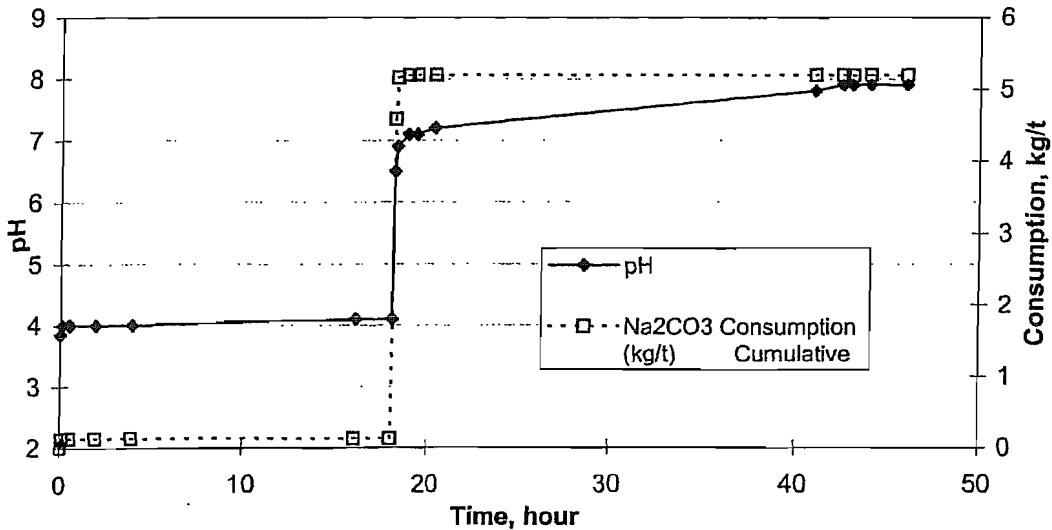
Test: AL1-T3  
 Sample: AL1 residue/Na<sub>2</sub>CO<sub>3</sub>

Date: February 26, 1998  
 Project: 97-084

- Procedure:
- mixed 1 kg wet residue with 5 kg deionized water;
  - titrated with 1.73 N (9.169%) Na<sub>2</sub>CO<sub>3</sub>;
  - sequentially increased the end points to pH 3.5, 4.0 and 7.0;
  - sampled the slurry for ICP analysis.

Time (hour)	pH	Na <sub>2</sub> CO <sub>3</sub> added (mL)	Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/t)		ICP Sample ID
			Individual	Cumulative	
0.0	3.9			0.00	
0.1	4.0	1.3	0.12	0.12	
0.5	4.0	0.1	0.01	0.13	
2.0	4.0			0.13	
4.0	4.0			0.13	
16.0	4.1			0.13	
18.0	4.1			0.13	
18.1	6.5	48.6	4.46	4.58	
18.2	6.9	6.3	0.58	5.16	
18.8	7.1	0.4	0.04	5.20	
19.3	7.1			5.20	
20.3	7.2			5.20	
41.0	7.8			5.20	
42.5	7.9			5.20	
43.0	7.9			5.20	
44.0	7.9			5.20	
46.0	7.9			5.20	AL1-T3 Filtrate
<b>Total</b>		<b>56.7</b>	<b>5.20</b>		

**Titration of AL1 Residue with Sodium Carbonate**



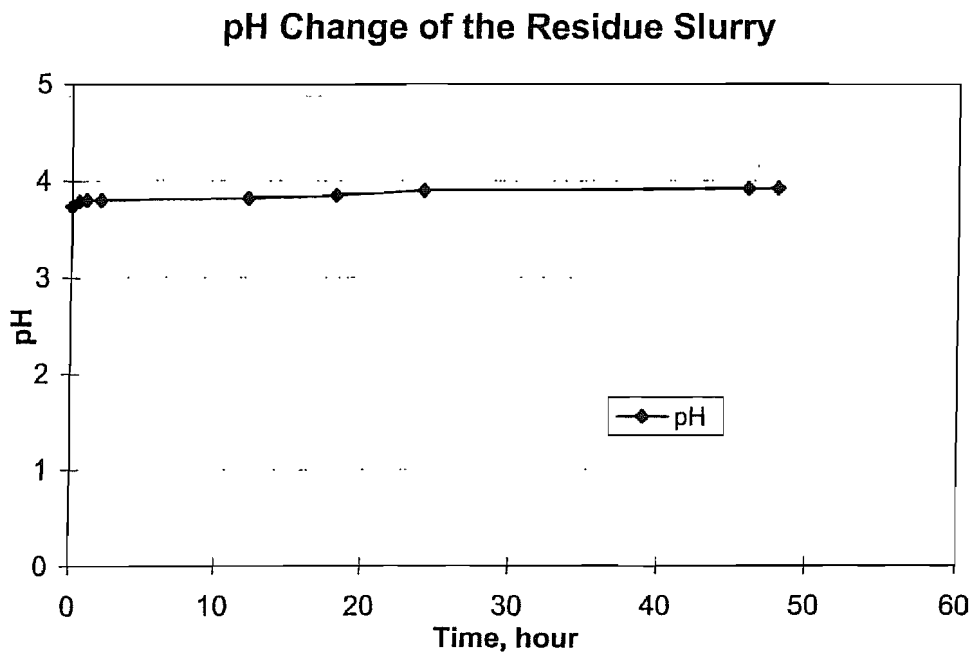
# WATER LEACH TEST ON WASTE SAMPLE L1

**Test:** AL1-T4  
**Sample:** AL1 residue

**Date:** February 26, 1998  
**Project:** 97-084

**Procedure:** - mixed 1 kg wet residue with 5 kg deionized water;  
- monitored pH but did not adjust;  
- sampled the slurry for ICP analysis as well as acidity and sulphate determinations.

Time (hour)	pH	SO <sub>4</sub> <sup>2-</sup> (mg/L)	Total Acidity (mg CaCO <sub>3</sub> /L)	ICP Sample ID
0.0	3.74			
0.5	3.79			
1.0	3.80			
2.0	3.80			
12.0	3.82			
18.0	3.85			
24.0	3.90			
46.0	3.92			
48.0	3.92	2,200.0	556.7	AL1-T4 Filtrate



## Multi-element ICP Analysis Results

Project: 97-084

Report Date: March 20, 1998

Element	Unit	Sample							
		WL1 Filtrate	AL1 Solution 1	AL Solution 2	AL 1-T1 Filtrate 1	AL 1-T1 Filtrate 2	AL-T2 Filtrate	AL1-T3 filtrate	AL1-T4 Filtrate
Al	mg/L	25.96	1984.59	1454.51	0.71	0.66	0.88	0.52	24.03
Sb	mg/L	< 0.05	0.34	0.20	<0.05	<0.05	<0.05	<0.05	<0.05
As	mg/L	0.08	4.62	3.30	<0.03	<0.03	<0.03	<0.03	0.08
Ba	mg/L	0.031	<0.005	<0.005	0.008	0.009	<0.005	0.007	0.021
Be	mg/L	0.004	0.117	0.095	<0.001	<0.001	<0.001	<0.001	0.005
Bi	mg/L	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
B	mg/L	0.65	3.93	3.77	0.31	0.38	0.12	0.13	0.10
Cd	mg/L	0.016	0.720	0.377	0.006	<0.005	<0.005	<0.005	0.010
Ca	mg/L	437.16	479.84	454.97	305.40	307.88	624.63	255.11	395.37
Cr	mg/L	< 0.01	0.02	0.02	<0.01	<0.01	<0.01	<0.01	<0.01
Co	mg/L	0.28	10.41	7.00	0.08	0.02	0.02	<0.01	0.15
Cu	mg/L	483.76	19.37g	12.77g	6.09	0.11	0.12	0.02	297.76
Fe	mg/L	13.09	35.97	38.45	<0.01	<0.01	<0.01	<0.01	13.64
Pb	mg/L	< 0.05	0.61	0.50	<0.05	<0.05	<0.05	<0.05	<0.05
Li	mg/L	0.04	1.15	0.89	<0.02	<0.02	<0.02	<0.02	0.02
Mg	mg/L	99.5	3706.1	2504.6	38.3	37.5	47.6	35.8	55.4
Mn	mg/L	13.580	559.789	371.125	3.949	3.085	3.956	0.778	7.107
Hg	mg/L	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Mo	mg/L	0.02	0.11	0.11	0.02	0.09	0.07	0.28	<0.01
Ni	mg/L	0.14	5.45	3.87	0.04	<0.01	<0.01	<0.01	0.12
P	mg/L	5.2	269.3	194.5	<0.1	0.1	<0.1	0.1	4.8
K	mg/L	66	34.	31.	11.	13.	4.	12.	16.
Se	mg/L	< 0.05	0.55	0.59	<0.05	<0.05	<0.05	<0.05	<0.05
Si	mg/L	10.97	43.05	56.08	7.28	6.55	5.18	4.29	10.18
Ag	mg/L	< 0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02	<0.02
Na	mg/L	5.4	45.2	31.9	247.1	335.1	1.1	379.1	2.7
Sr	mg/L	0.436	0.341	0.358	0.210	0.179	0.648	0.140	0.360
Tl	mg/L	< 0.2	0.9	0.8	<0.2	<0.2	<0.2	<0.2	<0.2
Sn	mg/L	< 0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1	<0.1
Ti	mg/L	0.03	0.76	0.52	0.01	0.01	0.02	0.02	0.03
W	mg/L	< 0.1	4.2	2.8	<0.1	<0.1	<0.1	<0.1	0.1
V	mg/L	< 0.01	0.08	0.10	<0.01	<0.01	<0.01	<0.01	<0.01
Zn	mg/L	0.718	65.051	44.115	0.192	<0.005	<0.005	<0.005	0.989

## **Appendix 4**

### **Waste Column Neutralization Test Details**



# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N1  
**Column Size:** 6"x216"  
**Initial Charge Height:** 216 inch  
**Final Charge Height:** inch  
**Sample Weight:** 165.0 kg  
**Bulk Density:** 1.649 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:**  
**Head Assay Cu<sub>PT</sub>:** Carmacks Waste L1 0.58 %  
**Head Assay Cu<sub>FeCl<sub>2</sub> soluble</sub>:** 0.42 %  
**Calculated Cu<sub>PT</sub>:** %  
**Calculated Cu<sub>FeCl<sub>2</sub> soluble</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**Na<sub>2</sub>CO<sub>3</sub> Concentration:** 5.00 %

**Starting Date:** May 15, 1998

Day	Feed							Effluent						Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/l)	Note		
	Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g.	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g.	Volume (L)	pH	SO <sub>4</sub> (g/L)	CO <sub>2</sub> (mg/L)			HCO <sub>3</sub> (mg/L)	
0	1000.00	20.00	14.50	1.0499	5.24	3.64	11.89									1.67	
1		14.50	8.00	1.0499	6.19	4.30	11.89									3.65	
2		8.00	1.10	1.0499	6.57	4.56	11.89									5.74	
3	1000.00	21.10	13.80	1.0491	6.96	4.83	11.78									7.96	
4		13.80	5.80	1.0491	7.63	5.30	11.78	0.80	1.1007	0.73	3.92	70.8	<1	<1		10.39	
5		5.80	0.60	1.0491	4.96	3.44	11.78	4.40	1.0763	4.09	4.55					11.98	Foaming PLS, precipitate formed
6	2000.00	40.60	33.60	1.0479	6.68	4.64	11.48	4.40	1.0566	4.16	6.01					14.11	Foaming PLS, precipitate formed
7		33.60	25.10	1.0479	8.11	5.63	11.48	7.30	1.0668	6.84	3.88					16.69	No foams
8		25.10	20.80	1.0479	4.10	2.65	11.48	9.30	1.0443	8.91	4.01					18.00	No foams
9		20.80	13.30	1.0479	7.16	4.97	11.48	3.00	1.0397	2.89	4.18					20.29	No foams
10		13.30	8.70	1.0479	4.39	3.05	11.48	19.20	1.0429	18.41	7.30					21.69	Large volume of PLS with foams
11		8.70	1.80	1.0479	6.58	4.57	11.48	5.60	1.0452	5.36	9.37					23.79	No foams but PLS turned brown
12	1000.00	21.80	15.30	1.0481	6.20	4.31	11.60	6.70	1.0467	6.40	10.03					25.76	Brown PLS
13		15.30	8.30	1.0481	6.68	4.64	11.60	6.50	1.0480	6.20	10.18					27.89	Brown PLS
14	1000.00	28.30	22.50	1.0473	5.54	3.85	11.38	7.30	1.0472	6.97	10.18					29.66	Brown PLS
15		22.50	14.50	1.0473	7.64	5.30	11.38	6.30	1.0474	6.01	10.48					32.10	Brown PLS
16		14.50	7.90	1.0473	6.30	4.38	11.38	8.50	1.0479	8.11	10.59					34.11	Brown PLS
17		7.90	1.40	1.0473	6.21	4.31	11.38	6.50	1.0483	6.20	10.36					36.09	Brown PLS
18	1000.00	21.40	14.90	1.0474	6.21	4.31	11.57	8.80	1.0480	6.49	10.60					38.07	Brown PLS
19		14.90	8.20	1.0474	6.40	4.44	11.57	7.10	1.0477	6.78	10.59					40.11	Brown PLS
20		8.20	1.10	1.0474	6.78	4.71	11.57	7.00	1.0475	6.68	10.63	0.6	9000	37000		42.27	Brown PLS
21																42.27	
22																42.27	
23																42.27	
24																42.27	
25																42.27	
26																42.27	
27																42.27	
28	0.03	20.00	14.20	0.9987	5.81	4.03	7.00	4.90	1.0491	4.67	10.59					42.27	Brown PLS
29		14.20	7.60	0.9987	6.61	4.59	7.00	0.10	1.0400	0.10	10.38					42.27	Brown PLS
30		7.60	0.60	0.9987	7.01	4.87	7.00	1.80	1.0514	1.71	10.61					42.27	Brown PLS
31	0.03	20.60	14.20	0.9983	6.41	4.45	6.56	3.10	1.0488	2.96	10.68					42.27	Brown PLS
32		14.20	5.20	0.9983	9.02	6.28	6.56	3.20	1.0478	3.05	10.59					42.27	Brown PLS
33	0.06	45.20	37.80	0.9987	7.41	5.15	6.38	7.10	1.0254	6.92	10.50					42.27	Brown PLS
34		37.80	31.40	0.9987	6.41	4.45	6.38	7.50	1.0195	7.36	10.61					42.27	Brown PLS
35		31.40	23.00	0.9987	8.41	5.84	6.38	6.50	1.0161	6.40	10.66					42.27	Brown PLS
36		23.00	16.40	0.9987	6.61	4.59	6.38	8.70	1.0095	8.62	10.48					42.27	
37		16.40	10.70	0.9987	5.71	3.96	6.38	6.80	1.0049	6.77	10.41					42.27	

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: N1  
 Column Size: 6"x216"  
 Initial Charge Height: 216 inch  
 Final Charge Height: inch  
 Sample Weight: 165.0 kg  
 Bulk Density: 1.849 tonne/m<sup>3</sup>  
 Sample Moisture: 8.40 %

Ore Sample:  
 Head Assay Cu<sub>(T)</sub>:  
 Head Assay Cu<sub>(acid soluble)</sub>:  
 Calculated Cu<sub>(T)</sub>:  
 Calculated Cu<sub>(acid soluble)</sub>:  
 Hold up Volume:  
 Drain Volume:  
 Na<sub>2</sub>CO<sub>3</sub> Concentration:

Carmacks Waste L1  
 0.58 %  
 0.42 %  
 %  
 %  
 Litre  
 Litre  
 5.00 %

Starting Date: May 15, 1998

Day	Feed							Effluent							Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/t)	Note
	Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	pH	SO <sup>4</sup> (g/L)	CO <sub>2</sub> (mg/L)	HCO <sub>3</sub> (mg/L)		
38		10.70	3.30	0.9987	7.41	5.15	6.38	4.70	1.0024	4.69	10.38				42.27	
39	0.03	23.30	17.30	0.9989	6.01	4.17	6.38	5.90	1.0017	5.89	10.30				42.27	
40		17.30	10.50	0.9989	6.81	4.73	6.38	5.60	1.0016	5.59	10.40				42.27	
41		10.50	4.20	0.9989	6.31	4.38	6.38	6.70	1.0010	6.69	10.13				42.27	
42	0.03	24.00	18.50	0.9987	5.51	3.82	6.32	6.00	1.0003	6.00	10.18				42.27	
43		18.50	7.50	0.9987	11.01	7.65	6.32	5.20	0.9999	5.20	10.56				42.27	
44		7.50	4.30	0.9987	3.20	2.23	6.32	10.80	0.9994	10.81	10.65				42.27	
45	0.03	24.30	16.80	0.9985	7.51	5.22	6.48	2.80	0.9992	2.80	10.59				42.27	
46		16.80	9.80	0.9985	7.01	4.87	6.48	7.70	0.9990	7.71	10.59				42.27	
47		9.80	5.30	0.9985	4.51	3.13	6.48	7.30	0.9987	7.31	10.57				42.27	
48	0.06	45.30	38.40	0.9981	6.91	4.80	6.38	4.60	0.9992	4.60	10.55				42.27	
49		38.40	31.40	0.9981	7.01	4.87	6.38	7.00	0.9989	7.01	10.45				42.27	
50		31.40	24.40	0.9981	7.01	4.87	6.38	7.00	0.9989	7.01	10.39				42.27	
51		24.40	16.50	0.9981	7.92	5.50	6.38	6.30	0.9989	6.31	10.48				42.27	
52		16.50	9.80	0.9981	6.71	4.66	6.38	7.30	0.9990	7.31	10.43				42.27	
53		9.80	3.60	0.9981	6.21	4.31	6.38	6.70	0.9984	6.71	10.42				42.27	
54	0.03	23.60	16.40	0.9984	7.21	5.01	6.18	6.00	0.9987	6.01	10.49				42.27	
55		16.40	9.30	0.9984	7.11	4.94	6.18	6.80	0.9986	6.81	10.52				42.27	
56	0.03	29.30	22.60	0.9982	6.71	4.66	5.80	6.80	0.9983	6.81	10.36				42.27	
57		22.60	16.00	0.9982	6.61	4.59	5.80	6.60	0.9988	6.61	10.38				42.27	
58		16.00	7.60	0.9982	8.42	5.84	5.80	6.50	0.9988	6.51	10.43				42.27	
59		7.60	1.50	0.9982	6.11	4.24	5.80	7.40	0.9989	7.41	10.43				42.27	
60								5.90	0.9987	5.91	10.39				42.27	
61								1.40	1.0009	1.40	10.45				42.27	
62								1.40	1.0011	1.40	10.36				42.27	



INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project : 97-084 PO#015  
Shipper : Liu Qi  
Shipment: PO#: 015  
Analysis: ICP(H2O)30 Water Package in mg/L

**CERTIFICATE OF ANALYSIS**  
iPL 98E0469

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Vancouver, B.C.  
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Phone (604) 879-7878  
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[046911:20:26:89052298]

2 Samples Out: May 22, 1998 In: May 19, 1998

CODE	AMOUNT	TYPE	PREPARATION DESCRIPTION	REJECT
B412	2	Solution	Solution received as it is, no sample prep.	DOM/D's

**Analytical Summary**

#	Code	Method	Units	Description	Element	Limit	Limit	PULP	REJECT
						Low	High	03M/D's	DOM/D's
01	0901	ICPH20	mg/L	Al ICP Water Analyses	Aluminum	0.2	9999.0		
02	0902	ICPH20	mg/L	Sb ICP Water Analyses	Antimony	0.1	9999.0		
03	0903	ICPH20	mg/L	As ICP Water Analyses	Arsenic	0.2	9999.0		
04	0904	ICPH20	mg/L	Ba ICP Water Analyses	Barium	0.01	999.00		
05	0905	ICPH20	mg/L	Bi ICP Water Analyses	Bismuth	0.1	9999.0		
06	0907	ICPH20	mg/L	Cd ICP Water Analyses	Cadmium	0.01	999.00		
07	0908	ICPH20	mg/L	Ca ICP Water Analyses	Calcium	0.1	9999.0		
08	0909	ICPH20	mg/L	Cr ICP Water Analyses	Chromium	0.01	9999.00		
09	0910	ICPH20	mg/L	Co ICP Water Analyses	Cobalt	0.01	9999.00		
10	0911	ICPH20	mg/L	Cu ICP Water Analyses	Copper	0.01	9999.00		
11	0912	ICPH20	mg/L	Fe ICP Water Analyses	Iron	0.03	9999.00		
12	0913	ICPH20	mg/L	La ICP Water Analyses	Lanthanum	0.05	999.00		
13	0914	ICPH20	mg/L	Pb ICP Water Analyses	Lead	0.05	9999.00		
14	0915	ICPH20	mg/L	Mg ICP Water Analyses	Magnesium	0.1	9999.0		
15	0916	ICPH20	mg/L	Mn ICP Water Analyses	Manganese	0.01	999.00		
16	0932	ICPH20	mg/L	Hg ICP Water Analyses	Mercury	0.05	9999.00		
17	0917	ICPH20	mg/L	Mo ICP Water Analyses	Molybdenum	0.02	9999.00		
18	0918	ICPH20	mg/L	Ni ICP Water Analyses	Nickel	0.02	9999.00		
19	0919	ICPH20	mg/L	P ICP Water Analyses	Phosphorus	0.1	9999.0		
20	0920	ICPH20	mg/L	K ICP Water Analyses	Potassium	2.	9999.		
21	0936	ICPH20	mg/L	Sc ICP Water Analyses	Scandium	0.01	100.00		
22	0921	ICPH20	mg/L	Ag ICP Water Analyses	Silver	0.02	999.00		
23	0922	ICPH20	mg/L	Na ICP Water Analyses	Sodium	1.	9999.		
24	0923	ICPH20	mg/L	Sr ICP Water Analyses	Strontium	0.01	999.00		
25	0924	ICPH20	mg/L	Th ICP Water Analyses	Thorium	0.1	9999.0		
26	0926	ICPH20	mg/L	Ti ICP Water Analyses	Titanium	0.1	999.0		
27	0927	ICPH20	mg/L	W ICP Water Analyses	Tungsten	0.1	9999.0		
28	0929	ICPH20	mg/L	V ICP Water Analyses	Vanadium	0.01	999.00		
29	0930	ICPH20	mg/L	Zn ICP Water Analyses	Zinc	0.01	9999.00		
30	0931	ICPH20	mg/L	Zr ICP Water Analyses	Zirconium	0.01	999.00		

**Comment:**

**Document Distribution**

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**CERTIFICATE OF ANALYSIS**  
**iPL 98E0469**

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INTERNATIONAL PLASMA LABORATORY LTD.

**Process Research Associates Ltd**

Project: 97-084 PO#015

Out: May 22, 1998  
In : May 19, 1998

Page 1 of 1  
[046911:20:26:89052298]

**2 Samples**      2=Solution

Symbol	Unit	Solution		Limit Low	Limit High
		COL. N1 PLS Day 4	COL. N2 PLS Day 4		
Al	mg/L	2213.8	2001.4	0.2	9999.0
Sb	mg/L	0.5	0.2	0.1	9999.0
As	mg/L	6.9	6.1	0.2	9999.0
Ba	mg/L	<0.01	<0.01	0.01	999.00
Bi	mg/L	<0.1	<0.1	0.1	9999.0
Cd	mg/L	0.08	0.85	0.01	999.00
Ca	mg/L	481.2	513.1	0.1	9999.0
Cr	mg/L	<0.01	0.03	0.01	9999.00
Co	mg/L	13.59	12.46	0.01	9999.00
Cu	mg/L	25.18g	23.37g	0.01	9999.00
Fe	mg/L	28.48	29.36	0.03	9999.00
La	mg/L	0.09	<0.05	0.05	999.00
Pb	mg/L	0.76	0.60	0.05	9999.00
Mg	mg/L	5155.2	4662.8	0.1	9999.0
Mn	mg/L	755.04	688.38	0.01	999.00
Hg	mg/L	<0.05	<0.05	0.05	9999.00
Mo	mg/L	0.05	0.15	0.02	9999.00
Ni	mg/L	7.18	6.67	0.02	9999.00
P	mg/L	334.0	288.1	0.1	9999.0
K	mg/L	33.	19.	2.	9999.
Sc	mg/L	0.47	0.44	0.01	100.00
Ag	mg/L	<0.02	<0.02	0.02	999.00
Na	mg/L	1077.	47.	1.	9999.
Sr	mg/L	0.18	0.20	0.01	999.00
Th	mg/L	0.5	0.5	0.1	9999.0
Ti	mg/L	0.9	0.9	0.1	999.0
W	mg/L	6.1	5.4	0.1	9999.0
V	mg/L	0.08	0.08	0.01	999.00
Zn	mg/L	82.99	77.45	0.01	9999.00
Zr	mg/L	0.01	0.01	0.01	999.00

—=No Test    Ins=Insufficient Sample    Del=Delay    Max=No Estimate    Rec=ReCheck    m=x1000    %=Estimate %    NS=No Sample

**BC Certified Assayer: David Chiu**

## Multi-element ICP Analysis of Column N1 PLS

Project: 97-084  
2001

Date Reported: January 17,

Element	Unit	Column N1 PLS					
		Day 4	Day 20				
Al	mg/L	2213.8	< 0.2				
Sb	mg/L	0.5	0.1				
As	mg/L	6.9	0.3				
Ba	mg/L	< 0.01	< 0.01				
Bi	mg/L	< 0.1	< 0.1				
Cd	mg/L	0.08	< 0.01				
Ca	mg/L	481.2	2.1				
Cr	mg/L	< 0.01	< 0.01				
Co	mg/L	13.59	< 0.01				
Cu	mg/L	25180	5.86				
Fe	mg/L	28.48	0.23				
La	mg/L	0.09	< 0.05				
Pb	mg/L	0.76	< 0.05				
Mg	mg/L	5155.2	< 0.1				
Mn	mg/L	755.04	0.02				
Hg	mg/L	< 0.05	0.10				
Mo	mg/L	0.05	4.29				
Ni	mg/L	7.18	0.94				
P	mg/L	334.0	88.3				
K	mg/L	33	49				
Sc	mg/L	0.47	< 0.01				
Ag	mg/L	< 0.02	< 0.02				
Na	mg/L	1077	18000				
Sr	mg/L	0.18	< 0.01				
Th	mg/L	0.5	< 0.1				
Ti	mg/L	0.9	< 0.1				
W	mg/L	6.1	0.2				
V	mg/L	0.08	1.11				
Zn	mg/L	82.99	< 0.01				
Zr	mg/L	0.01	0.04				

## WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N2  
**Column Size:** 6"x216"  
**Initial Charge Height:** 216 inch  
**Final Charge Height:** inch  
**Sample Weight:** 165.0 kg  
**Bulk Density:** 1.649 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>m</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>m</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**NaOH Solution pH:** 9.0

**Starting Date:** May 15, 1998

Day	Feed							Effluent				NaOH Consumption (kg/t)	Note	
	NaOH added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	pH			
0	0.11	20.00	14.50	0.9986	5.51	3.82	9.00						0.0002	
1		14.50	8.00	0.9986	6.51	4.52	9.00						0.0004	
2		8.00	1.10	0.9986	6.91	4.80	9.00						0.0006	
3	0.11	21.10	12.60	0.9983	8.51	5.91	9.00						0.0009	
4		12.60	5.10	0.9983	7.51	5.22	9.00	0.90	1.0906	0.83	3.49		0.0012	Clear blue PLS
5		5.10	0.20	0.9983	4.91	3.41	9.00	4.70	1.0701	4.39	3.42		0.0013	Clear blue PLS
6	0.23	40.20	33.20	0.9988	7.01	4.87	9.00	3.80	1.0437	3.64	3.78		0.0016	Clear blue PLS
7		33.20	24.70	0.9988	8.51	5.91	9.00	5.80	1.0261	5.65	3.67		0.0018	Clear blue PLS
8		24.70	20.20	0.9988	4.51	3.13	9.00	8.40	1.0172	8.26	3.81		0.0020	Clear blue PLS
9		20.20	13.50	0.9988	6.71	4.66	9.00	4.30	1.0086	4.26	3.90		0.0022	Clear blue PLS
10		13.50	7.60	0.9988	5.91	4.10	9.00	7.40	1.0064	7.35	4.11		0.0024	Clear blue PLS
11		7.60	0.70	0.9988	6.91	4.80	9.00	5.60	1.0048	5.57	3.98		0.0026	Clear blue PLS
12	0.11	20.70	14.20	0.9989	6.51	4.52	9.08	6.90	1.0043	6.87	4.13		0.0029	Clear blue PLS
13		14.20	7.20	0.9989	7.01	4.87	9.08	6.70	1.0036	6.68	4.28		0.0031	Clear blue PLS
14	0.11	27.20	21.40	0.9985	5.81	4.03	9.33	7.30	1.0032	7.28	4.20		0.0033	Clear blue PLS
15		21.40	13.40	0.9985	8.01	5.56	9.33	6.00	1.0025	5.99	4.73		0.0036	Clear blue PLS
16		13.40	7.30	0.9985	6.11	4.24	9.33	8.20	1.0025	8.18	4.60		0.0038	Clear blue PLS
17		7.30	0.60	0.9985	6.71	4.66	9.33	6.00	1.0021	5.99	4.93		0.0040	Clear blue PLS
18	0.11	20.60	14.10	0.9987	6.51	4.52	9.43	6.30	1.0016	6.29	4.83		0.0042	Clear blue PLS
19		14.10	7.40	0.9987	6.71	4.66	9.43	6.30	1.0016	6.29	4.28		0.0044	Clear blue PLS
20		7.40	0.40	0.9987	7.01	4.87	9.43	7.60	1.0013	7.59	4.60		0.0047	Clear blue PLS
21	0.11	20.40	13.90	0.9990	6.51	4.52	9.37	6.80	1.0019	6.79	4.23		0.0049	Clear blue PLS
22		13.90	7.40	0.9990	6.51	4.52	9.37	5.70	1.0015	5.69	3.91		0.0051	Clear blue PLS
23		7.40	0.10	0.9990	7.31	5.07	9.37	6.60	1.0010	6.59	3.98		0.0053	Clear blue PLS
24	0.11	20.10	13.90	0.9987	6.21	4.31	8.88	7.30	1.0011	7.29	3.99		0.0055	Clear blue PLS
25		13.90	7.40	0.9987	6.51	4.52	8.88	5.50	1.0015	5.49	3.96		0.0058	Clear blue PLS
26		7.40	0.00	0.9987	7.41	5.15	8.88	6.30	1.0014	6.29	3.90		0.0060	Clear blue PLS
27	0.23	40.00	33.40	0.9988	6.61	4.59	8.87	8.00	1.0013	7.99	3.96		0.0062	Clear blue PLS
28		33.40	27.60	0.9988	5.81	4.03	8.87	6.20	1.0010	6.19	4.56		0.0064	Clear blue PLS

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N2  
**Column Size:** 6"x216"  
**Initial Charge Height:** 216 inch  
**Final Charge Height:** inch  
**Sample Weight:** 165.0 kg  
**Bulk Density:** 1.649 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>T</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>T</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**NaOH Solution pH:** 9.0

**Starting Date:** May 15, 1998

Day	Feed							Effluent				NaOH Consumption (kg/t)	Note
	NaOH added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	pH		
29		27.60	20.00	0.9988	7.61	5.28	8.87	5.80	1.0012	5.79	4.38	0.0067	Clear blue PLS
30		20.00	12.30	0.9988	7.71	5.35	8.87	7.50	1.0012	7.49	4.52	0.0069	Clear blue PLS
31		12.30	4.80	0.9988	7.51	5.21	8.87	8.10	1.0015	8.09	4.00	0.0072	Clear blue PLS
32	0.11	24.80	15.40	0.9985	9.41	6.54	9.05	7.20	1.0007	7.19	4.55	0.0075	Clear blue PLS
33		15.40	8.10	0.9985	7.31	5.08	9.05	8.20	1.0011	8.19	4.50	0.0077	Clear blue PLS
34		8.10	1.70	0.9985	6.41	4.45	9.05	8.30	1.0010	8.29	4.50	0.0080	Clear blue PLS
35	0.11	21.70	13.30	0.9988	8.41	5.84	9.02	7.20	1.0010	7.19	4.50	0.0082	Clear blue PLS
36		13.30	7.70	0.9988	5.61	3.89	9.02	9.40	1.0000	9.40	4.08	0.0084	Clear blue PLS
37		7.70	3.70	0.9988	4.00	2.78	9.02	7.20	0.9999	7.20	4.18	0.0086	Clear blue PLS
38	0.11	23.70	17.10	0.9980	6.61	4.59	8.54	4.90	0.9999	4.90	3.43	0.0088	Clear blue PLS
39		17.10	11.10	0.9980	6.01	4.18	8.54	6.00	1.0005	6.00	4.21	0.0090	Clear blue PLS
40		11.10	5.70	0.9980	5.41	3.76	8.54	5.50	1.0010	5.49	4.22	0.0092	Clear blue PLS
41		5.70	0.00	0.9980	5.71	3.97	8.54	6.20	1.0009	6.19	4.08	0.0093	Clear blue PLS
42	0.11	20.00	15.20	0.9986	4.81	3.34	8.55	5.80	1.0009	5.79	4.10	0.0095	Clear blue PLS
43		15.20	6.10	0.9986	9.11	6.33	8.55	2.80	0.9998	2.80	4.21	0.0098	Clear blue PLS
44		6.10	3.50	0.9986	2.60	1.81	8.55	14.70	1.0000	14.70	4.16	0.0099	Clear blue PLS
45	0.11	23.50	16.00	0.9983	7.51	5.22	8.59	3.10	1.0003	3.10	4.23	0.0101	Clear blue PLS
46		16.00	9.00	0.9983	7.01	4.87	8.59	8.20	1.0000	8.20	4.15	0.0104	Clear blue PLS
47		9.00	6.90	0.9983	2.10	1.46	8.59	7.40	1.0000	7.40	4.14	0.0105	Clear blue PLS
48	0.23	46.90	42.10	0.9983	4.81	3.34	8.38	4.60	0.9999	4.60	4.12	0.0106	Clear blue PLS
49		42.10	35.10	0.9983	7.01	4.87	8.38	5.00	0.9998	5.00	4.15	0.0108	Clear blue PLS
50		35.10	28.00	0.9983	7.11	4.94	8.38	4.00	0.9998	4.00	4.20	0.0111	Clear blue PLS
51		28.00	21.00	0.9983	7.01	4.87	8.38	3.50	0.9997	3.50	4.22	0.0113	Clear blue PLS
52		21.00	15.00	0.9983	6.01	4.17	8.38	4.40	1.0000	4.40	4.24	0.0115	Clear blue PLS
53		15.00	9.00	0.9983	6.01	4.17	8.38	4.40	0.9995	4.40	4.25	0.0117	Clear blue PLS
54		9.00	2.20	0.9983	6.81	4.73	8.38	4.30	0.9996	4.30	4.22	0.0119	Clear blue PLS
55	0.23	42.20	36.70	0.9982	5.51	3.83	8.97	5.40	0.9997	5.40	4.32	0.0121	Clear blue PLS
56		36.70	30.00	0.9982	6.71	4.66	8.97	5.60	0.9994	5.60	4.25	0.0124	Clear blue PLS
57		30.00	23.40	0.9982	6.61	4.59	8.97	5.80	0.9997	5.80	4.30	0.0126	Clear blue PLS

## WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N2  
**Column Size:** 6"x216"  
**Initial Charge Height:** 216 inch  
**Final Charge Height:** inch  
**Sample Weight:** 165.0 kg  
**Bulk Density:** 1.649 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>T</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>T</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**NaOH Solution pH:** 9.0

**Starting Date:** May 15, 1998

Day	Feed							Effluent				NaOH Consumption (kg/t)	Note
	NaOH added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	pH		
58		23.40	15.80	0.9982	7.61	5.29	8.97	6.20	0.9997	6.20	4.31	0.0128	Clear blue PLS
59		15.80	9.90	0.9982	5.91	4.10	8.97	7.30	0.9998	7.30	4.38	0.0130	Clear blue PLS
60								5.90	0.9996	5.90	4.41	0.0130	
61								5.30	1.0001	5.30	4.43	0.0130	



# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N3  
**Column Size:** 4" x 60"  
**Initial Charge Height:** 54.5 inch  
**Final Charge Height:** inch  
**Sample Weight:** 16.5 kg  
**Bulk Density:** 0.653 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>T</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>T</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**Na<sub>2</sub>CO<sub>3</sub> Concentration:** 10.00 %

**Starting Date:** August 12, 1998

Date	Day	Feed							Effluent					Na <sub>2</sub> CO <sub>3</sub> Addition (kg/t)	Note
		Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	ORP mV	pH		
12-Aug-98	0	0.10	20.00		0.9981	20.04		7.02			0.00			0.0000	
13-Aug-98	1		20.00	17.20	0.9981	2.81	1.95	7.02	1.40	1.0747	1.30	360.8	3.43	0.0009	
14-Aug-98	2		17.20	14.70	0.9981	2.50	1.74	7.02	2.40	1.0203	2.35	304.80	3.60	0.0016	
15-Aug-98	3		14.70	12.00	0.9981	2.71	1.88	7.02	2.90	1.0059	2.88	302.80	3.71	0.0024	
16-Aug-98	4		12.00	9.50	0.9981	2.50	1.74	7.02	2.20	1.0033	2.19	292.20	3.82	0.0032	
17-Aug-98	5		9.50	7.30	0.9981	2.20	1.53	7.02	1.90	1.0029	1.89	280.80	3.86	0.0039	
18-Aug-98	6		7.30	4.60	0.9981	2.71	1.88	7.02	2.50	1.0024	2.49	245.40	3.95	0.0047	
19-Aug-98	7		4.60	2.10	0.9981	2.50	1.74	7.02	2.40	1.0021	2.39	261.80	3.98	0.0054	
20-Aug-98	8	0.15	20.00	17.60	0.9981	2.40	1.67	8.06	2.50	1.0015	2.50	218.20	3.95	0.0065	
21-Aug-98	9		17.60	14.50	0.9981	3.11	2.16	8.06	2.90	1.0011	2.90	260.80	3.94	0.0080	
22-Aug-98	10		14.50	11.90	0.9981	2.60	1.81	8.06	2.60	1.0007	2.60	284.40	3.98	0.0091	
23-Aug-98	11		11.90	9.40	0.9981	2.50	1.74	8.06	2.10	1.0004	2.10	273.10	4.00	0.0103	
24-Aug-98	12		9.40	7.30	0.9981	2.10	1.46	8.06	2.07	1.0009	2.07	262.80	4.01	0.0112	
25-Aug-98	13		7.30	4.20	0.9981	3.11	2.16	8.06	2.90	1.0005	2.90	208.20	4.01	0.0127	
26-Aug-98	14		4.20	2.30	0.9981	1.90	1.32	8.06	1.80	1.0009	1.80	196.80	4.00	0.0135	
27-Aug-98	15	0.18	20.00	17.30	0.9987	2.70	1.88	8.08	2.70	1.0009	2.70	236.30	4.05	0.0150	
28-Aug-98	16		17.30	14.80	0.9987	2.50	1.74	8.08	2.30	1.0004	2.30	254.90	3.96	0.0163	
29-Aug-98	17	0.41	20.00	18.10	0.9979	1.90	1.32	9.03	1.80	0.9998	1.80	275.70	4.04	0.0187	
30-Aug-98	18		18.10	15.30	0.9979	2.81	1.95	9.03	2.50	0.9998	2.50	267.30	4.06	0.0222	
31-Aug-98	19		15.30	13.00	0.9979	2.30	1.60	9.03	2.10	0.9994	2.10	258.40	4.08	0.0251	
1-Sep-98	20		9.90	7.00	0.9979	2.91	2.02	9.03	2.70	0.9993	2.70	252.00	4.12	0.0287	
2-Sep-98	21		7.00	4.20	0.9979	2.81	1.95	9.03	2.70	0.9988	2.70	232.00	4.19	0.0322	
3-Sep-98	22		4.20	2.10	0.9979	2.10	1.46	9.03	2.50	0.9982	2.50	240.50	4.20	0.0348	
4-Sep-98	23	0.32	20.00	18.30	0.9984	1.70	1.18	9.02	1.90	0.9988	1.90	257.90	4.08	0.0365	
5-Sep-98	24		18.30	15.40	0.9984	2.90	2.02	9.02	1.90	0.9986	1.90	276.60	4.31	0.0393	
6-Sep-98	25		15.40	12.40	0.9984	3.00	2.09	9.02	2.30	0.9985	2.30	270.80	4.32	0.0423	
7-Sep-98	26		12.40	10.50	0.9984	1.90	1.32	9.02	2.80	0.9985	2.80	251.70	4.32	0.0442	
8-Sep-98	27		10.50	7.95	0.9984	2.54	1.77	9.02	1.70	0.9986	1.70	243.80	4.44	0.0466	
9-Sep-98	28		7.90	5.20	0.9987	2.70	1.88	9.02	2.40	0.9987	2.40	255.40	4.18	0.0493	
10-Sep-98	29		5.20	2.90	0.9987	2.30	1.60	9.02	2.40	0.9987	2.40	228.90	4.27	0.0516	
11-Sep-98	30	0.32	20.00	17.50	0.9987	2.50	1.74	9.01	2.30	0.9987	2.30	312.80	4.29	0.0540	
12-Sep-98	31		17.50	15.50	0.9987	2.00	1.39	9.01	2.50	0.9984	2.50	303.90	4.23	0.0560	
13-Sep-98	32	1.95	20.00	17.30	0.9984	2.70	1.88	10.00	1.90	0.9985	1.90	291.30	4.14	0.0586	

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N3  
**Column Size:** 4" x 60"  
**Initial Charge Height:** 54.5 inch  
**Final Charge Height:** inch  
**Sample Weight:** 16.5 kg  
**Bulk Density:** 0.653 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>T</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>T</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**Na<sub>2</sub>CO<sub>3</sub> Concentration:** 10.00 %

Starting Date: August 12, 1998

Date	Day	Feed						Effluent					Na <sub>2</sub> CO <sub>3</sub> Addition (kg/t)	Note	
		Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	ORP mV			pH
14-Sep-98	33		17.30	14.60	0.9984	2.70	1.88	10.00	2.50	0.9988	2.50	284.20	4.34	0.0512	
15-Sep-98	34		14.60	12.20	0.9984	2.40	1.67	10.00	2.60	0.9986	2.60	230.80	4.98	0.0635	
16-Sep-98	35		12.20	9.70	0.9984	2.50	1.74	10.00	2.20	0.9987	2.20	349.70	4.60	0.0659	
17-Sep-98	36		9.70	7.30	0.9984	2.40	1.67	10.00	2.40	0.9985	2.40	221.60	4.63	0.0682	
18-Sep-98	37	2.91	20.00	17.00	0.9984	3.00	2.09	9.99	2.20	0.9986	2.20	291.30	5.16	0.0947	
19-Sep-98	38		17.00	14.30	0.9984	2.70	1.88	9.99	2.70	0.9984	2.70	344.80	6.28	0.1186	
20-Sep-98	39		14.30	12.80	0.9984	1.50	1.04	9.99	2.40	0.9984	2.40	314.80	5.52	0.1318	
21-Sep-98	40		12.80	10.30	0.9984	2.50	1.74	9.99	1.40	0.9986	1.40	324.80	5.50	0.1539	
22-Sep-98	41		10.30	7.80	0.9984	2.50	1.74	9.99	2.30	0.9989	2.30	222.10	5.74	0.1760	
23-Sep-98	42		7.80	5.20	0.9984	2.60	1.81	9.99	2.40	0.9988	2.40	329.80	5.49	0.1990	
24-Sep-98	43		5.20	2.70	0.9984	2.50	1.74	9.99	2.40	0.9986	2.40	380.80	5.24	0.2211	
25-Sep-98	44	2.69	20.00	18.10	0.9988	1.90	1.32	10.00	2.40	0.9985	2.40	357.00	5.22	0.2366	
26-Sep-98	45		18.10	15.30	0.9988	2.80	1.95	10.00	2.30	0.9988	2.30	192.80	5.75	0.2585	
27-Sep-98	46		15.30	12.10	0.9988	3.20	2.22	10.00	2.10	0.9987	2.10	217.30	6.10	0.2857	
28-Sep-98	47		12.10	10.40	0.9988	1.70	1.18	10.00	2.90	0.9986	2.90	208.00	5.94	0.2996	
29-Sep-98	48		10.40	7.70	0.9988	2.70	1.88	10.00	1.70	0.9981	1.70	211.10	5.55	0.3217	
30-Sep-98	49		7.70	5.40	0.9988	2.30	1.60	10.00	2.50	0.9987	2.50	208.10	5.61	0.3405	
1-Oct-98	50		5.40	2.90	0.9988	2.50	1.74	10.00	2.10	0.9986	2.10	263.80	5.91	0.3609	
2-Oct-98	51	4.69	20.00	17.30	0.9991	2.70	1.88	10.01	2.30	0.9990	2.30	309.50	6.01	0.3994	
3-Oct-98	52		17.30	15.10	0.9991	2.20	1.53	10.01	2.50	0.9990	2.50	292.80	5.24	0.4307	
4-Oct-98	53		15.10	12.70	0.9991	2.40	1.67	10.01	2.20	0.9993	2.20	323.80	5.68	0.4648	
5-Oct-98	54		12.70	10.30	0.9991	2.40	1.67	10.01	2.30	0.9994	2.30	315.40	5.54	0.4990	
6-Oct-98	55		10.30	7.20	0.9991	3.10	2.15	10.01	2.30	0.9990	2.30	345.40	5.32	0.5431	
7-Oct-98	56		7.20	5.30	0.9991	1.90	1.32	10.01	2.90	0.9990	2.90	211.30	5.16	0.5702	
8-Oct-98	57		5.30	2.80	0.9991	2.50	1.74	10.01	1.80	0.9990	1.80	322.80	5.14	0.6058	
9-Oct-98	58	3.76	20.00	17.60	0.9991	2.40	1.67	10.48	2.30	0.9990	2.30	160.80	6.21	0.6332	
10-Oct-98	59		17.60	15.10	0.9991	2.50	1.74	10.48	2.30	0.9990	2.30	184.30	5.94	0.6617	
11-Oct-98	60		15.10	12.10	0.9991	3.00	2.09	10.48	2.90	0.9990	2.90	183.30	6.01	0.6959	
12-Oct-98	61		12.10	10.30	0.9991	1.80	1.25	10.48	2.20	0.9990	2.20	192.80	5.99	0.7164	
13-Oct-98	62		10.30	8.00	0.9991	2.30	1.60	10.48	2.30	0.9990	2.30	190.50	5.79	0.7426	
14-Oct-98	63		8.00	7.70	0.9991	0.30	0.21	10.48	2.30	0.9990	2.30	191.00	5.76	0.7460	
15-Oct-98	64	9.25	20.00	17.30	0.9991	2.70	1.88	10.50	0.80	0.9990	0.80	190.90	5.71	0.8218	
16-Oct-98	65		17.30	15.00	0.9991	2.30	1.60	10.50	2.30	0.9990	2.30	272.80	5.75	0.8864	

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: N3  
 Column Size: 4" x 60"  
 Initial Charge Height: 54.5 inch  
 Final Charge Height: inch  
 Sample Weight: 16.5 kg  
 Bulk Density: 0.653 tonne/m<sup>3</sup>  
 Sample Moisture: 8.40 %

Ore Sample: Carmacks Waste L1  
 Head Assay Cu<sub>T</sub>: 0.58 %  
 Head Assay Cu<sub>(acid soluble)</sub>: 0.42 %  
 Calculated Cu<sub>T</sub>: %  
 Calculated Cu<sub>(acid soluble)</sub>: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Na<sub>2</sub>CO<sub>3</sub> Concentration: 10.00 %

Starting Date: August 12, 1998

Date	Day	Feed						Effluent					Na <sub>2</sub> CO <sub>3</sub> Addition (kg/t)	Note	
		Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	ORP mV			pH
17-Oct-98	66		15.00	12.70	0.9991	2.30	1.60	10.50	2.20	0.9990	2.20	351.00	5.74	0.9509	
18-Oct-98	67		12.70	10.10	0.9991	2.60	1.81	10.50	2.20	0.9990	2.20	323.50	6.06	1.0239	
19-Oct-98	68		10.10	7.90	0.9991	2.20	1.53	10.50	2.40	0.9990	2.40	304.50	5.94	1.0856	
20-Oct-98	69		7.90	5.30	0.9991	2.60	1.81	10.50	2.30	0.9990	2.30	108.70	6.04	1.1586	
21-Oct-98	70		5.30	2.50	0.9991	2.80	1.95	10.50	2.40	0.9990	2.40	105.10	5.56	1.2372	
22-Oct-98	71		2.50	0.00	0.9991	2.50	1.74	10.50	2.60	0.9990	2.60	128.90	5.79	1.3073	
23-Oct-98	72	7.30	20.00	17.60	0.9990	2.40	1.67	10.54	2.30	0.9990	2.30	296.80	6.54	1.3605	
24-Oct-98	73		17.60	15.30	0.9990	2.30	1.60	10.54	2.10	0.9990	2.10	210.90	7.50	1.4115	
25-Oct-98	74		15.30	12.40	0.9990	2.90	2.02	10.54	2.20	0.9990	2.20	192.80	7.81	1.4757	
26-Oct-98	75		12.40	10.50	0.9990	1.90	1.32	10.54	2.80	0.9990	2.80	197.00	7.43	1.5178	
27-Oct-98	76		10.50	8.00	0.9990	2.50	1.74	10.54	1.80	0.9990	1.80	193.90	7.02	1.5732	
28-Oct-98	77		8.00	5.10	0.9990	2.90	2.02	10.54	2.40	0.9990	2.40	324.80	6.94	1.6375	
29-Oct-98	78		5.10	3.30	0.9990	1.80	1.25	10.54	2.60	0.9990	2.60	248.20	6.88	1.6774	
30-Oct-98	79	8.00	20.00	17.40	0.9990	2.60	1.81	10.50	1.70	0.9990	1.70	103.80	6.78	1.7406	
31-Oct-98	80		17.40	15.00	0.9990	2.40	1.67	10.50	2.40	0.9990	2.40	118.30	7.68	1.7989	
1-Nov-98	81		15.00	13.10	0.9990	1.90	1.32	10.50	2.20	0.9990	2.20	124.80	7.84	1.8451	
2-Nov-98	82		13.10	10.80	0.9990	2.30	1.60	10.50	1.90	0.9990	1.90	154.50	7.38	1.9009	
3-Nov-98	83		10.80	8.40	0.9990	2.40	1.67	10.50	2.10	0.9990	2.10	223.90	6.98	1.9593	
4-Nov-98	84		8.40	6.20	0.9990	2.20	1.53	10.50	2.40	0.9990	2.40	260.50	6.74	2.0127	
5-Nov-98	85		6.20	3.20	0.9990	3.00	2.09	10.50	2.10	0.9990	2.10	228.10	7.03	2.0856	
6-Nov-98	86	8.28	20.00	18.10	0.9990	1.90	1.32	10.50	2.70	0.9990	2.70	168.00	7.28	2.1334	
7-Nov-98	87		18.10	15.50	0.9990	2.60	1.81	10.50	1.80	0.9990	1.80	201.80	8.33	2.1987	
8-Nov-98	88		15.50	13.30	0.9990	2.20	1.53	10.50	2.40	0.9990	2.40	204.80	7.94	2.2540	
9-Nov-98	89		13.30	11.10	0.9990	2.20	1.53	10.50	2.10	0.9990	2.10	208.20	7.54	2.3093	
10-Nov-98	90		11.10	8.40	0.9990	2.70	1.88	10.50	2.10	0.9990	2.10	171.80	7.38	2.3772	
11-Nov-98	91		8.40	6.10	0.9990	2.30	1.60	10.50	2.60	0.9990	2.60	137.50	7.98	2.4350	
12-Nov-98	92		6.10	3.80	0.9990	2.30	1.60	10.50	1.90	0.9990	1.90	148.40	7.61	2.44	
13-Nov-98	93	1.69	20.00	17.70	0.9990	2.30	1.60	7.00	2.10	0.9990	2.10	182.20	7.68	2.45	Tap water f.
14-Nov-98	94		17.70	15.10	0.9990	2.60	1.81	7.00	1.50	0.9990	1.50	183.30	8.40	2.46	
15-Nov-98	95		15.10	13.00	0.9990	2.10	1.46	7.00	2.10	0.9990	2.10	174.00	8.30	2.47	
16-Nov-98	96		13.00	10.40	0.9990	2.60	1.81	7.00	2.30	0.9990	2.30	176.50	7.78	2.48	
17-Nov-98	97	0.91	15.00	13.00	0.9990	2.00	1.39	5.30	2.10	0.9990	2.10	113.20	7.51	2.49	Deion. water f.
18-Nov-98	98		13.00	9.60	0.9990	3.40	2.36	5.30	2.70	0.9990	2.70	212.30	7.33	2.50	

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

**Project:** 97-084  
**Column:** N3  
**Column Size:** 4" x 60"  
**Initial Charge Height:** 54.5 inch  
**Final Charge Height:** inch  
**Sample Weight:** 16.5 kg  
**Bulk Density:** 0.653 tonne/m<sup>3</sup>  
**Sample Moisture:** 8.40 %

**Ore Sample:** Carmacks Waste L1  
**Head Assay Cu<sub>(T)</sub>:** 0.58 %  
**Head Assay Cu<sub>(acid soluble)</sub>:** 0.42 %  
**Calculated Cu<sub>(T)</sub>:** %  
**Calculated Cu<sub>(acid soluble)</sub>:** %  
**Hold up Volume:** Litre  
**Drain Volume:** Litre  
**Na<sub>2</sub>CO<sub>3</sub> Concentration:** 10.00 %

**Starting Date:** August 12, 1998

Date	Day	Feed						Effluent					Na <sub>2</sub> CO <sub>3</sub> Addition (kg/t)	Note	
		Na <sub>2</sub> CO <sub>3</sub> added (g)	Start Weight (kg)	End Weight (kg)	s.g. (g/mL)	Volume (L)	Pumping Rate (mL/min)	pH	Weight (kg)	s.g. (g/mL)	Volume (L)	ORP mV			pH
19-Nov-98	99		9.60	6.60	0.9990	3.00	2.09	5.30	2.30	0.9990	2.30	182.80	7.10	2.51	
20-Nov-98	100		6.60	4.20	0.9990	2.40	1.67	5.30	2.60	0.9990	2.60	192.70	6.99	2.51	
21-Nov-98	101		STOP F.						2.20	0.9990	2.20	192.80		2.51	Rest 2 weeks
22-Nov-98									0.20	0.9990	0.20	171.60	6.80	2.51	
23-Nov-98	126							7.00					7.41		
24-Nov-98	127							7.00					7.11		
25-Nov-98	128							7.00					6.78		

# COLUMN NEUTRALIZATION TEST DATA

PROJECT: 97-084  
TEST: COLUMN N3

Date	Time	Day	Soda ash g	FEED	
				Total Volume mL	pH
11-May	11:30	0	0.1	6400	7.0
12-May	12:20	1	-	2375	7.0
13-May	8:00	2	-	4335	7.0
14-May	12:30	3	0.02	4915	7.0
15-May	11:25	4	0.05	7985	7.0
16-May	16:00	5	-	6200	7.0
17-May	17:00	6	0.02	5730	7.0
18-May	17:15	7			
19-May	16:45	8			
20-May		9			

Volume mL	pH	DISCHARGE SOLUTION				
		Eh mV	H+ g/L	SO4 mg/L	Alk mg/L	Acidity mg/L
3300	5.9	224		160	11.5	19.3
3415	6.3	205				
4125	6.2	192				
4905	6.5	186				
7035	6.8	212				
6185	6.3	216				
5075	6.4	186		8	12.1	14.9
1285	6.3	205				
56	6.3	210				

Note: Feed rate 4.3 ml/min. Eh - Ag/AgCl reference.  
Soda ash consumption is the amount used to adjust the pH for the initial volume.

**Appendix 5**

**Column C Neutralization Details**

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: C  
 Column Size: 6" inch  
 Initial Charge Height: 17'10" inch  
 Final Charge Height: kg  
 Sample Weight: 164.2 tonne/m<sup>3</sup>  
 Bulk Density: 1.566 %  
 Sample Moisture:

Ore Sample: Column C Residue  
 Head Assay Cu<sub>(T)</sub>: %  
 Head Assay Cu<sub>(acid soluble)</sub>: %  
 Calculated Cu<sub>(T)</sub>: %  
 Calculated Cu<sub>(acid soluble)</sub>: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Na<sub>2</sub>CO<sub>3</sub> Concentration: 10 %

Starting Date: October 22, 1998

Day	Feed							DISCHARGE SOLUTION							Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/l)	
	Na <sub>2</sub> CO <sub>3</sub> in soln. (g)	Volume (L)	Pumping Rate (mL/min)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	Volume (L)	Sulphate (g/l)	Acidity (g/l CaCO <sub>3</sub> )	Alkalinity (g/l CaCO <sub>3</sub> )	Eh (mV)	pH		
0	0.005	3.00		7.01												0.00
6	0.005	3.00	2.09	7.00				2.49	2.37	43.75	22.4	pH<4	515	3.43		0.00
7	0.005	3.00	2.09	7.05												0.00
10								2.90	2.79	41.25	22.1	pH<4	434	3.12		0.00
11	5.40	6.61	4.59	10.50												0.00
12		6.01	4.17	10.50				3.10	3.00	37.50	17.9	pH<4	448	3.09		0.01
13		5.71	3.96	10.50				6.50	6.37	22.50	10.70	pH<4	449	3.18		0.02
14	5.56	7.41	5.14	10.50				5.80	5.74	13.70	5.80	pH<4	428	3.15		0.03
15	9.20	4.90	3.41	10.50				6.90	6.86	8.75	3.20	pH<4	448	3.17		0.05
16		6.01	4.17	10.50				4.90	4.87	6.75	2.40	pH<4	450	3.21		0.06
17		4.70	3.27	10.50				6.10	6.08	6.00	1.80	pH<4	460	3.26		0.08
18	7.22	0.00	0.00	10.50				4.80	4.78	5.50	1.54	pH<4	454	3.21		0.08
19		6.81	4.73	10.50				2.80	2.79	4.38	1.50	pH<4	265	3.34		0.09
20		4.20	2.92	10.50				3.20	3.19	4.75	1.49	pH<4	478	3.35		0.10
21		4.80	3.34	10.50				4.70	4.69	4.38	1.30	pH<4	455	3.32		0.11
22	6.62	5.21	3.61	10.52				5.10	5.09	4.38	1.12	pH<4	452	3.31		0.12
23		5.31	3.68	10.52				5.10	5.09				482	3.36		0.13
24		5.41	3.75	10.52				5.10	5.09				479	3.31		0.14
25	6.96	4.80	3.34	10.50				5.30	5.29				468	3.28		0.15
26		5.21	3.61	10.50				4.70	4.70				448	3.27		0.16
27		5.61	3.89	10.50				5.10	5.09				415	3.26		0.18
28	10.03	6.61	4.59	10.50				5.50	5.49				446	3.32		0.20
29	10.22	5.61	3.89	10.50				6.60	6.59				436	3.15		0.21
30		4.60	3.20	10.50				5.50	5.49				459	3.29		0.23
31		6.61	4.59	10.50				4.10	4.09				429	3.38		0.25
32	7.64	5.21	3.61	10.50				6.10	6.09				441	3.32		0.26
33		6.11	4.24	10.50				5.10	5.10				400	3.33		0.27
34		6.21	4.31	10.50				6.00	6.00				410	3.38		0.29
35	6.65	6.51	4.52	10.51				6.10	6.10				417	3.40		0.30
36	7.49	6.81	4.73	10.53				6.40	6.40				442	3.39		0.32

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: C  
 Column Size: 6" inch  
 Initial Charge Height: 17'10" inch  
 Final Charge Height: kg  
 Sample Weight: 164.2 tonne/m<sup>3</sup>  
 Bulk Density: 1.566 %  
 Sample Moisture:

Ore Sample: Column C Residue  
 Head Assay Cu<sub>(T)</sub>: %  
 Head Assay Cu<sub>(acid soluble)</sub>: %  
 Calculated Cu<sub>(T)</sub>: %  
 Calculated Cu<sub>(acid soluble)</sub>: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Na<sub>2</sub>CO<sub>3</sub> Concentration: 10 %

Starting Date: October 22, 1998

Day	Feed							DISCHARGE SOLUTION							Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/t)
	Na <sub>2</sub> CO <sub>3</sub> in soln. (g)	Volume (L)	Pumping Rate (mL/min)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	Volume (L)	Sulphate g/l	Acidity g/l CaCO <sub>3</sub>	Alkalinity g/l CaCO <sub>3</sub>	Eh mV	pH	
37		6.51	4.52	10.53				6.70	6.69				448	3.40	0.33
38		5.61	3.89	10.53				6.40	6.39				456	3.41	0.35
39	6.91	5.41	3.75	10.50				5.50	5.49				461	3.39	0.36
40		6.41	4.45	10.50				5.30	5.30				452	3.42	0.37
41		6.21	4.31	10.50				6.20	6.19				447	3.43	0.38
42	6.29	7.01	4.87	10.50				6.20	6.19				418	3.47	0.40
43	9.09	6.21	4.31	10.49				6.70	6.69				440	3.44	0.41
44		5.81	4.03	10.49				6.10	6.10				451	3.47	0.43
45		4.80	3.34	10.49				5.70	5.70				439	3.47	0.44
46	6.85	6.11	4.24	10.50				4.70	4.70				439	3.43	0.46
47		6.11	4.24	10.50				6.10	6.10				472	3.48	0.47
48		6.11	4.24	10.50				6.10	6.10				428	3.43	0.48
49	5.88	6.21	4.31	10.50				6.00	6.00				471	3.47	0.49
50	5.86	6.71	4.66	10.49				6.20	6.20				466	3.49	0.50
51		6.71	4.66	10.49				5.60	5.60				468	3.51	0.52
52		5.21	3.61	10.49				7.20	7.19				479	3.49	0.53
53	3.51	6.41	4.45	10.50				5.60	5.60				468	3.53	0.53
54		6.11	4.24	10.50				6.00	6.00				472	3.50	0.54
55		5.91	4.10	10.50				6.10	6.10				461	3.54	0.55
56	2.28	6.21	4.31	10.49				6.00	6.00				459	3.54	0.55
57	3.37	6.71	4.66	10.50				6.10	6.10				444	3.60	0.56
58		6.01	4.17	10.50				6.90	6.90				477	3.63	0.56
59		5.31	3.68	10.50				6.00	6.00				471	3.63	0.57
60	2.34	6.21	4.31	10.50				5.90	5.90				468	3.64	0.57
61		6.11	4.24	10.50				6.00	6.00				473	3.64	0.58
62		6.11	4.24	10.50				6.00	6.00				475	3.64	0.58
63	4.19	5.91	4.10	10.50				6.10	6.10				478	3.59	0.59
64		13.01	9.04	10.50				5.90	5.90				497	3.58	0.61
66		13.81	9.59	10.50				12.70	12.70				504	3.52	0.62
68		4.60	3.20	10.50				10.90	10.89				484	3.49	0.63



# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: C  
 Column Size: 6" inch  
 Initial Charge Height: 17'10" inch  
 Final Charge Height: kg  
 Sample Weight: 164.2 tonne/m<sup>3</sup>  
 Bulk Density: 1.566 %  
 Sample Moisture:

Ore Sample: Column C Residue  
 Head Assay Cu<sub>(T)</sub>: %  
 Head Assay Cu<sub>(acid soluble)</sub>: %  
 Calculated Cu<sub>(T)</sub>: %  
 Calculated Cu<sub>(acid soluble)</sub>: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Na<sub>2</sub>CO<sub>3</sub> Concentration: 10 %

Starting Date: October 22, 1998

Day	Feed							DISCHARGE SOLUTION							Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/t)
	Na <sub>2</sub> CO <sub>3</sub> in soln. (g)	Volume (L)	Pumping Rate (mL/min)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	Volume (L)	Sulphate (g/l)	Acidity (g/l CaCO <sub>3</sub> )	Alkalinity (g/l CaCO <sub>3</sub> )	Eh (mV)	pH	
69	2.88	6.81	4.73	10.50				5.40	5.40				483	3.47	0.63
70	5.60	5.81	4.03	10.50				6.10	6.10				495	3.50	0.64
71		6.31	4.38	10.50				6.40	6.40				459	3.59	0.66
72		5.71	3.96	10.50				6.10	6.10				448	3.60	0.67
73		6.11	4.24	10.50				5.70	5.70				445	3.60	0.68
74		5.81	4.03	10.50				6.10	6.10				446	3.61	0.69
75		6.01	4.17	10.50				5.70	5.70				504	3.68	0.70
76	3.30	6.31	4.38	10.50				6.10	6.10				445	3.68	0.70
77		5.91	4.10	10.50				6.10	6.10				481	3.54	0.71
78	3.29	6.01	4.17	10.49				6.00	6.00				443	3.51	0.71
79		6.11	4.24	10.49				5.90	5.90				493	3.54	0.72
80		6.11	4.24	10.49				6.20	6.20				491	3.55	0.73
81	2.70	6.21	4.31	10.50				4.80	4.80				486	3.54	0.73
82		5.71	3.96	10.50				6.20	6.20				480	3.53	0.74
83		6.31	4.38	10.50				5.70	5.70				483	3.50	0.74
84	2.34	6.31	4.38	10.50				6.20	6.20				473	3.54	0.75
85	3.40	6.21	4.31	10.49				6.20	6.20				496	3.57	0.75
86		6.31	4.38	10.49				6.30	6.30				483	3.62	0.76
87		4.80	3.34	10.49				4.70	4.70				482	3.61	0.76
88	2.56	5.91	4.10	10.49				5.40	5.40				480	3.61	0.77
89		6.31	4.38	10.49				6.00	6.00				478	3.63	0.77
90		6.21	4.31	10.49				6.40	6.40				435	3.63	0.78
91	2.50	6.11	4.24	10.50				6.10	6.10				444	3.62	0.78
92	2.84	6.31	4.38	10.50				6.10	6.10				481	3.70	0.79
93		12.41	8.62	10.50				6.30	6.30				430	3.70	0.80
95	3.18	6.31	4.38	10.51				12.40	12.40				443	3.71	0.81
96		6.41	4.45	10.51				6.30	6.30				443	3.73	0.81
97		5.51	3.82	10.51				6.40	6.40				414	3.70	0.82
98	3.69	6.01	4.17	10.50				6.40	6.40				239	3.73	0.82
99	3.78	6.31	4.38	10.50				6.30	6.30				243	3.75	0.83

# WASTE COLUMN NEUTRALIZATION TEST DATA

Carmacks Project

Project: 97-084  
 Column: C  
 Column Size: 6" inch  
 Initial Charge Height: 17'10" inch  
 Final Charge Height: kg  
 Sample Weight: 164.2 tonne/m<sup>3</sup>  
 Bulk Density: 1.566 %  
 Sample Moisture:

Ore Sample: Column C Residue  
 Head Assay Cu<sub>m</sub>: %  
 Head Assay Cu<sub>(acid soluble)</sub>: %  
 Calculated Cu<sub>m</sub>: %  
 Calculated Cu<sub>(acid soluble)</sub>: %  
 Hold up Volume: Litre  
 Drain Volume: Litre  
 Na<sub>2</sub>CO<sub>3</sub> Concentration: 10 %

Starting Date: October 22,1998

Day	Feed							DISCHARGE SOLUTION							Na <sub>2</sub> CO <sub>3</sub> Consumption (kg/l)
	Na <sub>2</sub> CO <sub>3</sub> in soln. (g)	Volume (L)	Pumping Rate (mL/min)	pH	Cu (g/L)	Fe (g/L)	Free H <sub>2</sub> SO <sub>4</sub> (g/L)	Weight (kg)	Volume (L)	Sulphate (g/l)	Acidity (g/l CaCO <sub>3</sub> )	Alkalinity (g/l CaCO <sub>3</sub> )	Eh (mV)	pH	
100		12.41	8.62	10.50				6.50	6.50				283	3.79	0.84
102	3.05	6.41	4.45	10.50				12.90	12.91				233	3.80	0.85
103		6.41	4.45	10.50				6.40	6.41				183	3.76	0.86
104		6.41	4.45	10.50				6.40	6.41				188	3.75	0.86
105	4.42	6.51	4.52	10.50				6.30	6.30				222	3.78	0.87
106	4.88	6.61	4.59	10.50				6.50	6.51				209	3.82	0.88
107		11.71	8.13	10.50				6.60	6.60				222	3.81	0.88
109	3.52	6.41	4.45	10.50				12.70	12.71				217	3.84	0.89
110		6.41	4.45	10.50				6.30	6.31				211	3.88	0.90
111		6.61	4.59	10.50				6.40	6.41	1.00	0.06		166	3.87	0.90
112	3.41	6.01	4.17	10.50				6.60	6.61				208	3.57	0.91
113	4.18	6.11	4.24	10.50				6.10	6.11				207	3.57	0.92
114		13.11	9.11	10.50				6.40	6.41				215	3.63	0.93
116	3.97	6.11	4.24	10.50				13.10	13.12				217	3.68	0.94
117		6.41	4.45	10.50				6.10	6.11				142	3.61	0.95
118		6.31	4.38	10.50				6.40	6.41				189	3.69	0.96
119	3.94	6.41	4.45	10.50				6.30	6.31				190	3.66	0.96
120	5.08	5.61	3.89	10.50				6.40	6.41				196	3.71	0.97
121		12.71	8.83	10.50				6.30	6.31				208	3.70	0.99
123	4.03	6.31	4.38	10.50				12.70	12.72				209	3.73	1.00
124		6.41	4.45	10.50				6.30	6.31				200	3.73	1.01
125		6.41	4.45	10.50				6.40	6.41				204	3.82	1.02
126	5.78	6.41	4.45	10.50				6.40	6.41				197	3.83	1.03
127		20.02	13.90	10.50				6.40	6.48				167	3.84	1.06
131	5.50	16.62	11.54	10.50				22.00	22.03				215	3.87	1.09
134	6.50	22.02	15.29	10.50				16.60	16.62				215	3.90	1.13
137	5.50	16.02	11.12	10.50				22.00	22.03				157	3.92	1.16
140	3.00	5.81	4.03	10.50				16.00	16.02				159	3.95	1.17
141	6.07	18.02	12.51	10.50				5.80	5.81				155	4.02	1.20

# COLUMN NEUTRALIZATION TEST DATA AFTER REST PERIOD

PROJECT: 97-084  
TEST: COLUMN C

Date	Time	Day	Soda ash g	FEED		pH	DISCHARGE SOLUTION												
				Total Volume mL			Volume mL	pH	Eh mV	H+ g/L	SO4 .mg/L	Alk g/L	Acidity mg/L						
11-May	11:45	0	0.07	6400	7.0														
12-May	14:00	1	0.02	2800	7.0														
13-May	8:10	2	-	5600	7.0														
14-May	11:00	3	0.01	5000	7.0	4675	4.0	398			1025								69.3
15-May	13:00	4	0.03	5700	7.0	4700	3.9	412											
16-May	13:10	5	0.02	6800	7.0	5000	4.0	414											
17-May	15:15	6	-	5800	7.0	5600	3.9	390											
18-May	15:30	7				5400	4.0	413			600								46.5
19-May		8	Drain down			2500	4.0	372											
20-May		9				256	4.0	391											
				38100		28131													

Note: Feed rate 4.3 ml/min. Eh - Ag/AgCl reference  
Soda ash consumption is the amount used to adjust pH for the initial volume  
Day 1 = day 525 in overall rinse test

# COLUMN NEUTRALIZATION TEST DATA

PROJECT: 97-084

TEST: COLUMN AB

Date	Time	Day	FEED		pH	DISCHARGE SOLUTION												
			Soda ash g	Total Volume L		Volume L	pH	Eh mv	H+ g/L	SO4 g/L	Alk g/L	Acidity g/L						
11-May	11:45	0	0.7	120	7.0													
12-May	13:30	1	0.65	80	7.0													
13-May	8:10	2	0.8	125	7.0													
14-May	11:00	3	0.8	119	7.0													
15-May	11:45	4	0.55	119	7.0													
16-May	11:45	5	0.9	130	7.0	73	3.0	386										
17-May	14:45	6	0.8	116	7.0	131	3.1	381										
18-May	15:00	7				113.5	3.2	386										
19-May	14:15	8				109.1	3.2	375										

Note: Feed rate 77 ml/min. Eh - Ag/AgCl reference  
 Soda ash consumption is the amount used to adjust pH for the initial volume



INTERNATIONAL PLASMA LABORATORIES LTD.

# CERTIFICATE OF ANALYSIS

## iPL 00E0489

2355 UNIVERSITY STREET  
Vancouver, B.C.  
Canada V5Y 3E1  
Phone (604) 879-7678  
Fax (604) 879-7698

Client : Process Research Associates Ltd  
Project : 97-084

Out: May 30, 2000  
In : May 30, 2000

[048914:40:26:00053000]

6 Samples  
6-Solution

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Section 1 of 2

Sample Name	Type	Al mg/L	Sb mg/L	As mg/L	Ba mg/L	Bi mg/L	Cd mg/L	Ca mg/L	Cr mg/L	Co mg/L	Cu mg/L	Fe mg/L	La mg/L	Pb mg/L	Mg mg/L	Mn mg/L
Col. M3-Day 1	Solution	27.2	<0.1	0.2	0.29	<0.1	<0.01	4.7	<0.01	<0.01	2.85	27.69	<0.05	0.21	6.6	0.17
Col. M3-Day 7	Solution	4.4	<0.1	<0.2	0.09	<0.1	<0.01	0.4	<0.01	<0.01	0.69	5.39	<0.05	<0.05	1.5	0.06
Col. C -Day 3	Solution	4.2	<0.1	<0.2	<0.01	<0.1	<0.01	282.9	<0.01	0.03	13.71	<0.03	<0.05	0.25	22.5	1.48
Col. C -Day 7	Solution	1.2	0.1	<0.2	<0.01	<0.1	<0.01	187.9	<0.01	<0.01	5.81	<0.03	<0.05	0.36	9.7	0.62
Col. AB -Day 5	Solution	5179.2	<0.1	16.4	<0.01	1.7	<0.01	470.5	0.32	15.57	2444.77	131.45	0.23	0.19	6903.7	545.98
Col. AB -Day 7	Solution	3210.7	<0.1	10.9	<0.01	0.9	<0.01	477.0	0.21	10.40	1583.75	65.96	0.15	0.43	4382.2	349.74

Minimum Detection  
Maximum Detection  
Method

0.2 0.1 0.2 4.01 0.1 0.01 0.1 0.01 0.1 0.01 0.01 0.01 0.03 0.05 0.1 0.01  
 9999.0 9999.0 9999.0 999.00 999.0 999.00 9999.0 9999.00 9999.0 9999.00 9999.00 9999.00 9999.00 9999.00 9999.0 9999.00  
 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20  
 No Fee Insufficient Sample Det-Delay Mass-No Estimate Res-RecCheck new/DIF %-Estimate % No Sample



INTERNATIONAL PLASMA LABORATORY LTD.

Client : Process Research Associates Ltd  
Project: 97-084

6 Samples  
6-Solution

[048914:40:26:00053000]

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Page 1 of 1  
Section 2 of 2

# CERTIFICATE OF ANALYSIS

## IPL 00E0489

Sample Name	Hg mg/L	Mo mg/L	Mn mg/L	P mg/L	K mg/L	Sc mg/L	Ag mg/L	As mg/L	Sr mg/L	Tl mg/L	Ti mg/L	V mg/L	Zn mg/L	Zr mg/L
Col. N3-Day 1	<0.05	0.08	<0.02	1.0	4	0.03	<0.02	88	0.04	<0.2	0.7	0.13	0.04	0.02
Col. N3-Day 7	<0.05	<0.02	<0.02	<0.1	<2	<0.01	<0.02	15	0.03	<0.2	0.1	0.02	<0.01	<0.01
Col. C -Day 3	<0.05	<0.02	<0.02	<0.1	19	0.01	<0.02	67	<0.01	<0.2	<0.1	<0.01	0.40	<0.01
Col. C -Day 7	<0.05	<0.02	<0.02	0.3	16	<0.01	<0.02	110	0.02	0.5	<0.1	0.02	0.17	<0.01
Col. AB -Day 5	<0.05	0.26	6.37	27.0	10	0.61	<0.02	30	0.18	<0.2	0.3	<0.01	73.34	<0.01
Col. AB -Day 7	<0.05	0.28	4.33	21.2	8	0.42	<0.02	22	0.19	<0.2	0.1	<0.01	48.71	<0.01

Minimum Detection 0.05 0.02 0.02 0.1 2 0.01 0.02 1 0.01 0.2 0.1 0.1 0.01 0.01 0.01  
Maximum Detection 9999.00 9999.00 9999.00 9999.00 9999.00 100.00 999.00 999.00 9999.00 999.00 999.00 9999.00 999.00 9999.00 999.00  
Method ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20 ICPH20  
---No Test Ins-Inadequate Sample Del-Delay Max-No Estimate Rec=Re-Check m=1000 %-Estimate % NS=No Sample