COPPER FLOTATION - TESTWORK DATA

UU6189

To: Ron Murarka
From: Sibyl Frei
Date: September 13, 1983

Subject: Discrepancies in recent "duplicate" Cu tests on 2EFore

Discussion and Conclusions:

1. Test B-2 and B-3 have been compared. Although both tests were done on the large ball mill with the small ball charge, the grinding and flotation stages were not performed exactly the same. Z-11 was used as the collector in test B-2 whereas Minerec 1661 was the collector used in test B-3. Thus differences in grade or recovery could be expected although a better Cu recovery with Minerec 1661 was anticipated than that accomplished.
   As noticed by R. Murarka, the weights of the 8kg tests are considerably less than expected. For the most part, this loss of sample occured as the ground sample was removed from the mill. Spillage was considerable, but this should now be avoidable as a funnel has been constructed to aid in emptying the large ball mill.

2. Tests E-3 and E-6 have also been compared. These two tests were identical in procedure. It seems likely that, as there was very little of the Minerec 1661 product remaining, it may have been too old and a poor sample. This test should be repeated once a new sample of Minerec 1661 is received.

3. Tests B-3 and E-6 should be compared. Although the first test is large scale and the second test is small scale, the same reagents (including old Minerec 1661) were used in each test, although in different amounts. These tests were much more similar in results (see attached table 1) than E-3 vs E-6, which supports the conclusion in part 2 above.

4. Tests A-8 and A-15 were duplicates in procedure. Test A-15 showed considerably less Cu recovery even in the rougher stage. One reason for this is that two different technicians performed the test. This

METALLURGICAL BALANCE – Table 1

2EF tests for Cu with Minerec 1661 performed Sept. 1983

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%) Pb	Zn	Fe	Cu	Ag	DISTRIBUTION (%) Pb	Zn	Fe	Cu	Ag
B-3	Large Scale 2EF (8kg) small ball charge 3kg/tonne Na_2CO_3 1kg/tonne Na_2SO_3 (100/50) g/tonne M.1661	Cu Ro Conc	115.5	5.96	6.84	32.6	6.67	253	2.23	1.84	1.33	44.38	3.03
		Cu Ro Tls	7426.3	4.07	5.69	37.6	0.13	1.26	97.77	98.16	98.67	55.62	96.97
		CALCHEAD	7591.8	4.10	5.71	37.5	0.23	1.28					
E-6	Small Scale 2EF (2kg) CALCULATED	Cu Conc	88.9	12.94	8.77	29.9	3.01	3.80	13.68	6.90	3.63	53.40	10.34
		Cu Tls	1915.1	3.79	5.49	36.8	0.12	1.53	86.32	93.10	96.37	46.60	89.66
		CALCHEAD	2004.0	4.20	5.64	36.5	0.25	1.63					

TO: R. Murarka
FROM: Rhonda Martel
DATE: July 13, 1983

Subject: Copper Flotation-Update
(To be attached to Copper Flotation-Update, Rhonda Martel to R. Murarka, June 2 and June 21, 1983).

GROUP E TESTWORK - Lg. scale Cu Rougher Flotation

E-5 - This test was done to generate Cu Rougher Conc for a future Cu locked-cycle test. It consumed 3 kg/T Na_2CO_3, 1 kg/T Na_2SO_3, 100 g/T Z-11 to grind and 50 g/T Z-11 to the Rougher.

E-5

• Generation of Copper Rougher concentrate •

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
3Kg/T Soda Ash	Cu Ro. conc	754.4	26.50	5.19	19.3	1.03	13.51	81.17	8.72	15.69	51.75	60.98
1Kg/T Na_2SO_3	tails	7245.6	0.64	5.66	10.8	0.10	0.90	18.83	91.28	84.31	48.25	39.02
100g/T Z-11 TO GRIND	HEADS	8000	3.08	5.62	11.6	0.19	2.09	100.00	100.00	100.00	100.00	100.00
50g/T Z-11 TO Rougher												

Copper Flotation Update (cont'd)

GROUP F TESTWORK - Cu Locked Cycle Tests

F-1 - This test was done following test # B-9 reagent scheme. We wanted to see how recycling would affect the Copper flotation. Closed circuit.

Primary Grind - 1 kg/T Na_2SO_3
3 kg/T Na_2CO_3
50 g/T Z-11 (in the first cycle only)
40 g/T Z-11 (in all other cycles)

	Z-11 g/T				
	Cu Rougher	1st cleaner	2nd cleaner	3rd cleaner	4th
First cycle	20	10	5	2	—
Second cycle	10	10	5	2	—
3rd to 6th cycle	10	—	—	—	—

The Z-11 additions were changed because the higher Z-11 collected too much Pb. The final scheme proved to be the best.
There was a problem with too much Pb being recycled so it was suggested that the 1st cleaner be open. The Pb problem may have been due to the large amount of Pb pulled in the roughers though.

The met balance for this test was good.

F-2 - This test was done using a pH of 5.5 for Cu flotation. The pH was lowered with H_2SO_3. The feed for the test was the Cu rougher conc. generated from test # E-5.

The Z-11 was added as necessary

	1st cleaner	2nd cleaner	3rd cleaner
Z-11	10 g/T	15 g/T	10 g/T

Only 3 cleaners were done because of the smaller feed sample.

This test was not as good as F-1.

F-3

This test was identical to F-1 (ie. cycle 3-6 of F-1) except the first cleaner was open.

This test was not as good as F-1.

F-1

TABLE I

June 30-83

LOCKED CYCLE CLEANER TEST "To upgrade copper"

ORETYPE and Test Description

No $K_2Cr_2O_7$
No NaCN
1 Kg/T Na_2SO_3
Low Z-11

Prim. Grind
Na_2CO_3 3 Kg/T
Na_2SO_3 1 Kg/T
Z-11 50 g/T
25 min. grind

Rougher
pH to 9.5

1ST CLNR
pH to 9.5

2nd CLNR
pH to 9.5

3RD CLNR
pH to 9.5

4TH CLNR
pH to 9.5

		ASSAYS					DISTRIBUTION				
SAMPLE	WTS	Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
Cu Conc I	56.3	64.90	4.79	6.1	2.64	27.90	10.74	0.41	0.26	5.50	6.57
II	36.7	62.20	4.32	6.5	4.38	27.60	6.71	0.24	0.18	5.95	4.24
III	11.3	32.80	6.95	12.7	11.60	22.15	1.09	0.12	0.11	4.85	1.05
IV	5.8	23.30	6.47	15.3	16.10	19.93	0.40	0.06	0.07	3.45	0.48
V	13.3	39.10	7.29	12.0	11.30	25.37	1.53	0.14	0.12	5.56	1.41
VI	13.8	42.10	6.93	10.6	9.95	24.67	1.71	0.15	0.11	5.08	1.42
Tails I	1835.8	0.74	5.25	11.5	0.19	0.90	3.99	14.81	15.70	12.90	6.91
II	1937.8	1.52	5.73	11.6	0.17	1.36	8.66	17.06	16.72	12.19	11.03
III	1934.2	1.82	5.69	11.8	0.11	1.62	10.35	16.91	16.98	7.87	13.11
IV	1933.5	1.70	5.62	11.7	0.12	1.58	9.66	16.70	16.83	8.58	12.78
V	1977.8	1.83	5.77	12.3	0.11	1.71	10.64	17.54	18.10	8.05	14.15
VI	1578.0	1.57	5.34	11.7	0.13	1.55	7.28	12.95	13.73	7.59	10.24
4TH clnr tls VI	30.4	58.50	8.65	5.5	2.19	22.29	5.23	0.40	0.12	2.46	2.84
3rd clnr tls VI	60.1	53.70	9.55	6.3	1.20	23.05	9.49	0.88	0.28	2.67	5.80
2nd clnr tls VI	88.6	41.50	10.68	8.9	0.68	17.61	10.81	1.45	0.59	2.23	6.53
1ST clnr tls VI	138	42.10	6.93	10.6	9.95	24.67	1.71	0.15	0.11	5.08	1.42
HEADS	11,527.2	2.95	5.64	11.66	0.23	2.07	100.00	100.00	100.00	100.00	100.00

	wts	Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
Cu Conc	135.5	40.60	7.11	11.3	10.62	25.02	15.40	0.96	0.71	40.28	10.47
Tails	1777.9	1.70	5.56	12.0	0.12	1.63	84.60	99.03	99.29	59.72	89.53
HEADS	1791.45	1.99	5.57	12.0	0.20	1.81	100.00	100.00	100.00	100.00	100.00

June 30. 83

TABLE II

F-1

• METALLURGICAL RESPONSE OF INDIVIDUAL CYCLES •

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
CYCLE 1	Cu Conc	56.3	64.90	4.79	6.1	2.64	27.90	72.90	2.72	1.60	29.88	48.74
	TAILS	1835.8	0.74	5.25	11.5	0.19	0.90	27.10	97.28	98.40	70.12	51.26
	HEADS	1892.1	2.65	5.24	11.3	0.26	1.70	100.00	100.00	100.00	100.00	100.00
CYCLE 2	Cu Conc	36.7	62.20	4.32	6.5	4.38	27.60	43.66	1.41	1.05	32.79	27.76
	TAILS	1937.8	1.52	5.73	11.6	0.17	1.36	56.34	98.59	98.95	67.21	72.24
	HEADS	1974.5	2.65	5.70	11.5	0.25	1.85	100.00	100.00	100.00	100.00	100.00
CYCLE 3	Cu Conc	11.3	32.80	6.95	12.7	11.60	22.15	9.52	0.71	0.62	38.12	7.40
	TAILS	1934.2	1.82	5.69	11.8	0.11	1.62	90.47	99.29	99.38	61.88	92.60
	HEADS	1945.5	2.00	5.70	11.8	0.18	1.74	100.00	100.00	100.00	100.00	100.00
CYCLE 4	Cu Conc	5.8	23.30	6.47	15.3	16.10	19.93	3.95	0.34	0.39	28.70	3.64
	TAILS	1933.5	1.70	5.62	11.7	0.12	1.58	96.05	99.66	99.61	71.30	96.35
	HEADS	1939.3	1.76	5.62	11.7	0.17	1.63	100.00	100.00	100.00	100.00	100.00
CYCLE 5	Cu Conc	13.3	39.10	7.29	12.0	11.30	25.37	12.56	0.84	0.65	40.86	9.07
	TAILS	1977.8	1.83	5.77	12.3	0.11	1.71	87.44	99.16	99.35	59.14	90.93
	HEADS	1991.1	2.08	5.78	12.3	0.18	1.87	100.00	100.00	100.00	100.00	100.00
CYCLE 6	Cu Conc	13.8	42.10	6.93	10.6	9.95	24.67	19.00	1.12	0.79	40.10	12.22
	TAILS	1578.0	1.57	5.34	11.7	0.13	1.55	81.00	98.88	99.21	59.90	87.78
	HEADS	1591.8	1.92	5.35	11.7	0.22	1.75	100.00	100.00	100.00	100.00	100.00

F-2 2BCD Locked Cycle Test - Averages by Cycle

TABLE II

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
F-2 cycle 1 (2BCD)	$CuCC_3$	33.0	53.00	6.40	9.8	2.71	25.35	51.45	2.89	2.17	38.47	35.68
	$CuCT_1$	65.5	13.40	3.97	23.4	0.34	6.43	25.82	3.56	10.29	9.58	17.96
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	22.73	93.55	87.54	51.95	46.36
	CALCHEAD	1306.1	2.60	5.59	11.4	0.18	1.80	100.0	100.0	100.0	100.0	100.0
F-2 cycle 2 (2BCD)	$CuCC_3$	5.1	42.30	3.82	12.9	8.85	23.70	5.80	0.26	0.43	20.93	4.89
	$CuCT_1$	105.9	25.80	4.88	19.3	0.47	11.92	73.43	7.01	13.49	23.08	51.11
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	20.77	92.72	86.08	55.99	44.00
	CALC. HEAD	1318.6	2.82	5.59	11.5	0.16	1.87	100.0	100.0	100.0	100.0	100.0
F-2 cycle 3 (2BCD)	$CuCC_3$	12.7	38.00	4.43	15.7	5.91	20.64	11.50	0.75	1.29	29.35	9.51
	$CuCT_1$	115.3	25.50	5.24	19.1	0.52	12.21	70.08	8.06	14.26	33.12	51.07
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	18.42	91.19	84.45	66.71	39.42
	CALC. HEAD	1335.6	3.14	5.61	11.6	0.19	2.06	100.0	100.0	100.0	100.0	100.0
F-2 cycle 4 (2BCD)	$CuCC_3$	22.7	46.60	3.98	13.4	3.57	23.27	28.85	1.23	2.01	33.15	21.24
	$CuCT_1$	87.0	21.10	5.07	20.3	0.99	10.02	50.07	5.99	11.69	17.44	35.05
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	21.08	92.79	86.30	49.40	43.70
	CALC. HEAD	1317.3	2.78	5.59	11.5	0.19	1.89	100.0	100.0	100.0	100.0	100.0
F-2 cycle 5 (2BCD)	$CuCC_3$	16.4	36.00	4.65	16.3	5.54	19.70	13.83	1.02	1.73	34.86	11.63
	$CuCT_1$	114.0	25.50	5.16	19.1	0.43	12.01	68.08	7.84	14.06	18.81	49.27
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	18.10	91.14	84.21	46.33	39.11
	CALC. HEAD	1338.0	3.19	5.61	11.6	0.19	2.08	100.0	100.0	100.0	100.0	100.0
F-2 cycle 6 (2BCD)	$CuCC_3$	32.2	38.30	3.90	16.3	2.91	19.62	33.31	1.70	3.48	37.72	25.05
	$CuCT_1$	77.1	22.00	5.38	19.7	0.44	10.42	45.81	5.62	10.07	13.66	31.86
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	20.88	92.67	86.45	48.62	43.09
	CALC. HEAD	1316.9	2.81	5.60	11.5	0.19	1.92	100.0	100.0	100.0	100.0	100.0

F-2 2BCD Locked Cycle Test - Low pH - First Cleaner Open

TABLE I

ORE TYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
F-2	$CuCC_3$ I	33.0	53.00	6.40	9.8	2.71	25.35	7.39	0.47	0.35	5.98	5.31
2BCD locked cycle test	II	5.1	42.30	3.82	12.9	8.85	23.70	0.91	0.04	0.07	3.02	0.77
-6 cycles	III	12.7	38.00	4.43	15.7	5.91	20.64	2.04	0.13	0.22	5.02	1.67
-prod. Cu conc. only	IV	22.7	46.60	3.98	13.4	3.57	23.27	4.47	0.20	0.33	5.42	3.36
	V	16.4	36.00	4.65	16.3	5.54	19.70	2.50	0.17	0.29	6.07	2.05
- cleaning stages at pH = 5.5 using H_2SO_3 as the pH modifier.	VI	32.2	38.30	3.90	16.3	2.91	19.62	5.21	0.28	0.57	6.27	4.01
	$Cu\ CT_1$ I	65.5	13.40	3.97	23.4	0.34	6.43	3.71	0.58	1.67	1.49	2.68
- open 1st cleaner	II	105.9	25.80	4.88	19.3	0.47	11.92	11.55	1.16	2.23	3.33	8.02
	III	115.3	25.50	5.24	19.1	0.52	12.21	12.43	1.35	2.40	4.01	8.94
	IV	87.0	21.10	5.07	20.3	0.49	10.02	7.76	0.99	1.92	2.85	5.54
	V	114.0	25.50	5.16	19.1	0.43	12.01	12.29	1.32	2.37	3.28	8.70
	VI	77.1	22.00	5.38	19.7	0.44	10.42	7.17	0.93	1.65	2.27	5.10
	Fin. Tls. (total)	724.5.6	0.64	5.66	10.8	0.10	0.90	19.60	91.89	85.25	48.45	41.43
	$Cu\ CT_2$ VI	25.8	20.90	6.39	19.0	0.98	11.20	2.28	0.37	0.53	1.69	1.84
	$Cu\ CT_3$ VI	7.0	23.90	7.00	17.9	1.85	13.37	0.71	0.11	0.14	0.87	0.59
	Calc. HEAD	7965.3	2.97	5.60	11.5	0.19	1.97	100.0	100.0	100.0	100.0	100.0
F-2 average of cycles 4, 5 and 6	$CuCC_3$	23.8	40.30	4.18	15.3	4.01	20.86	24.87	1.34	2.39	36.97	19.17
	$CuCT_1$	92.7	22.87	5.20	19.7	0.45	10.82	55.06	6.50	11.99	16.18	38.79
	Fin. Tls.	1207.6	0.64	5.66	10.8	0.10	0.90	20.07	92.16	85.62	46.85	42.03
	Calc. HEAD	1324.1	2.91	5.60	11.5	0.19	1.95	100.0	100.0	100.0	100.0	100.0

TABLE 1

F-3

2BCD LOCKED-CYCLE TEST (First Cleaner Open)

ORETYPE and Test Description

Reagents were identical to F-1

Grind: 2kg ore
66% sol.
1 kg/t Na_2SO_3
3 kg/t Na_2CO_3
40 g/t Z-11
30 min.

Rougher:
10 g/t Z-11

First Cleaner: (open)
no Z-11

Second Cleaner:
no Z-11

Third Cleaner:
no Z-11

Fourth Cleaner:
no Z-11

		ASSAYS					DISTRIBUTION				
SAMPLE	WT	Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
CuCC4 I	5.7	17.30	6.24	17.3	18.40	20.35	.3	.1	.1	4.6	.5
II	10.9	39.70	4.38	11.3	11.50	25.97	1.2	.1	.1	5.5	1.1
III	46.1	63.00	4.37	5.4	4.23	31.13	8.3	.3	.2	8.6	5.8
IV	22.5	56.00	4.29	7.2	6.67	29.74	3.6	.2	.1	6.6	2.7
V	29.3	48.70	4.46	6.4	5.57	30.42	4.1	.2	.1	7.2	3.6
VI	28.5	54.90	5.55	6.4	5.44	28.83	4.5	.2	.1	6.8	3.3
CuCT, I	56.9	10.20	8.64	10.6	.23	5.53	1.7	.7	.4	.6	1.3
II	57.0	6.71	7.09	10.8	.18	3.67	1.1	.6	.4	.5	.8
III	53.9	8.68	7.37	11.0	.22	4.24	1.3	.6	.4	.5	.9
IV	78.1	10.80	7.57	10.6	.25	5.39	2.4	.9	.6	.9	1.7
V	71.9	6.46	6.78	11.2	.20	3.68	1.3	.7	.6	.6	1.1
VI	68.9	6.62	6.92	10.9	.20	3.40	1.3	.7	.5	.6	.9
CuROTb I	1833.6	1.31	5.64	11.9	.10	1.20	6.9	15.1	15.2	8.1	8.9
II	1884.4	1.42	5.77	11.9	.10	1.40	7.7	15.8	15.7	8.3	10.6
III	1891.0	1.43	5.49	12.3	.09	1.32	7.8	15.1	16.2	7.5	10.1
IV	1870.1	1.21	5.71	12.1	.10	1.17	6.5	15.6	15.8	8.2	8.8
V	1873.5	1.39	5.77	11.9	.09	1.29	7.5	15.7	15.6	7.4	9.7
VI	1865.1	1.40	5.58	12.8	.12	1.46	7.5	15.2	16.7	9.9	11.0
CuCT4 VII	58.2	63.00	7.23	4.1	1.19	27.65	10.5	.6	.2	3.1	6.5
CuCT3 VI	61.6	39.50	7.77	5.9	.82	23.78	7.0	.7	.3	2.2	5.9
CuCT2 VI	75.2	35.60	9.82	9.0	.60	15.85	7.7	1.1	.5	2.0	4.8
Heads	11,942.1	2.92	5.75	12.0	.19	2.08	100.0	100.0	100.0	100.0	100.0

TABLE 2 (cont'd on Table 3)

F-3

2BCD Cu Locked-Cycle Test - Metallurgy Calculated by Cycle

ORETYPE and Test Description	SAMPLE	WT3	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
I	CuCC4	5.7	17.30	6.24	17.3	18.40	20.35	3.21	.33	.44	34.57	4.40
	CuCT1	56.9	10.20	8.64	10.6	.23	5.53	18.89	4.52	2.67	4.31	11.94
	CuRoTls	1833.6	1.31	5.64	11.9	.10	1.20	78.19	95.18	96.70	60.44	83.48
	Heads	1896.2	1.62	5.73	11.9	.16	1.39					
II	CuCC4	10.9	39.70	4.78	11.3	11.50	25.97	12.38	.46	.53	37.77	9.06
	CuCT1	57.0	6.71	7.09	10.8	.18	3.67	10.94	3.57	2.65	3.09	6.70
	CuRoTls	1884.4	1.42	5.77	11.9	0.10	1.40	76.57	96.02	96.52	56.78	84.46
	Heads	1952.3	1.79	5.80	11.9	.17	1.60					
III	CuCC4	46.1	63.00	4.37	5.4	4.23	31.13	47.98	1.83	1.03	51.55	34.49
	CuCT1	53.9	8.08	7.37	11.0	.22	4.24	7.20	3.61	2.46	3.13	5.49
	CuRoTls	1891.0	1.43	5.49	12.3	.09	1.32	44.68	94.46	96.55	44.99	59.99
	Heads	1991.0	3.04	5.52	12.1	.19	2.09					
IV	CuCC4	22.5	56.00	4.29	7.2	6.67	29.74	28.80	.85	.69	42.31	20.45
	CuCT1	78.1	10.80	7.57	10.6	.25	5.39	19.28	5.20	3.51	5.50	12.87
	CuRoTls	1870.1	1.21	5.71	12.1	.10	1.17	51.72	93.91	95.85	52.72	66.88
	Heads	1970.7	2.22	5.77	11.98	.18	1.66					
V	CuCC4	29.3	48.70	4.46	6.4	5.57	30.42	31.69	1.14	.80	45.91	24.94
	CuCT1	71.9	6.46	6.78	11.2	.20	3.68	10.32	4.26	3.46	4.05	7.40
	CuRoTls	1873.5	1.39	5.77	11.9	.09	1.29	57.84	94.55	95.68	47.44	67.62
	Heads	1974.7	2.28	5.79	11.8	.18	1.81					

TABLE 3

F-3 2BCD Cu Locked-Cycle Test - Metallurgy Calculated by Cycle.

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
VI	CuCC4	28.5	54.90	5.55	6.4	5.44	28.83	33.78	1.43	.74	39.50	21.69
	CuCT1	68.9	6.62	6.92	10.9	.20	3.40	9.85	4.32	3.04	3.51	6.18
	CuROT5	1865.1	1.40	5.58	12.8	.12	1.46	56.38	94.19	96.55	57.02	71.89
	Heads	1962.5	2.36	5.63	12.6	.20	1.93					
Average of Cycles IV, V, and VI	CuCC4	26.8	53.20	4.77	6.7	5.89	29.66	31.75	1.14	.75	44.53	22.42
	CuCT1	73.0	7.96	7.09	10.9	.22	4.16	12.94	4.61	3.31	4.53	8.57
	CuROT5	1869.6	1.33	5.69	12.3	.10	1.31	55.38	94.77	95.71	52.74	69.09
	Heads	1969.4	2.28	5.70	12.2	.18	1.80					

Cu Flotation Update (cont'd)

GROUP G TESTWORK - ZBCD Cu Pre-float Testing - Reagent testing. (Rougher tests)

G-1 This was a preliminary test in a new test program for collectors and promoters. This test used only 315-p a Resinex collector (potassiumamyl xanthate) 70 g/t of 315-P was used and from visual observations, it was decided if more or less should be used.
There was a lot of Pb in the conc.

G-2 This test followed G-1. Again only 315-P was used and only 40g/T since the G-1 had too much Pb in the conc.
There were visual changes but the assays show only slightly lower Pb recovery.

G-3 to G-9 These tests used various Resinex promoters on a 1:1 ration with 315-P ie. 40 g/T of any one promoter and 315-P.
Seven promoters were tested.
The promoter was added to a 2 min rougher conditioning stage while the 315-P was added to both the grind and conditioning. It was suggested that the promoter would work better if added in stages, so the 40g/T of promoter was split in the three stages, Ro, Sc_1, and Sc_2.

None of the tests were very successful. Perhaps the collector is too strong.

GROUP G TESTWORK (cont'd)

G10 - G16 These tests were done the same as G-3 to G-9 but only 30% of the 315-P was used. (or 12 g/T)

Test # 10 (N-30 promoter), #13 (3459 promoter and #16 (3730 promoter) stood out in this group because there was a slightly higher grade of Cu but still not that great.

G-17 to G-19 - These were repeats of # 10, 13, 16. In these tests the promoter was only added to the grind with the collector. So the collector and promoter used in these tests were 10 g/T and 20 g/T respectively.

There was no improvement ~~of~~ over the duplicate tests but Cu recovery dropped considerably.

TABLE I

6

2BCD Cu-Preflood : Collector/Promoter Testing

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
1. 315-P collector (Potassium Amyl Xanthate) 70 g/T	CuRo	54.00	46.10	8.22	8.80	1.66	22.79	74.74	7.65	3.84	77.10	57.48
	CuSc1	22.40	15.80	13.90	14.10	.61	9.05	10.63	5.37	2.56	11.75	9.47
	CuSc2	15.50	5.67	13.90	14.10	.25	4.05	2.64	3.71	1.77	3.33	2.93
	CuScTls	908.10	.44	5.32	12.50	.01	.71	12.00	83.27	91.83	7.81	30.12
	Heads	7000.00	3.33	5.80	12.36	.12	2.14					
2. 315-P 40 g/T	CuRo	39.10	51.50	7.29	6.70	2.21	25.75	65.68	4.94	2.18	77.38	51.68
	CuSc1	19.10	22.40	15.90	11.30	.65	11.31	13.96	5.27	1.80	11.12	11.09
	CuSc2	12.40	8.58	16.30	12.50	.29	4.81	3.47	3.51	1.29	3.22	3.06
	CuScTls	924.60	.56	5.38	12.30	.01	.72	16.89	86.28	94.73	8.28	34.17
	Heads	995.20	3.08	5.79	12.06	.11	1.96					
3. 315-P 40g/T (prom) N-30 40g/T	CuRo	48.00	45.00	8.76	7.90	1.72	22.32	72.20	7.63	3.15	77.22	54.56
	CuSc1	21.70	15.70	14.60	12.70	.56	8.53	11.39	5.75	2.29	11.37	9.43
	CuSc2	12.00	7.17	15.00	13.10	.25	4.46	2.88	3.27	1.31	2.81	2.73
	CuScTls	920.60	.44	4.99	12.20	.01	.71	13.54	83.36	93.26	8.61	33.29
	Heads	1002.30	2.98	5.50	12.02	.11	1.96					
4. 315-P 40g/T (prom) 1334 40g/T	CuRo	46.20	46.70	7.97	7.90	1.78	22.62	74.26	6.90	3.17	79.82	55.51
	CuSc1	14.20	18.10	13.60	12.70	.60	9.21	8.85	3.62	1.57	8.27	6.95
	CuSc2	10.90	8.25	13.90	13.10	.27	4.98	3.10	2.84	1.24	2.86	2.88
	CuScTls	932.30	.43	4.96	11.60	.01	.70	13.80	86.64	94.02	9.05	34.66
	Heads	1003.60	2.89	5.32	11.46	.10	1.88					

TABLE III

G

2BCD Cu Re-float : Collector / Promoter Testing

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
5. 315-P 40g/T (prom) 1335 40g/T	CuRo	51.50	45.70	8.07	8.60	1.70	21.90	76.18	7.25	3.59	75.01	58.20
	$CuSc_1$	15.10	17.20	13.70	13.30	.54	8.93	8.41	3.61	1.63	6.99	6.96
	$CuSc_2$	8.90	8.78	13.20	14.00	.28	5.12	2.53	2.05	1.01	2.14	2.35
	CuScTls	926.10	.43	5.39	12.50	.02	.68	12.89	87.09	93.78	15.87	32.49
	Heads	1001.60	3.08	5.72	12.32	.12	1.93					
6. 315-P 40g/T (prom) 3459 40g/T	CuRo	44.60	50.80	7.74	7.20	1.92	25.22	73.17	5.98	2.64	72.46	55.72
	$CuSc_1$	15.80	20.20	14.90	12.40	.67	10.21	10.42	4.13	1.63	9.06	8.08
	$CuSc_2$	12.60	7.67	14.70	12.90	.25	4.65	3.16	3.25	1.35	2.70	2.94
	CuScTls	922.20	.44	5.36	12.30	.02	.72	13.25	86.64	94.38	15.78	33.26
	Heads	994.70	3.08	5.74	12.08	.12	2.01					
7. 315 -P 40g/T (prom) 3700 40g/T	CuRo	49.30	46.80	8.31	8.60	1.69	23.16	75.71	7.06	3.44	78.35	57.98
	$CuSc_1$	17.40	17.20	14.20	13.40	.61	9.08	9.82	4.26	1.89	9.98	8.02
	$CuSc_2$	11.90	6.91	14.80	14.50	.27	4.49	2.70	3.03	1.40	3.02	2.71
	CuScTls	919.30	.39	5.41	12.50	.01	.67	11.77	85.66	93.27	8.65	31.28
	Heads	991.90	3.05	5.82	12.35	.11	1.97					
8 315-P 40g/T (prom) 3710 40g/T	CuRo	52.40	45.20	8.34	8.60	1.73	21.75	76.50	7.58	3.68	81.02	56.80
	$CuSc_1$	16.80	16.20	13.80	13.00	.53	8.59	8.79	4.05	1.78	7.96	7.19
	$CuSc_2$	12.80	7.04	14.20	14.30	.25	4.39	2.91	3.15	1.49	2.86	2.80
	CuScTls	912.80	.40	5.38	12.50	.01	.73	11.79	85.21	93.05	8.16	33.21
	Heads	994.8	3.11	5.79	12.33	.11	2.02					

TABLE IV

G

2BCD Cu Preflot: Collector/Promoter Testing

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
9. 315-P 40g/t (prom) 3730 40g/t	CuRoConc	47.60	49.40	7.66	7.50	1.97	24.61	71.36	6.31	2.91	74.86	55.09
	CuSc1	18.00	17.30	14.60	11.40	.56	9.60	9.45	4.55	1.67	8.05	8.13
	CuSc2	11.30	7.72	14.10	12.50	.26	4.65	2.65	2.76	1.15	2.35	2.47
	CuSCTls	923.80	.59	5.40	12.50	.02	.79	16.54	86.38	94.26	14.75	34.32
	Heads	1000.70	3.29	5.77	12.24	.13	2.13					
10. 315-P 12g/t (prom) N-30 40g/t	CuRoConc	25.60	41.20	7.82	8.50	3.54	20.24	35.79	3.61	1.81	80.80	27.77
	CuSc1	19.20	35.40	10.64	8.50	.49	15.10	23.07	3.69	1.36	8.39	15.54
	CuSc2	10.00	18.40	12.60	10.60	.26	8.69	6.24	2.28	.88	2.32	4.66
	CuSCTls	952.00	1.08	5.26	12.10	.01	1.02	34.89	90.42	95.95	8.49	52.04
	Heads	1006.80	2.93	5.50	11.92	.11	1.85					
11. 315-P 12g/t (prom) 1334 40g/t	CuRoConc.	46.90	49.90	7.94	7.40	1.87	23.64	75.43	6.58	2.80	79.92	57.35
	CuSc1	20.30	15.40	13.90	13.40	.49	7.95	10.08	4.98	2.19	9.06	8.35
	CuSc2	12.30	6.08	14.00	13.40	.24	4.12	2.41	3.04	1.33	2.69	2.62
	CuSCTls	914.30	.41	5.29	12.70	.01	.67	12.08	85.40	93.68	8.33	31.68
	Heads	993.80	3.12	5.70	12.47	.11	1.95					
12. 315-P 12g/t (prom) 1335 40g/t	CuRoConc.	45.40	48.30	8.17	7.40	1.83	23.88	73.01	6.83	2.83	78.91	53.87
	CuSc1	19.90	17.00	14.40	12.30	.57	8.42	11.26	5.28	2.06	9.64	8.69
	CuSc2	12.40	6.93	14.40	12.80	.23	4.05	2.86	3.29	1.34	2.71	2.60
	CuSCTls	920.00	.42	4.99	12.10	.01	.73	12.87	84.59	93.77	8.74	34.83
	Heads	997.70	3.01	5.44	11.90	.11	1.93					

G

TABLE IV

2BCD Cu Preflot + Collector/Promoter Testing

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
13. 315-P 12 g/t (prom) 3459 40 g/t	CuRoConc.	41.30	50.90	8.29	7.30	2.21	24.98	66.47	5.49	2.51	81.26	50.52
	CuSc1	17.60	26.00	13.40	10.60	.50	12.78	14.47	3.78	1.55	7.83	11.01
	CuSc2	12.00	11.71	14.40	11.70	.25	6.12	4.44	2.77	1.17	2.67	3.60
	CuSCTls.	924.90	.50	5.93	12.30	.01	.77	14.62	87.96	94.76	8.23	34.87
	Heads	995.80	3.18	6.26	12.06	.11	2.05					
14. 315-P 12 g/t (prom) 3700 40 g/t	CuRoConc.	55.80	44.50	9.47	8.10	1.66	22.34	78.26	8.33	3.70	80.75	58.77
	CuSc1	19.00	14.60	13.70	12.60	.55	7.88	8.74	4.11	1.96	9.11	7.06
	CuSc2	12.00	5.53	13.50	13.10	.21	3.48	2.09	2.55	1.29	2.20	1.97
	CuSCTls	910.50	.38	5.92	12.50	.01	.75	10.90	85.01	93.06	7.94	32.20
	Heads	997.30	3.18	6.36	12.26	.12	2.13					
15. 315-P 12 g/t (prom) 3710 40 g/t	CuRoConc.	55.00	44.40	10.16	8.20	1.72	21.75	76.90	9.31	3.70	81.56	56.27
	CuSc1	19.60	14.60	13.50	11.80	.50	7.95	9.01	4.41	1.90	8.45	7.33
	CuSc2	11.90	6.28	13.30	12.20	.21	3.90	2.35	2.64	1.19	2.15	2.18
	CuSCTls	909.10	.41	5.52	12.50	.01	.80	11.74	83.64	93.21	7.84	34.21
	Heads	995.60	3.19	6.03	12.25	.12	2.14					
16. 315-P 12 g/t (prom) 3730 40 g/t	CuRoConc.	26.30	44.80	7.41	7.60	3.83	21.72	37.05	3.18	1.63	76.20	2.65
	CuSc1	21.00	36.20	12.10	8.20	.46	14.92	23.91	4.14	1.40	7.31	2.11
	CuSc2	10.60	19.10	13.60	9.50	.29	8.72	6.37	2.35	.82	2.33	1.07
	CuSCTls	936.20	1.11	5.92	12.60	.02	1.18	32.68	90.33	96.15	14.16	94.18
	Heads	994.10	3.20	6.17	12.34	.13	2.09					

Table IV

G

2BCD Cu Preflout : Collector / Promoter Testing

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
17. 315-P 10g/T (prom) N-30 20g/T (to grind only)	CuRoConc	26.70	37.50	8.85	9.00	3.43	19.78	31.41	3.98	1.87	53.35	23.04
	CuSc$_1$	15.50	32.60	11.66	8.20	.62	14.46	15.85	3.05	.99	5.60	9.78
	CuSc$_2$	11.60	19.40	12.51	9.80	.38	9.14	6.69	2.32	.84	2.44	4.39
	CuSCTls	947.00	1.55	5.68	13.10	.07	1.52	46.05	90.65	96.31	38.62	62.80
	Heads	1000.20	3.19	5.93	12.88	.17	2.29					
18. 315-P 10g/T (prom) 3459 20g/T (to grind only)	CuRoConc	44.80	44.00	8.84	7.00	2.19	23.10	65.15	6.67	2.49	55.44	51.56
	CuSc$_1$	19.00	18.90	14.40	10.30	.51	9.08	11.87	4.61	1.56	5.48	8.60
	CuSc$_2$	14.60	8.14	14.30	11.70	.28	4.42	3.93	3.52	1.36	2.31	3.22
	CuSCTls	929.80	.62	5.44	12.80	.07	.79	19.05	85.20	94.59	36.78	36.61
	Heads	1005.20	3.00	5.89	12.48	.18	1.99					
19. 315-P 10g/T (prom) 3730 20g/T (to grind only)	CuRoConc	29.20	41.30	8.91	8.40	3.14	20.86	38.51	4.43	1.96	53.57	27.40
	CuSc$_1$	16.60	29.00	11.84	8.70	.56	13.65	15.37	3.35	1.15	5.43	10.19
	CuSc$_2$	11.60	16.70	12.20	10.00	.33	7.68	6.19	2.41	.93	2.24	4.01
	CuSCTls	947.60	1.32	5.56	12.70	.07	1.37	39.94	89.80	95.97	38.76	58.40
	Heads	1005.00	3.12	5.84	12.48	.17	2.21					

Sizing Analysis of 2A mag June 21-85

- 2A Heads (1KG)
25 min prim. grind
76% solids
P80 76µm

MESH	wt. Ret.	%wt Ret	%Cum Passing
65	0.15	0.08	99.92
65/100	2.19	1.09	98.83
100/150	13.42	6.71	92.12
150/200	25.70	12.85	79.27
200/325	30.77	15.39	63.88
-325	127.78	63.89	-

- 2A Pulp tails
47808 (1KG fd)
30 min prim. grind
66% solids
P80 <47µm

MESH	wt. Ret	%wt. Ret	%Cum Passing
65	0.08	0.04	99.96
65/100	0.10	0.05	99.91
100/150	0.10	0.05	99.86
150/200	0.37	0.18	99.68
200/325	19.00	9.50	90.18
-325	180.25	90.19	-

- 2A Pulp tails
47807 (1KG fd)
(3hr prim grind)
50% solids
P80 ≈ 44µm

MESH	wt. Ret	%wt. Ret	%Cum Passing
[illegible]	0.11	0.06	[illegible]
65/100	0.24	0.12	[illegible]
100/150	0.73	0.37	[illegible]
150/200	6.55	3.28	[illegible]
200/325	26.79	13.50	[illegible]
-325	165.58	[illegible]	-

Work done

June 16-83
no assay have yet been received

Friday June 10/83

47814 ABC Cu test optimum Reagent scheme B-13
2 Kg/T Sulphite, 70 g/T Z-11 (Total)

47819 ABC (B-11) Cu test - pre flot (same as b-7 but with 20 min prim grind
Sulphite 1 kg/T
Z-11 (100/50/30)

47818 AB Cu test To duplicate 2nd Large scale Test (47 &2

47816 Cu test (Vihanti Process) D-6

Cu test To upgrade the Cu from the PbCt1
200 g/T NaCN
Ro/SCAV from PbCt1 AS feed
- not to impressive - sample may have been sitting to long.

Tuesday June 14-83

47813 ABC Cu testing (no sulphide, B-7 scheme to the Ro, one CLNR stage with 200 g/T CN- to regrind)

47809 A-B Cu testing Low pH with H_2SO_3 (low Xanth 20 g/T)
went to pit to get 2A ore

Wednesday June 15·83

2A TESTWORK

47807 - GENERATION of Pb ROUGHER conc for "Treatment scheme of graphitic quartzites"

47808 - Open cycle CLNR test (4 cleaners stages) Dext. added to 2nd and 3rd cleaners.

Pb 1ST CLNR → 40g/T Z-11
Pb 2nd CLNR → 40g/T Dext
→ 40g/T Z-11
Pb 3rd CLNR → 20g/T Dext
→ 30g/T Z-11
Pb 4th CLNR → 10g/T Z-11

26600 - Open cycle CLNR Test (4 cleaner stages) Dext. added to 2nd and 3rd cleaners (same as test 47808 [above] but with reduced Dext.)

Pb 1ST CLNR → 40g/T Z-11
Pb 2nd CLNR → 20g/T Dext
40g/T Z-11
Pb 3rd CLNR → 10g/T Dext
→ 30g/T Z-11
Pb 4th CLNR → 10g/T Z-11

test N° & conditions	1ST CLNR Dext	Z-11	2nd CLNR Dext	Z-11	3rd CLNR Dext	Z-11	4th CLNR Dext	Z-1
26595 BLANK	–	90g/T	–	50g/T	–	20g/T	–	10g
26596 Low Dext - Low Z-11	–	90g/T	5g/T	10g/T	–	5g/T	–	5g/
26597 Low Dext - High Z-11	–	90g/T	5g/T	50g/T	–	20g/T	–	10g/
26598 High Dext - High Z-11	–	90g/T	60g/T	50g/T	40g/T	20g/T	–	10g/
26599 High Z-11 Low Dext Xan Thate added before Dext.	–	90g/T	40g/T	50g/T	20g/T	20g/T	–	10g/

To: R. Murarka
From: Rhonda Martel
DATE: July 13, 1983

Subject: Copper Flotation - Update (ZEF only)
(Attach to Copper Flotation Update, Rhonda Martel to R. Murarka, June 2, June 21 and July 13, 1983.)

GROUP A TESTWORK

A-3 to A-12 - These tests were done to test various Z-11 additions. The schemes used were those used in a number of ZBCD copper pre-float tests. Several of the ZBCD tests also used $K_2Cr_2O_7$, but we didn't use it in the ZEF tests.

ZEF test #	g/t Z-11			Duplicates ZBCD test #	
	grind	Ro	Cln.		
A-3	30	30	X	B-1	
A-4	30	30	20	B-3	
A-5	50	30	20	B-4	
A-6	70	30	20	B-6	
A-7	100	50	30	B-7	
A-8	50	15	5	B-9	
A-9	100	50	30	B-10	— 2 kg/t Na_2SO_3
A-10	150	75	X	B-12	
A-11	50	15	5	B-13	— 2 kg/t Na_2SO_3
A-12	—	20	X	B-14	— NO Na_2SO_3, low pH

X - no 1st cleaner, done to Rougher stage only
— - not added to this stage.

A-7 and A-9 can be compared directly to one another. They are identical except that A-9 had twice as much Na_2SO_3 in the grind. A-9 is the better of the two, Pb grade and recovery has made a significant drop while Cu grade has gone up.

GROUP A TESTWORK (cont'd)

As well, A-8 and A-11 can be directly compared A-11 used twice as much Na_2SO_3 as A-8. There was no significant difference between the two tests, probably because of the low level of Z-11 used.

The best overall test appears to be A-8 where the least reagents were used and the metallurgy was still good. Copper grade and recovery are ~~ter~~ very good and Pb grade and recovery is down considerably.

July 13.83

• 2EF Cu Prefloat test • Group A

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
1 Kg/T Na_2SO_3 **A-3**	Cu Ro conc	36.1	33.00	7.68	18.0	4.36	8.87	31.29	5.22	2.11	73.10	25.10
30 g/T Z-11 to grind	Tails	965.2	2.71	5.22	31.3	0.06	0.99	68.71	94.78	97.89	26.90	74.90
30 g/T Z-11 to Rougher												
(Repeat of 2BCD-B-1)	Heads	1001.3	3.80	5.31	30.8	0.22	1.27	100.00	100.00	100.00	100.00	100.00
1 Kg/T Na_2SO_3 **A-4**	Cu CC1	20.2	46.50	5.23	12.5	6.69	12.31	23.55	1.96	0.82	65.87	21.18
30 g/T Z-11 to grind	Cu Ct1	15.5	14.00	10.52	24.8	0.75	3.82	5.44	3.03	1.26	5.67	5.04
30 g/T Z-11 to Ro.	Rougher Conc	35.7	32.39	7.53	17.8	4.11	8.62	28.99	4.99	2.08	71.54	26.22
20 g/T Z-11 to 1ST CLNR	Tails	973.5	2.91	5.25	30.8	0.06	0.89	71.01	95.01	97.92	28.47	73.78
(Repeat of 2BCD-B-3)	Heads	1009.2	3.95	5.33	30.3	0.20	1.16	100.00	100.00	100.00	100.00	100.00
1 Kg/T Na_2SO_3 **A-5**	Cu CC1	15.7	38.10	6.18	14.3	8.75	10.17	15.56	1.79	0.73	69.37	15.18
50 g/T Z-11 to grind	Cu Ct1	13.0	10.22	11.54	26.0	0.90	3.08	3.46	2.76	1.10	5.91	3.81
30 g/T Z-11 to Ro.	Rougher Conc	28.7	25.47	8.61	19.6	5.20	6.96	19.02	4.55	1.83	75.28	18.99
20 g/T Z-11 to 1ST CLNR	Tails	979.2	3.18	5.29	30.8	0.05	0.87	80.99	95.45	98.17	24.72	81.01
(Repeat of 2BCD-B-4)	Heads	1007.9	3.81	5.38	30.5	0.20	1.04	100.00	100.00	100.00	100.00	100.00
1 Kg/T Na_2SO_3 **A-6**	Cu CC1	13.0	36.00	5.90	14.9	10.11	9.59	11.65	1.35	0.63	63.97	9.33
70 g/T Z-11 to grind	Cu Ct1	13.8	9.89	10.96	25.2	1.10	3.24	3.40	2.67	1.13	7.39	3.35
30 g/T Z-11 to Ro.	Rougher Conc	26.8	22.5	8.51	20.2	5.47	6.32	15.05	4.02	1.76	71.36	12.68
20 g/T Z-11 to 1ST CLNR	Tails	980.8	3.48	5.54	30.7	0.06	1.19	84.95	95.97	98.23	28.64	87.33
(Repeat of 2BCD-B-6)	Heads	1007.6	3.99	5.62	30.4	0.20	1.33	100.00	100.00	100.00	100.00	100.00

.2EF Cu Prefloat test • Group A July 13·83

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
1 kg/T Na_2SO_3 **A-7**	$CuCC_1$	44.3	51.90	3.53	9.6	3.29	14.69	67.71	3.03	1.40	68.50	53.55
100 g/T Z-11 to grind	$CuCt_1$	18.4	8.10	10.82	27.0	0.57	2.51	3.93	3.86	1.63	4.93	3.80
50 g/T Z-11 to Ro.	Roughercons	62.7	43.28	5.67	14.7	2.49	11.12	71.64	6.89	3.03	73.43	57.35
30 g/T Z-11 to 1ST CLNR	Tails	942.2	1.14	5.10	31.3	0.06	0.55	28.35	93.11	96.97	26.57	42.65
(Repeat of 2BCD - B-7)	HEADS	1004.9	3.77	5.14	30.3	0.21	1.21	100.00	100.00	100.00	100.00	100.00
1 kg/T Na_2SO_3 **A-8**	$CuCC_1$	7.7	16.40	7.86	19.3	14.70	5.31	3.20	1.08	0.48	61.75	3.63
50 g/T Z-11 to grind	$CuCt_1$	18.0	13.60	9.86	25.0	1.15	3.78	6.20	3.18	1.45	11.29	6.04
15 g/T Z-11 to Ro.	Roughercons	25.7	14.44	9.26	23.3	5.21	4.24	9.40	4.26	1.93	73.04	9.67
5 g/T Z-11 to 1ST CLNR	Tails	988.1	3.62	5.41	30.9	0.05	1.03	90.60	95.74	98.08	26.95	90.33
(Repeat of 2BCD - B-9)	HEADS	1013.8	3.89	5.51	30.7	0.18	1.11	100.00	100.00	100.00	100.00	100.00
2 kg/T Na_2SO_3 **A-9**												
100 g/T Z-11 to grind	$CuCC_1$	10.4	19.20	7.89	19.6	11.40	5.75	5.45	1.59	0.66	59.62	5.53
50 g/T Z-11 to Ro.	$CuCt_1$	17.9	5.21	10.20	27.5	1.20	1.80	2.54	3.53	1.59	10.80	2.98
30 g/T Z-11 to 1ST CLNR	Roughercons	28.3	10.35	9.35	24.6	4.95	3.25	7.99	5.12	2.25	70.42	8.51
	Tails	980.5	3.44	5.01	30.8	0.06	1.01	92.01	94.89	97.75	29.58	91.50
(Repeat of 2BCD - B-10)	HEADS	1008.8	3.63	5.13	30.6	0.20	1.07	100.00	100.00	10000	100.00	100.00

•2EF Cu Prefloat test • Group A

July 13·83

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
1Kg/T Na_2SO_3 **A-10**	Cu Ro. conc	78.4	41.30	5.41	16.4	2.03	10.66	81.91	7.90	4.18	77.41	62.06
150g/T Z-11 to grind	Tails	928.9	0.77	5.32	31.7	0.05	0.55	18.09	92.10	95.82	22.59	37.94
75g/T Z-11 to Ro.												
(Repeat of 2BCD-B-12)	HEADS	1007.3	3.92	5.33	30.5	0.20	1.34	100.00	100.00	100.00	100.00	100.00
2Kg/T Na_2SO_3 **A-11**	CuCC1	8.4	11.60	9.83	20.1	14.30	4.01	2.57	1.58	0.55	63.68	3.30
50g/T Z-11 to grind	CuCT1	19.8	14.90	10.46	24.6	0.99	3.97	7.77	3.96	1.58	10.39	7.69
15g/T Z-11 to Ro.	Roughercons	28.2	13.92	10.27	23.2	4.95	3.98	10.34	5.54	2.13	74.07	10.99
5g/T Z-11 to 1ST CLNR	Tails	978.2	3.58	5.05	30.9	0.05	0.93	89.66	94.46	97.88	25.93	89.01
(Repeat of 2BCD-B-13)	HEADS	1006.4	3.77	5.20	30.7	0.19	1.02	100.00	100.00	100.00	100.00	100.00
No Sulphite **A-12**	Cu Ro conc	25.6	10.76	7.80	25.6	4.69	3.43	7.26	3.93	2.11	63.59	6.67
20g/T Z-11 to Ro	Tails	982.2	3.58	4.97	30.9	0.07	1.25	92.74	96.07	97.89	36.41	93.33
	Heads	1007.8	3.76	5.04	30.77	0.19	1.31	100.00	100.00	100.00	100.00	100.00
(Repeat of 2BCD-B-14)												

B

ZEF Cu Pre-float, Large Scale

July 13-83

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
1. 2hr grind 8kg charge 100g/T Z-11 to grind 50 g/T Z-11 to Ro ScTIs P80 Z 52 u	CuRoConc	113.8	5.50	5.86	27.8	4.39	2.71	2.0	1.5	1.3	23.0	2.7
	CuRoTIs	7948.0	3.92	5.45	29.2	0.21	1.40	98.0	98.5	98.7	77.0	97.3
	Heads	8061.8	3.94	5.46	29.18	0.27	1.42	100.0	100.0	100.0	100.0	100.0

2EF - GROUP B TESTWORK - Rougher Conc Generation on a large scale.

B-1 This test was done to generate Cu Ro Conc to repeat some 2BCD group D tests on 2EF ore. (Cu/Pb separation from a Cu/Pb Rougher conc.)

8kg 2EF, ground for 2hrs
≈ p80 = 52 μ
100 g/T Z-11 to grind
50 g/T Z-11 to rougher

The concentrate that was generated was too little to do any of the group D tests.

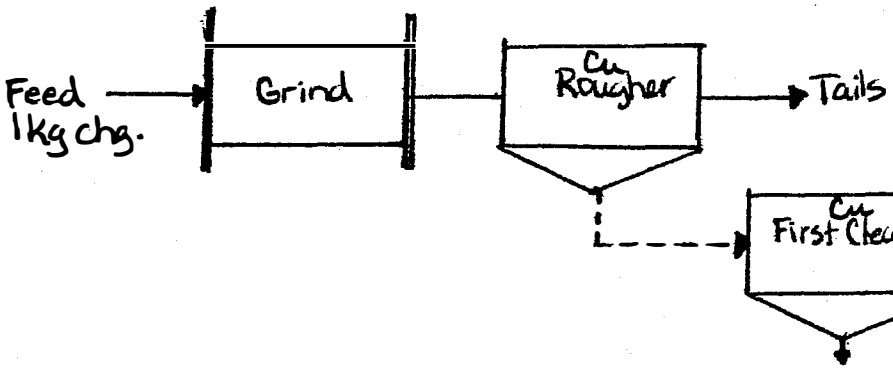
The metallurgy looked pretty good for this test though. Pb grade and recovery was low but Cu grade looked good and recovery, although low, would probably improve with a longer flotation time.

To: R. Murarka
From: Rhonda Martel
Date: June 2, 1983

Subject: Copper Flotation. - Update.

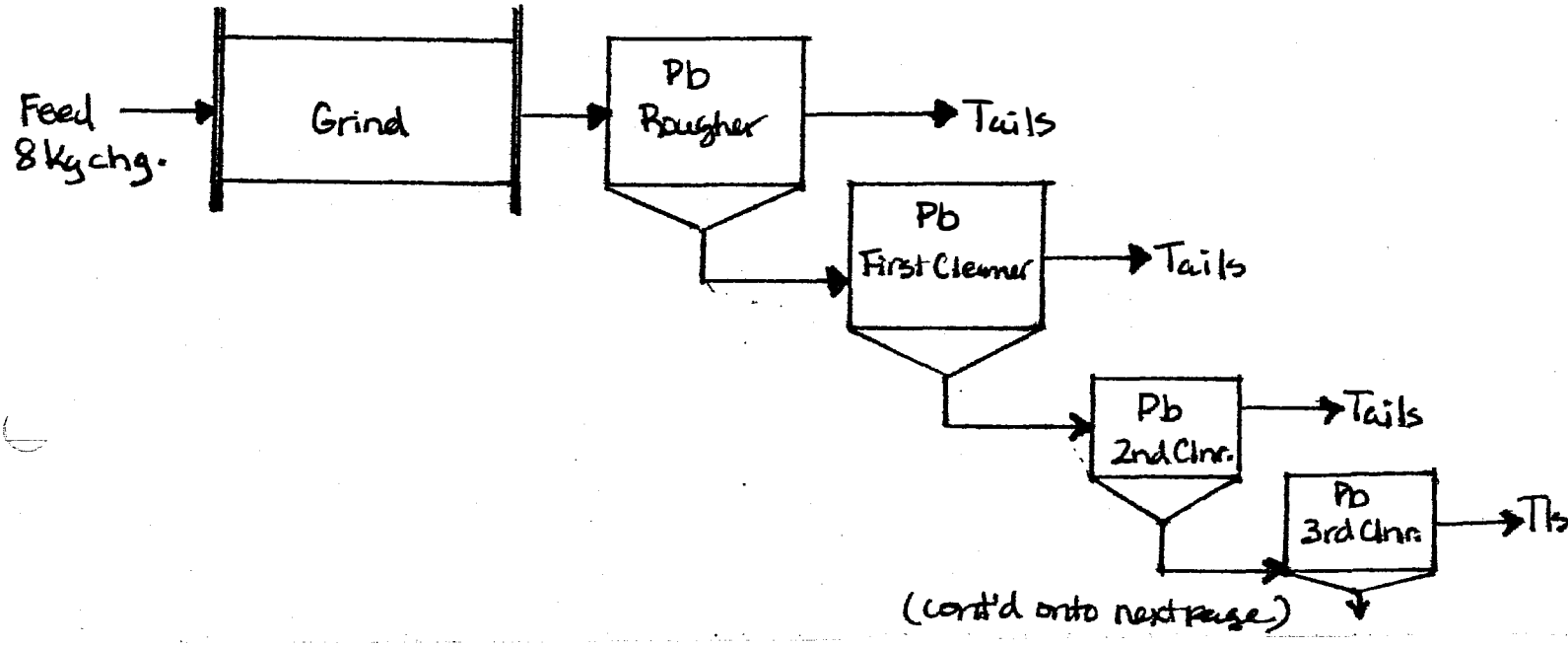
Copper Flotation was investigated for 2BCD and 2EF ores. Testwork with 2EF was doing a copper pre-float ie. floting copper before Pb and Zn. Testwork with 2BCD was done in two manners; by pre-flotation and also by Cu/Pb separation after the $PbCC_3$ was produced. In some 2BCD tests, copper flotation was carried out to a first or second cleaner. See flowsheets below:

Cu Pre-float



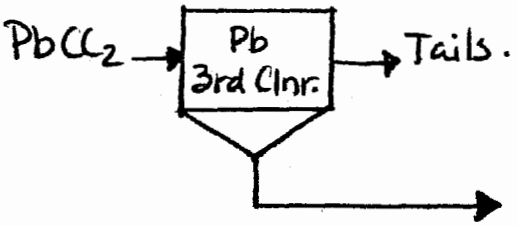
N.B. 2EF was done to the Rougher Stage only.
2BCD was done to either the rougher stage or the first cleaner.

Cu/Pb Separation - Part I



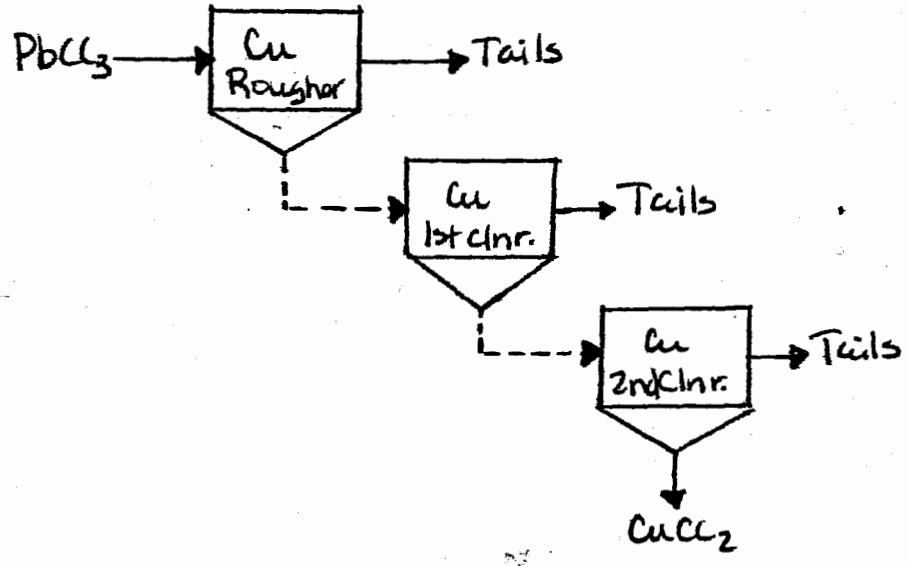
(cont'd onto next page)

Cu/Pb Separation - Part I (cont'd)



$PbCC_3$ slurry was split into seven 300 ml samples (weights were found to range from 40 to 70 gram

Cu/Pb Separation - Part II



N.B. 2BCD only was treated with this method. These tests may have been stopped at the rougher stage or the first cleaner or the second cleaner.

A. 2EF Pre-floats - see Tables I + II

Test no. 1 - First test done, so little was expected. Used on 10 g/T NaCN so as to depress some of the pyrite while not the chalcopyrite.
Z-11 added to the grind was lowered so that Pb would not be collected. (30 g/T Z-11 to grind)
During the roughing Z-11 was added slowly to 50 g/T. The Pb was activated and it was decided that the Z-11 was in excess.
- Rougher only.

A-2EF Pre-floats (cont'd)

Test no. 2 - This test was done after a 2BCD pre-float test where Na_2SO_3 was used. It was believed that the Na_2SO_3 was beneficial.
As well, lower Z-11 was used in the roughers (30 g/T)
Although there was little improvement in Copper flotation, the Pb recovery dropped considerably.

B. 2BCD Pre-floats (see table I + II)

Test no. 1 - Done with Na_2SO_3, 10 g/T NaCN and 30 g/T Z-11 to the grind and 30 g/T Z-11 to the roughers. Results were better than either of the 2EF tests.

Test no. 2 - Done as test no. 1 but without NaCN. The only improvement was a slight decrease in Pb grade and recovery.

Test no. 3 - Done as test no. 2 but with a first cleaner stage. Potassium dichromate (1000 g/T) was added to the first cleaner with 20 g/T Z-11. The copper conc. upgraded by 4.4% and Pb recovery dropped considerably.

Test no. 4-8 - These tests were all done with Na_2SO_3 in the grind and no NaCN. A first cleaner was done. The purpose of this group of tests was to find a ratio of Z-11 to $K_2Cr_2O_7$ that was best for Cu flotation.
Z-11 ranged from 100 - 180 g/T
$K_2Cr_2O_7$ ranged from 2000 - 3000 g/T (added to Cu cleaner 1 only.)
- No conclusive results.

B 2BCD Prefloats (cont'd)

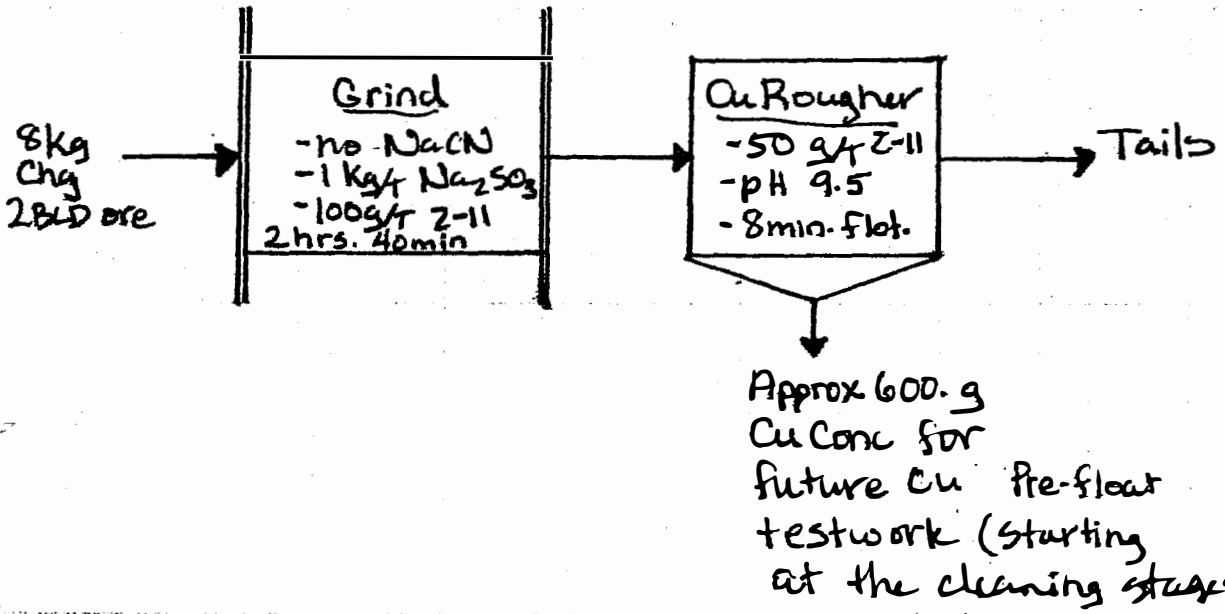
*Test no. 9 - This test was done because of the concern of the effect of $K_2Cr_2O_7$ on the Pb circuit. Using $K_2Cr_2O_7$ in the Cu cleaners depressed the Pb, but, because of the tails being recycled to the Pb circuit, residual $K_2Cr_2O_7$ may affect Pb flotation badly. So, no $K_2Cr_2O_7$ was used in this test.

Because no $K_2Cr_2O_7$ was used, lower Z-11 additions were used, too. This was so that the Pb would not be floated. (70 g/t Z-11 in whole Cu circuit)

*Test no. 10 - This test was done to test the use of increased Na_2SO_3 to the grind. Test no. 7 was followed but with 2 kg/t Na_2SO_3 rather than 1 kg/t.

* no assays for these tests yet.

June 1, 1983, a large Cu pre-float was done to generate a large Cu Ro conc. for further testwork. It was done using test no. 11 reagent additions to the grind and Rougher. See diagram below:



C. Cu/Pb Separation (from $PbCC_3$) - see TABLES III - IV

Test no. 1 - First test, so little was expected. Rougher only. No Z-11 was used because it was feared that Pb would float.
Potassium dichromate was used - 1200 g/t
Two drops of MIBC was added, seemed to affect Cu flotation adversely.
Cu was upgraded, but, Pb remained a high grade in the Cu cone.

Test no. 2 - Same as test no. 1 but 1800 g/t $K_2Cr_2O_7$ instead, and no MIBC this time.

Test no. 3 - Cleaner test. (one cleaner only)
Rougher was the same as test no. 2 - with one drop MIBC.
500 g/t $K_2Cr_2O_7$ to the first cleaner and 1 drop MIBC.
The Cu upgraded, Pb downgraded some, but Recoveries for both Pb and Cu dropped considerably.

Test no. 4-8 - These tests were done to try and find the correct ratio of $K_2Cr_2O_7$ to Z-11 for Cu/Pb Separation. As well, MIBC additions were varied. (Rougher tests)
Reagent Ranges were:

$K_2Cr_2O_7$	Z-11	MIBC
1200-1800 g/t	0-100 g/t.	2-4 drops.

- No trends apparent.

C. Cu/Pb Separation (cont'd) - see tables III - IV
(from $PbCC_3$)

Tests no. 9-11 - Cleaner tests done with 2 cleaner stages.
- Varied reagent additions used to find best ratio of $K_2Cr_2O_7$ and Z-11, and to find best balance of roughers to cleaners.

Reagent Ranges were:

$K_2Cr_2O_7$	Z-11	MIBC
1980-4950 g/t	82.5 g/t	4-7 drops.

- The more $K_2Cr_2O_7$, the more Cu upgrades, and Pb downgrades.
- The more cleaning stages have assisted in upgrading.
- Recovery has lowered tremendously though.
- no trends.

D. Cu/Pb Separation From Cu/Pb Rougher Conc.

Test no. 1-5 - These tests were done to make a $PbCC_3$ because the Pb recovery to the Cu/Pb Rougher Conc. is so high. They are done using varying amounts of NaCN to the regrind. (0, 50, 100, 200, and 500 g/T NaCN in the respective tests.)
It is hoped that Pb upgrades and the Cu will remain in the tails. Decisions of what to do with the Cu will be made later when assays have been received.

Rhonda Merrill
Met. Tech.

Issued: June 2, 1983

Test Type	Test no.	DATE Performed	ASSAY RECEIVED	
A 2EF Pre-floats	A-1	MAY 20 '83	Yes	TABLE I
	A-2	"	Yes	
B. 2BCD PreFlocts				
Rougher	B-1	MAY 20 '83	Yes	TABLE I
Rougher	B-2	"	Yes	
Cleaner	B-3	"	Yes	
C. 2BCD Cu/Pb Sep. from $PbCl_2$ - Rougher	C-1	MAY 20 '83	Yes	TABLE III
Rougher	C-2	"	"	
Cleaner	C-3	"	"	
B. 2BCD Cu Preflocc Cln	B-4	MAY 25 '83	Yes	Table I
"	B-5	"	"	
"	B-6	"	"	
"	B-7	"	"	
"	B-8	"	"	
C. 2BD Cu/Pb Sep. from $PbCl_2$ - 1 cleaner	C-4	MAY 26 '83	Yes	TABLE II+IV
"	C-5	"	"	
"	C-6	"	"	
"	C-7	"	"	
"	C-8	"	"	
2 Cleaners	C-9	"	"	
"	C-10	"	"	
"	C-11	"	"	
B. 2BCD Pre-float 1 cleaner	B-9	June 1 '83	no	
	B-10	"	"	
D 2BCD Cu/Pb Separation from Cu/Pb Rougher cone. Pb cleaning.	D-1	June 2 '83	no	
	D-2		"	
	D-3		"	
	D-4		"	
	D-5		"	

Cu Pre-float Tests

TABLE I

Test No. & Description	Sample	Wts.	Assays					Distribution				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
1. 2EF - no Na_2SO_3												
A. - 10g/t NaCN	Cu/Pb conc	87.4	28.7	5.97	22.6	.66	8.83	74.6	12.5	5.8	57.5	47.5
- 30g/t Z-11 to grind	Cu/Pb Tls	916.5	.93	4.00	35.1	.10	.93	25.4	87.5	94.2	42.5	52.5
- 50g/t Z-11 to flot.	Heads	1003.9	3.35	4.17	34.0	.15	1.62	100.0	100.0	100.0	100.0	100.0
2. 2EF - with Na_2SO_3												
A. - 10g/t NaCN	Cu/Pb conc	56.1	9.31	7.55	29.1	.99	3.12	15.4	9.4	4.8	37.1	12.2
- 30g/t Z-11 to grind	Cu/Pb Tls	942.0	3.06	4.33	34.2	.10	1.34	84.6	90.6	95.2	62.9	87.8
- 30g/t Z-11 to Flot.	Heads	998.1	3.41	4.51	33.9	.15	1.44	100.0	100.0	100.0	100.0	100.0
B1. 2BCD - with Na_2SO_3												
- 10g/t NaCN	Cu/Pb conc	134.2	19.4	9.03	11.9	1.04	7.05	83.3	18.4	12.5	61.4	68.0
- 30g/t Z-11 to grind	Cu/Pb Tls	854.3	.61	6.30	13.1	.10	.65	16.7	81.6	87.5	38.6	37.0
- 30g/t Z-11 to Flot	Heads	988.5	3.16	6.67	12.9	.23	1.52	100.0	100.0	100.0	100.0	100.0
B2. 2BCD - with Na_2SO_3												
- no NaCN	Cu/Pb conc	129.0	17.0	8.93	12.6	1.07	6.37	72.1	18.8	12.8	62.9	56.8
- 30 g/t Z-11 to grind	Cu/Pb Tls	868.3	.98	6.16	12.7	.09	.72	27.9	81.2	81.2	37.1	43.2
- 30 g/t Z-11 to Flot	Heads	997.3	3.05	6.52	12.7	.22	1.45	100.0	100.0	100.0	100.0	100.0
B3. 2BCD - with Na_2SO_3	Rougher Con	87.9	12.6	10.13	11.5	1.61	5.02	35.7	13.5	7.8	61.5	29.8
- no NaCN	Cu Conc	21.0	12.8	13.40	14.0	6.06	6.60	9.7	4.3	2.3	55.3	9.4
- 30 g/t Z-11 to grind	Cu Tls,	66.9	12.5	9.10	10.7	.21	4.53	27.0	9.3	5.5	6.1	20.5
- 30 g/t Z-11 to Flot	Cu Ro Tls.	912.8	2.19	6.24	13.0	.10	1.14	64.3	86.4	92.2	39.6	70.1
Clnr. - 1000 g/t $K_2Cr_2O_7$	Heads	1000.7	3.10	6.58	12.9	.23	1.48	100.0	100.0	100.0	100.0	100.0
- 20 g/t Z-11												

Cu Preflot TABLE II

B. ZBCD ORETYPE and Test Description

	9/T	Z-11		$K_2Cr_2O_7$	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
	Grind	Ro	Cln	to Clnr 1			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
4.	50	30	20	2000	Cu Conc	15.7	16.20	10.71	15.10	6.75	7.76	8.85	2.83	1.74	59.23	9.96
					Cu Tls 1	68.7	25.80	7.20	11.00	.26	9.05	61.70	8.34	5.56	9.98	50.85
					Cu Ro Met	84.4	24.01	7.85	11.76	1.47	8.81	70.55	11.17	7.30	69.21	60.81
					Cu Ro Tls	909.6	.93	5.80	13.80	.06	.53	29.45	88.83	92.70	30.79	39.19
					Heads	994.0	2.89	5.97	13.67	.18	1.23	100.00	100.00	100.00	100.00	100.00
5.	50	30	20	3000	Cu Conc	17.8	15.60	11.25	14.60	6.40	7.62	9.15	3.27	1.90	63.19	9.67
					Cu Tls 1	77.1	26.80	7.97	11.60	.26	9.47	68.09	10.02	6.55	11.12	52.07
					Cu Ro Met.	94.9	24.70	8.59	12.16	1.41	9.12	77.24	13.29	8.46	74.31	61.74
					Cu Ro Tls	906.7	.76	5.86	13.80	.05	.59	22.76	86.71	91.55	25.69	38.26
					Heads	1001.6	3.03	6.12	13.64	.18	1.40	100.00	100.00	100.00	100.00	100.00
6.	70	30	20	2000	Cu Conc.	18.5	13.30	11.52	15.70	6.07	6.60	8.17	3.45	2.20	59.85	8.77
					Cu Tls. 1	82.5	22.90	7.39	12.60	.16	8.42	62.73	9.88	7.87	7.04	49.89
					Cu Ro Met	101.0	21.14	8.15	13.17	1.24	8.09	70.90	13.33	10.07	66.89	58.66
					Cu Ro Tls	886.5	.99	6.03	13.40	.07	.65	29.10	86.67	89.93	33.11	41.34
					Heads	987.5	3.05	6.25	13.38	.19	1.41	100.00	100.00	100.00	100.00	100.00
7.	100	50	30	2000	Cu Conc	29.1	13.10	8.67	19.90	4.14	6.12	12.86	4.36	4.27	67.04	14.87
					Cu Tls 1	131.4	16.90	5.26	21.00	.16	6.26	74.90	11.94	20.35	11.70	68.66
					Cu Ro Met	160.5	16.21	5.88	20.80	.88	6.23	87.76	16.30	24.62	78.74	83.53
					Cu Ro Tls	837.8	.43	5.78	12.20	.05	.23	12.24	83.70	75.38	21.26	16.47
					Heads	998.3	2.97	5.80	13.58	.18	1.20	100.00	100.00	100.00	100.00	100.00
8.	100	50	30	3000	Cu Conc.	22.4	13.80	9.21	19.40	5.06	6.77	10.14	3.34	3.39	59.86	11.89
					Cu Tls 1	150.4	15.80	5.10	23.30	.15	5.99	77.93	12.42	27.30	11.92	70.63
					Cu Ro Met	172.8	15.54	5.63	22.79	.79	6.09	88.07	15.76	30.69	61.78	82.52
					Cu Ro Tls	823.7	.44	6.32	10.80	.06	.27	11.93	84.24	69.31	38.22	17.48
					Heads	996.5	3.06	6.20	12.88	.19	1.28	100.00	100.00	100.00	100.00	100.00

Cu/Pb Separation from $PbCC_3$

TABLE III

	ORE TYPE and TEST DESCRIPTION	SAMPLE	WTS.	Assays Pb	Zn	Fe	Cu	Ag	Distribution Pb	Zn	Fe	Cu	Ag
C.	2BCD - Assayed Heads ($PbCC_3$)	$PbCC_3$	—	59.3	4.13	6.3	2.51	20.72	—	—	—	—	—
		$PbCT_3$	—	3.25	9.43	18.8	.64	2.08	—	—	—	—	—
1.	2BCD - 1200g/T $K_2Cr_2O_7$ + no 2-11 - 2 drops MIBC	Cu Conc	16.4	46.6	4.97	8.5	5.54	17.44	32.3	21.5	27.7	63.9	33.8
		Cu Tls*	35.5	45.2	8.36	10.2	1.45	15.78	67.7	78.5	72.3	36.1	66.2
		Heads	51.9	45.6	7.29	9.7	2.74	16.36	100.0	100.0	100.0	100.0	100.0
2.	2BCD - 1800g/T $K_2Cr_2O_7$ - no 2-11 - no MIBC	Cu Conc	9.5	50.0	3.97	8.1	6.01	18.69	14.4	12.0	17.4	38.5	15.4
		Cu Tls*	49.6	57.2	5.56	7.4	1.84	19.60	85.6	88.0	82.6	61.5	84.6
		Heads	59.1	56.0	5.30	7.5	2.51	19.45	100.0	100.0	100.0	100.0	100.0
3.	2BCD - Rougher - 1800g/T $K_2Cr_2O_7$ + 1 drop MIBC	Rougher Conc	13.3	55.3	4.47	7.11	4.75	19.36	21.1	19.4	21.4	39.1	21.5
		Cu Conc	3.5	46.2	4.18	9.1	7.73	17.03	4.6	4.8	7.2	16.7	5.0
	- Cleaner - 500g/T $K_2Cr_2O_7$ + 1 dr. MIBC	Cu 1st Tls*	9.8	58.5	4.58	6.4	3.68	20.19	16.5	14.7	14.2	22.3	16.5
		Cu RO Tls*	47.2	58.1	5.21	7.4	2.08	19.91	78.9	80.5	78.6	61.0	78.5
		Heads	60.5	57.5	5.05	7.3	2.67	19.79	100.0	100.0	100.0	100.0	100.0

* The Tls are really $PbCC_3$.

Cu / Pb Separation TABLE IV
from $PbCC_3$

C.

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%)					DISTRIBUTION (%)				
				Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
4.	2BCD - 1200 g/t $K_2Cr_2O_7$ - no Z-11 - 4 drops MIBC	Cu Ro. Conc.	23.5	57.2	4.17	6.1	4.27	20.42	35.82	32.04	33.15	64.58	36.78
		Cu Ro. Tls	39.6	60.8	5.25	7.3	1.39	20.83	64.17	67.96	66.85	35.42	63.22
		Calc. Head	63.1	59.5	4.85	6.9	2.46	20.68	100	100	100	100	100
5.	2BCD - 1800 g/t $K_2Cr_2O_7$ - 20 g/t Z-11 - 2 drops MIBC	Cu Ro. Conc.	25.4	50.5	6.53	7.7	4.40	17.71	48.54	49.92	43.24	78.91	48.99
		Cu Ro. Tls.	26.2	51.9	6.35	9.8	1.14	17.88	51.46	50.08	56.76	21.09	51.01
		Calc. Head	51.6	51.2	6.44	8.8	2.74	17.80	100	100	100	100	100
6.	2BCD - 1800 g/t $K_2Cr_2O_7$ - 50 g/t Z-11 - 2 drops MIBC	Cu Ro. Conc.	48.9	55.8	5.22	6.9	3.97	19.72	68.25	58.19	54.67	94.93	69.34
		Cu Ro. Tls.	25.9	49.0	7.08	10.8	0.40	16.46	31.75	41.81	45.33	5.07	30.66
		Calc. Head	74.8	53.4	5.86	8.3	2.73	18.59	100	100	100	100	100
7.	2BCD - 1800 g/t $K_2Cr_2O_7$ - 80 g/t Z-11 - 2 drops MIBC	Cu Ro. Conc.	32.6	50.5	7.09	8.1	4.08	17.57	59.47	60.04	49.72	85.24	59.84
		Cu Ro. Tls.	24.5	45.8	6.28	10.9	0.94	15.69	40.53	39.96	50.28	14.76	40.16
		Calc. Head	57.1	48.5	6.74	9.3	2.73	16.73	100	100	100	100	100
8.	2BCD - 1800 g/t $K_2Cr_2O_7$ - 100 g/t Z-11 - 2 drops MIBC	Cu Ro. Conc	47.6	56.9	5.04	6.7	3.64	19.99	69.20	57.07	52.66	91.24	69.66
		Cu Ro. Tls	25.6	47.1	7.05	11.2	0.65	16.19	30.80	42.93	47.34	8.76	30.34
		Calc. Head	73.2	53.5	5.74	8.3	2.59	18.66	100	100	100	100	100

Cu / Pb Separation TABLE V
from $PbCC_3$

C.

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%) Pb	Zn	Fe	Cu	Ag	DISTRIBUTION (%) Pb	Zn	Fe	Cu	Ag
9.	2BCD R_o - 1200 g/t $K_2Cr_2O_7$ - 50 g/t Z-11 - 2 drops MIBC C_1 - 600 g/t $K_2Cr_2O_7$ - 25 g/t Z-11 - 1 drop MIBC C_2 - 180 g/t $K_2Cr_2O_7$ - 7.5 g/t Z-11 - 1 drop MIBC	$CuCC_2$	2.89	32.8	5.05	12.4	11.21	14.07	4.03	4.04	7.02	25.06	4.98
		$CuCT_2$	12.5	51.6	5.00	7.6	4.95	18.64	27.39	17.28	18.62	47.87	28.54
		Calc. $CuCC_1$	15.4	48.1	5.01	8.5	6.13	17.78	(31.42)	(21.32)	(25.64)	(72.93)	(33.52)
		$CuCT_1$	15.0	50.7	5.25	7.8	1.38	17.22	32.29	21.78	22.93	16.02	31.64
		Calc. Cu Ro. Conc	30.4	49.4	5.13	8.2	3.78	17.50	(63.71)	(43.10)	(48.57)	(88.95)	(65.16)
		Cu Ro. Tls.	21.6	40.7	9.80	12.5	0.68	13.54	36.29	56.91	51.44	11.05	34.83
		Calc. Head	51.4	45.8	7.04	9.9	2.52	15.88	100	100	100	100	100
10.	2BCD R_o - 3000 g/t $K_2Cr_2O_7$ - 50 g/t Z-11 - 2 drops MIBC C_1 - 1500 g/t $K_2Cr_2O_7$ - 25 g/t Z-11 - 1 drop MIBC C_2 - 450 g/t $K_2Cr_2O_7$ - 7.5 g/t Z-11 - 1 drop MIBC	$CuCC_2$	2.38	19.2	7.25	15.2	13.89	10.59	1.15	9.28	6.39	18.66	1.82
		$CuCT_2$	12.8	43.4	7.19	8.5	6.77	16.41	13.97	22.83	19.22	48.92	15.18
		Calc. $CuCC_1$	15.2	39.6	7.20	9.6	7.89	15.50	(15.12)	(27.11)	(25.61)	(67.58)	(17.00)
		$CuCT_1$	25.9	62.0	4.60	4.9	1.46	20.81	40.39	29.56	22.41	21.35	38.96
		Calc. Cu Ro. Conc.	41.1	53.7	5.56	6.6	3.83	18.85	(55.51)	(56.67)	(48.02)	(88.93)	(55.96)
		Cu Ro. Tls	32.7	54.1	5.34	9.0	0.60	18.63	49.49	43.32	51.98	11.08	44.04
		Calc. Head	73.8	53.9	5.46	7.7	2.40	18.75	100	100	100	100	100
11.	2BCD R_o - 1800 g/t $K_2Cr_2O_7$ - 50 g/t Z-11 - 4 drops MIBC C_1 - 900 g/t $K_2Cr_2O_7$ - 25 g/t Z-11 - 2 drops MIBC C_2 - 270 g/t $K_2Cr_2O_7$ - 7.5 g/t Z-11 - 1 drop MIBC	$CuCC_2$	3.56	29.7	6.98	11.9	9.73	12.58	5.24	6.29	7.91	28.11	6.23
		$CuCT_2$	11.2	42.8	7.08	8.7	5.05	15.84	23.74	20.08	18.20	45.90	24.67
		Calc. $CuCC_1$	14.8	39.6	7.06	9.5	6.18	15.05	(28.98)	(26.37)	(26.11)	(74.01)	(30.90)
		$CuCT_1$	16.5	48.8	6.89	7.7	1.45	17.03	39.87	28.79	23.73	19.42	39.07
		Calc. Cu Ro. Conc.	31.3	44.5	6.97	8.5	3.68	16.10	(68.85)	(55.16)	(49.84)	(93.43)	(69.97)
		Cu Ro. Tls.	18.4	34.2	9.62	14.6	0.44	11.77	31.16	44.83	50.17	6.57	30.11
		Calc. Head	49.7	40.7	7.95	10.8	2.48	14.48	100	100	100	100	100