COPPER FLOTATION

July 12-14/83

2H Cu Pre-Float Tests

UU6192

*calculated

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
A-1	2H ore - 1kg charge grind: NO Na_2SO_3 30g/t Z-11 rougher: 30g/t Z-11 pH=9.5	Cu Ro Conc	40.4	13.00	7.38	28.1	6.10	5.38	13.29	4.36	3.18	54.93	9.88
		Cu Ro Tls	962.9	3.56	6.79	35.9	0.21	2.06	86.71	95.64	96.82	45.07	90.12
		CALCHEAD	1003.3	3.94	6.81	35.6	0.45	2.19	100.0	100.0	100.0	100.0	100.0
A-2	2H ore - 1kg charge grind: 1kg/t Na_2SO_3 30g/t Z-11 rougher: 30g/t Z-11 pH=9.5	Cu Ro Conc	33.9	22.10	6.89	22.4	7.97	8.49	18.76	3.54	2.14	58.18	13.56
		Cu Ro Tls	971.1	3.34	6.56	35.7	0.20	1.89	81.24	96.46	97.86	41.82	86.44
		CALCHEAD	1005.0	3.97	6.57	35.3	0.46	2.11	100.0	100.0	100.0	100.0	100.0
A-4	2H ore - 1kg charge grind: 1kg/t Na_2SO_3 30g/t Z-11 rougher: 30g/t Z-11 pH=9.5 1st cleaner: 20g/t Z-11 pH=8.9	Cu CC1	13.9	22.60	4.44	17.6	15.70	882	7.83	0.93	0.67	52.65	5.74
		Cu CT1	19.6	19.20	8.70	27.1	1.09	7.00	9.38	2.56	1.45	5.15	6.43
		Cu Ro Conc	33.5	20.61	6.93	23.2	7.15	7.76	17.21	3.49	2.12	57.80	12.17
		Cu Ro Tls	971.7	3.42	6.61	37.0	0.18	1.93	82.80	96.51	97.89	42.20	87.83
		CALCHEAD	1005.2	3.99	6.62	36.5	0.41	2.12	100.0	100.0	100.0	100.0	100.0
A-5	2H ore - 1kg charge grind: 1kg/t Na_2SO_3 50g/t Z-11 rougher: 30g/t Z-11 pH=9.5 1st cleaner: 20g/t Z-11 pH=9.0	Cu CC1	13.5	19.10	4.47	19.5	17.10	7.61	6.43	0.88	0.75	54.63	4.41
		Cu CT1	21.7	20.80	8.94	25.4	1.21	7.46	11.26	2.84	1.58	6.21	6.95
		Cu Ro Conc	35.2	20.15	7.23	23.1	7.30	7.52	17.69	3.72	2.33	60.84	11.37
		Cu Ro Tls	973.4	3.39	6.76	35.1	0.17	2.12	82.31	96.28	97.67	39.16	88.63
		CALCHEAD	1008.6	3.97	6.78	34.7	0.42	2.31	100.0	100.0	100.0	100.0	100.0

July 12-14/83

2H Cu, Pre-Float Tests

* calculated

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
A-6	2Hore-1kg charge grind: 1kg/t Na_2SO_3 70g/t Z-11 rougher: 30g/t Z-11 , pH=9.5 1st cleaner: 20g/t Z-11 pH=9.0	CuCC$_1$	13.9	18.60	4.67	19.1	17.50	7.77	6.42	0.92	0.75	58.53	4.95
		CuCT$_1$	22.1	22.80	8.93	24.2	1.64	8.45	12.51	2.80	1.52	8.72	8.56
		Cu RoConc	36.0	21.18	7.29	22.2	7.76	8.19	18.92	3.73	2.27	67.25	13.51
		Cu RoTls	972.3	3.36	6.97	35.4	0.14	1.94	81.08	96.27	97.73	32.75	86.49
		CALCHEAD	1008.3	4.00	6.98	34.9	0.41	2.16	100.0	100.0	100.0	100.0	100.0
A-7	2Hore-1kg charge grind: 1kg/t Na_2SO_3 100g/t Z-11 rougher: 50g/t Z-11 pH=9.5 1st cleaner: 30g/t Z-11 pH=9.1	CuCC$_1$	27.1	32.10	3.93	17.9	10.47	11.78	21.87	1.65	1.35	67.90	14.40
		CuCT$_1$	25.1	13.30	10.11	27.4	1.15	5.45	8.39	3.94	1.92	6.91	6.17
		Cu RoConc	52.2	23.06	6.90	22.5	5.99	8.74	30.26	5.60	3.27	74.81	20.57
		Cu RoTls	956.8	2.90	6.35	36.3	0.11	1.84	69.74	94.40	96.73	25.19	79.43
		CALCHEAD	1009.0	3.94	6.38	35.6	0.41	2.20	100.0	100.0	100.0	100.0	100.0
A-8	2Hore-1kg charge grind: 1kg/t Na_2SO_3 50g/t Z-11 rougher: 15g/t Z-11 pH=9.5 1st cleaner: 5g/t Z-11 pH=8.9	CuCC$_1$	7.0	18.00	3.42	19.9	18.80	7.25	3.15	0.37	0.38	31.66	2.37
		CuCT$_1$	20.2	22.90	7.02	25.6	2.48	8.38	11.56	2.17	1.40	12.05	7.91
		Cu RoConc	27.2	21.64	6.09	24.1	6.68	8.09	14.71	2.53	1.78	43.71	10.28
		Cu RoTls	975.1	3.50	6.54	37.2	0.24	1.97	85.29	97.47	98.22	56.29	89.72
		CALCHEAD	1002.3	3.99	6.53	36.8	0.41	2.14	100.0	100.0	100.0	100.0	100.0
A-9	2Hore-1kg charge grind: 2kg/t Na_2SO_3 100g/t Z-11 rougher: 50g/t Z-11 pH=9.5 1st cleaner: 30g/t Z-11 pH=9.1	CuCC$_1$	15.6	38.30	3.99	14.2	10.30	13.70	16.07	0.90	0.61	53.75	10.29
		CuCT$_1$	22.3	12.30	10.99	27.1	1.39	4.87	7.38	3.56	1.67	10.37	5.23
		Cu RoConc	37.9	23.00	8.11	21.8	5.06	8.50	23.44	4.47	2.29	64.12	15.52
		Cu RoTls	974.9	2.92	6.74	36.2	0.11	1.80	76.56	95.53	97.71	35.88	84.48
		CALCHEAD	1012.8	3.71	6.86	36.0	0.30	2.07	100.0	100.0	100.0	100.0	100.0

July 12-14/83

2H Cu Pre-Float Tests

*calculated

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
A-10	2H ore - 1kg charge grind: 1 kg/t Na_2SO_3, 150 g/t Z-11 rougher: 75 g/t Z-11, pH = 9.6	Cu RoConc	112.9	25.50	5.40	23.0	3.08	9.59	68.55	8.73	7.10	77.99	50.07
		Cu RoTls	892.4	1.48	7.14	38.1	0.11	1.21	31.45	91.27	92.90	22.01	49.93
		CALCHEAD	1005.3	4.18	6.94	36.4	0.44	2.15	100.0	100.0	100.0	100.0	100.0
A-11	2H ore - 1kg charge grind: 2 kg/t Na_2SO_3, 50 g/t Z-11 rougher: 15 g/t Z-11, pH = 9.5 1st cleaner: 5 g/t Z-11, pH = 9.0	Cu CC_1	10.7	19.60	4.58	19.4	17.60	7.80	5.35	0.77	0.57	42.78	3.94
		Cu CT_1	21.6	20.50	7.93	27.0	1.25	7.31	11.30	2.71	1.60	6.13	7.45
		Cu RoConc	32.3	20.20	6.82	24.5	6.67	7.47	16.66	3.48	2.17	48.91	11.39
		Cu RoTls	977.6	3.34	6.25	36.5	0.23	1.92	83.34	96.52	97.83	51.08	88.61
		CALCHEAD	1009.9	3.88	6.27	36.1	0.44	2.10	100.0	100.0	100.0	100.0	100.0
A-12	2H ore - 1kg charge LOW pH grind: no Na_2CO_3, no Na_2SO_3, no Z-11 Ro: 20 g/t Z-11, pH = 5.1	Cu RoConc	34.8	6.18	7.30	32.9	0.71	2.73	5.43	3.90	3.23	5.86	4.27
		Cu RoTls	968.7	3.87	6.47	35.4	0.41	2.20	94.57	96.10	96.77	94.14	95.73
		CALCHEAD	1003.5	3.95	6.50	35.3	0.42	2.22	100.0	100.0	100.0	100.0	100.0

C-1

2EF LOCKED CYCLE TEST (CLOSED CIRCUIT)

July 14/83

TABLE I : METALLURGICAL BALANCE AND AVERAGE OF FINAL CYCES

ORETYPE and Test Description

2EF locked cycle test
- 6 cycles

grind: 2kg ore
76% solids
1 kg/t Na_2SO_3
3 kg/t Na_2CO_3
50 g/t Z-11
30 min

rougher: 15 g/t Z-11
pH = 9.5

first cleaner: (closed)
5 g/t Z-11
pH = 9.5

second cleaner:
2.5 g/t Z-11
pH = 9.6

third cleaner:
no Z-11
pH = 9.8

fourth cleaner:
no Z-11
pH = 10.0

average of cycles 5 & 6

SAMPLE	WTS	ASSAYS					DISTRIBUTION				
		Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
CuCC4 I	4.8	23.70	2.23	16.2	19.60	6.80	0.25	0.02	0.02	3.08	0.19
II	8.3	37.50	2.36	12.8	14.20	9.84	0.68	0.03	0.03	3.86	0.47
III	7.5	40.10	2.17	12.4	13.20	10.37	0.66	0.03	0.03	3.24	0.44
IV	9.0	37.60	2.27	12.6	13.60	9.80	0.74	0.03	0.03	4.00	0.50
V	14.6	46.10	2.06	10.1	10.63	11.61	1.47	0.05	0.04	5.08	0.97
VI	17.9	47.80	2.13	10.7	9.60	12.42	1.87	0.06	0.06	5.62	1.27
CuRoTls I	1881.9	3.25	4.96	28.3	0.23	1.34	13.36	15.66	15.50	14.16	14.39
II	1935.9	3.14	4.76	28.7	0.17	1.45	13.28	15.46	16.17	10.77	16.02
III	1968.1	3.28	5.02	28.9	0.16	1.29	14.10	16.58	16.55	10.30	14.49
IV	1975.9	3.34	4.99	28.6	0.15	1.31	14.42	16.54	16.44	9.70	14.77
V	1981.5	3.06	4.87	29.3	0.12	1.20	13.24	16.19	16.89	7.78	13.57
VI	2000.4	2.93	5.15	29.4	0.16	1.23	12.80	17.29	17.11	10.47	14.04
CuCT1 VI	77.6	6.49	7.50	27.6	0.30	2.17	1.10	0.98	0.62	0.76	0.96
CuCT2 VI	42.7	25.00	7.21	20.3	1.26	6.88	2.33	0.52	0.25	1.76	1.68
CuCT3 VI	43.3	50.30	5.01	12.2	2.90	12.57	4.76	0.36	0.15	4.11	3.11
CuCT4 VI	38.6	58.70	3.06	8.3	4.21	14.33	4.95	0.20	0.09	5.32	3.16
CALC HEAD	1200.0	3.81	4.96	28.6	0.25	1.46	100.0	100.0	100.0	100.0	100.0
CC4	16.25	47.04	2.10	10.4	10.06	12.06	11.38	0.34	0.29	36.97	7.47
CuRoTls	1990.95	2.99	5.01	29.4	0.14	1.22	88.62	99.66	99.71	63.03	92.53
CALCHEAD	2007.2	3.35	4.99	29.2	0.22	1.31	100.0	100.0	100.0	100.0	100.0

July 14/83

C-1 2EF LOCKED CYCLE TEST

TABLE II: MET. BALANCE BY CYCLE

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
cycle 1	CuCC4	4.8	23.70	2.23	16.2	19.60	6.80	1.83	0.11	0.15	17.85	1.28
	CuRoTls	1881.9	3.25	4.96	28.3	0.23	1.34	98.17	99.89	99.85	82.15	98.72
	CALCHEAD	1886.7	3.30	4.95	28.3	0.28	1.35	100.0	100.0	100.0	100.0	100.0
cycle 2	CuCC4	8.3	37.50	2.36	12.8	14.20	9.84	4.87	0.21	0.19	26.37	2.83
	CuRoTls	1935.9	3.14	4.76	28.7	0.17	1.45	95.13	99.79	99.81	73.63	97.17
	CALCHEAD	1944.2	3.29	4.75	28.6	0.23	1.49	100.0	100.0	100.0	100.0	100.0
cycle 3	CuCC4	7.5	40.10	2.17	12.4	13.20	10.37	4.45	0.16	0.16	23.92	2.97
	CuRoTls	1968.1	3.28	5.02	28.9	0.16	1.29	95.55	99.84	99.84	76.08	97.03
	CALCHEAD	1975.6	3.42	5.01	28.8	0.21	1.32	100.0	100.0	100.0	100.0	100.0
cycle 4	CuCC4	9.0	37.60	2.27	12.6	13.60	9.80	4.88	0.21	0.20	29.23	3.30
	CuRoTls	1975.9	3.34	4.99	28.6	0.15	1.31	95.12	99.79	99.80	70.77	96.70
	CALCHEAD	1984.9	3.50	4.98	28.5	0.21	1.35	100.0	100.0	100.0	100.0	100.0
cycle 5	CuCC4	14.6	46.10	2.06	10.1	10.63	11.61	9.99	0.31	0.25	39.49	6.65
	CuRoTls	1981.5	3.06	4.87	29.3	0.12	1.20	90.01	99.69	99.75	60.51	93.35
	CALCHEAD	1996.1	3.37	4.85	29.2	0.20	1.28	100.0	100.0	100.0	100.0	100.0
cycle 6	CuCC4	17.9	47.80	2.13	10.7	9.60	12.42	12.74	0.37	0.32	34.93	8.29
	CuRoTls	2000.4	2.93	5.15	29.4	0.16	1.23	87.26	99.63	99.68	65.07	91.71
	CALCHEAD	2018.3	3.33	5.12	29.2	0.24	1.33	100.0	100.0	100.0	100.0	100.0

To: R. Munanka
FROM: Ron MARTEL
DATE: July 13, 83

Subject: 2A ORE Insol preFloat D1

Purpose: To liberate the ore from the insoluble fraction

Discussion: - This test was done to investigate whether graphite can be floated prior to Pb flotation.

- Ten one minute Insol. rougher conc. were collected. After the Insol. Rougher stage, XanThate was added and conditioned so that Pb could be floated.

- Only 14% of the insolubles reported to the preFloat. There was also a 32% Lead recovery loss to this stage.

D-1 Insol. prefloat 2A ORE.

July 13.83

TEST DESCRIPTION	SAMPLE	wts	ASSAY Pb	Zn	FE	Cu	Ag	Insol.	DISTRIBUTION Pb	Zn	FE	Cu	Ag	Insol.
1Kg. chg.	Insol. Ro 1	27.0	3.84	3.13	2.8	0.21	4.29	76.30	10.26	3.31	2.24	13.24	13.31	2.46
	2	23.3	2.59	2.60	2.4	0.20	2.74	81.38	5.97	2.37	1.66	10.88	7.34	2.26
-NO Z-11 to graphite cct.	3	19.2	2.05	2.29	2.2	0.24	2.21	85.21	3.89	1.72	1.25	10.76	4.88	1.95
	4	15.5	1.81	2.11	2.1	0.19	1.81	85.41	2.78	1.23	0.96	6.87	3.22	1.58
	5	13.5	1.67	2.12	2.1	0.18	1.74	86.92	2.23	1.12	0.84	5.67	2.70	1.40
-50g/t Z-11 to the Lead Ro.	6	11.9	1.65	2.18	2.2	0.14	1.72	86.66	1.94	1.02	0.77	3.89	2.35	1.23
	7	8.9	1.55	2.32	2.3	0.15	1.44	85.61	1.36	0.81	0.61	3.12	1.47	0.91
-20g/t Z-11 to the Lead scav.	8	8.3	1.58	2.40	2.3	0.13	1.28	86.50	1.30	0.78	0.56	2.52	1.22	0.86
	9	6.9	1.53	2.46	2.2	0.12	1.36	86.34	1.04	0.66	0.45	1.93	1.08	0.71
	10	7.7	1.51	2.61	2.5	0.10	1.43	85.76	1.15	0.79	0.57	1.80	1.26	0.79
	Lead Ro.	53.7	8.64	6.81	11.4	0.14	5.96	49.85	45.91	14.31	18.12	17.55	36.77	3.19
	Lead Scav.	35.4	1.20	4.88	15.3	0.05	1.30	49.55	4.20	6.76	16.03	4.13	5.29	2.09
	Tails	756.1	0.24	2.20	2.5	0.01	0.22	89.39	17.96	65.08	55.94	17.65	19.11	80.60
	HEADS	987.4	1.02	2.59	3.4	0.04	0.88	84.93	100.00	100.00	100.00	100.00	100.00	100.00

E-1

2A Graphite Gravity Separation

July 13. 83

Test Description	Sample	Wts	Assay						Distribution					
			Pb	Zn	Fe	Cu	Ag	Insol.	Pb	Zn	Fe	Cu	Ag	Insol
Low Density 5 min setting Rate	U/F	8.6	0.81	2.24	3.5	0.05	0.63	83.05	78.30	79.78	86.86	79.64	77.71	84.51
	O/F	1.57	1.23	3.11	2.9	0.07	0.99	83.41	21.70	20.22	13.14	20.36	22.29	15.49
	Heads	10.17	0.87	2.37	3.41	0.05	0.68	83.10	100.00	100.00	100.00	100.00	100.00	100.00
High Density 5 Min Setting Rate	U/F	37.3	0.84	2.32	3.7	0.04	0.63	85.62	62.54	66.63	76.34	64.31	62.08	73.48
	O/F	13.8	1.36	3.14	3.1	0.06	1.04	83.51	37.46	33.37	23.66	35.69	37.92	26.52
	Heads	51.10	0.98	2.54	3.5	0.04	0.74	85.05	100.00	100.00	100.00	100.00	100.00	100.00
High Density 1 hr setting Rate	U/F	28.9	0.94	2.50	3.4	0.05	0.79	84.53	96.87	97.43	98.39	96.86	96.59	—
	O/F	0.52	1.69	3.66	3.1	0.09	1.55	—	3.13	2.56	1.61	3.14	3.41	—
	Heads	29.42	0.95	2.52	3.4	0.05	0.80	—	100.00	100.00	100.00	100.00	100.00	

A. June 22.83

Large-Scale Flotation for Feed Generation

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
S. NewS, Blend	PbCC1	350.3	42.30	8.70	8.0	1.03	24.56	89.29	8.33	2.86	61.20	60.14
PbCl1 generation	PbCT1	398.7	.82	7.19	15.2	.21	1.39	1.97	7.84	6.18	14.20	3.87
Std. Pb flotation	Pb RoConc	749.0	[illegible]	[illegible]	[illegible]	.57	12.23	91.26	16.17	9.04	75.40	64.01
	PbScT's	7251.0	.20	4.23	[illegible]	.02	.71	8.74	83.83	90.96	24.60	35.99
	Heads	8000.0	2.07	4.57	12.3	.07	1.79	100.0	100.0	100.0	100.0	100.0

B

ZEF Cu Pre-float, Large Scale

July 13-83.

ORETYPE and Test Description	SAMPLE	ASSAYS WT	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 ScTls P80 ≠ 52 μ	CuRoConc	113.8	5.50	5.86	27.8	4.39	2.71	2.0	1.5	1.3	23.0	2.7
	CuRoTls	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
B-2 8kg ore: LARGESCALE 66% solids grind: 1kg/tonne Na_2SO_3 no NaCN 100g/tonne Z-11 rougher: 50g/tonne Z-11 pH=9.5	Cu Ro Conc	131.8	15.30	5.79	25.9	6.98	4.78	7.54	2.14	1.39	68.27	7.63
	Cu Ro Tls	7127.1	3.47	4.90	34.1	0.06	1.07	92.46	97.86	98.61	31.73	92.37
	CALCHEAD	7258.9	3.68	4.92	34.0	0.19	1.14	100.0	100.0	100.0	100.0	100.0

July 20, 1983
NEW BALL CHARGE
SHORTER GRINDTIM

2EF Air Addition tests - Std Pb circuit (3kg/tonne Na_2CO_3, 200g/tonne NaCN, 60g/tonne Z-11 tog.
Call on Denver D-2 with 2kg charge in 5l cell at 900 rpm)

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
normal (2l/min)	Pb Ro Conc	144.8	46.40	4.37	16.0	0.85	11.60	87.88	5.76	3.12	30.68	68.33
	Pb Ro Tls	1854.0	0.50	5.58	38.8	0.15	0.42	12.12	94.24	96.88	69.32	31.67
	CALCHEAD	1998.8	3.83	5.49	37.1	0.20	1.23	100.0	100.0	100.0	100.0	100.0
6l/min	Pb Ro Conc	158.1	47.10	4.86	15.7	0.66	11.69	90.27	7.39	3.23	29.58	73.43
	Pb Ro Tls	1850.4	0.42	5.04	38.9	0.13	0.35	9.73	92.61	96.77	70.42	26.57
	CALCHEAD	2003.5	3.99	5.03	37.1	0.17	1.22	100.0	100.0	100.0	100.0	100.0
10l/min	Pb Ro Conc	167.7	40.20	4.91	18.4	0.89	10.07	89.98	8.44	4.15	40.44	71.36
	Pb Ro Tls	1831.5	0.41	4.88	38.9	0.12	0.37	10.02	91.56	95.85	59.56	28.64
	CALCHEAD	1999.2	3.75	4.88	37.2	0.18	1.18	100.0	100.0	100.0	100.0	100.0

16%

2EF Cu Tests: Cu / Pb Separation

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
D-1 "best 2BCD dichromate test" Same as 2BCD B-7 2kg ore charge at 66% solids grind: 1kg/tonne Na_2SO_3 no NaCN 100g/tonne Z-11 rougher: 50g/tonne Z-11 pH=9.5 1st cleaner: 2kg/tonne $K_2Cr_2O_7$ 30g/tonne Z-11	$CuCC_1$	16.1	34.0	3.71	16.3	10.90	9.08	7.27	0.58	0.39	38.22	6.00
	$CuCT_1$	143.0	20.3	5.98	25.6	0.57	5.62	38.55	8.25	5.38	17.75	32.96
	CALC CuRo Conc	159.1	21.7	5.75	24.7	1.62	5.97	45.82	8.83	5.77	55.97	38.96
	Cu RoTls	1837.7	2.22	5.14	34.9	0.11	0.81	54.18	91.17	94.24	44.03	61.05
	CALCHEAD	1996.8	3.77	5.19	34.1	0.23	1.22	100.0	100.0	100.0	100.0	100.0
D-2 "best 2BCN NaCN on regrinding test" Same as 2BCD B-4 2kg ore charge at 66% solids grind: 1kg/tonne Na_2SO_3 no NaCN 100g/tonne Z-11 rougher: 50g/tonne Z-11 pH=9.5 regrind: 100g/tonne NaCN 10 min regrind 1st Cleaner: 90g/tonne Z-11 pH=10.2 2nd Cleaner: 50g/tonne Z-11 pH=10.1 3rd Cleaner: 20g/tonne Z-11 pH=10.1	$CuCC_3$ stb9	24.6	78.3	0.67	1.5	0.34	18.35	25.64	0.16	0.05	2.07	18.85
	$CuCT_3$ stb5	8.8	58.5	2.40	8.9	2.15	14.33	6.85	0.21	0.12	4.68	5.27
	CALC $CuCC_2$	33.4	73.1	1.13	3.4	0.82	17.29	32.49	0.37	0.17	6.75	24.12
	$CuCT_2$ stb6	17.5	28.7	5.11	21.4	2.47	7.60	6.69	0.88	0.56	10.69	5.56
	CALC $CuCC_1$	50.9	57.8	2.50	9.6	1.39	13.96	39.18	1.25	0.73	17.44	29.68
	$CuCT_1$ stb7	105.4	9.12	6.59	30.3	1.77	2.88	12.80	6.81	4.75	46.15	12.68
	CALC CuRo Conc	156.3	24.9	5.26	23.6	1.65	6.49	51.98	8.06	5.48	63.59	42.36
	Cu RoTls stb2	1840.2	1.96	5.10	34.5	0.08	0.75	48.02	91.95	94.52	36.41	57.65
	CALC HEAD stb3	1996.5	3.76	5.11	33.6	0.20	1.20	100.0	100.0	100.0	100.0	100.0

2EF Cu/Pb Separation – D-3 – Rougher test with Guar Gum

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
D-3 : 2kg charge grind: 1kg/tonne Na_2SO_3 100g/tonne Z-11 rougher: 50g/tonne Z-11 52.5g/tonne Guar gum	Cu Ro Conc	28.0	16.90	8.12	27.8	2.59	4.58	6.71	2.29	1.07	18.97	5.23
	Cu RO Tls	1936.5	3.40	5.02	37.0	0.16	1.20	93.29	97.71	98.93	81.03	94.77
	CALCHEAD	1964.5	3.59	5.06	36.9	0.19	1.25	100.0	100.0	100.0	100.0	100.0

1 kg/t Na_2SO_3 **A-8**
50 g/t Z-11 to grind
15 g/t Z-11 to Ro.
5 g/t Z-11 to 1st clnr
Repeat of (2BCD - B-9)

CuCC1	7.7	16.40	7.86	19.3	14.70	5.31	3.20	1.08	0.48	61.75	3.63
CuCt1	18.0	13.60	9.86	25.0	1.15	3.78	6.20	3.18	1.45	11.29	6.04
Rougher Cons	25.7	14.44	9.26	23.3	5.21	4.24	9.40	4.26	1.93	73.04	9.67
Tails	988.1	3.62	5.41	30.9	0.05	1.03	90.60	95.74	98.08	26.95	90.33
HEADS	1013.8	3.89	5.51	30.7	0.18	1.11	100.00	100.00	100.00	100.00	100.00

2E

PROD.	WEIGHTS GM.	%	ASSAYS PB	Cu	Ag	UNITS PB	Cu	Ag	DISTRIBUTION PB	Cu	Ag
CuCC1	5.80	.01	16.20	16.50	4.85	.09	.10	.03	2.27	35.34	2.12
CuCt1	20.30	.02	11.25	.96	3.22	.23	.02	.07	5.51	7.20	4.92
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Rotts	972.40	.97	3.93	.16	1.27	3.83	.16	1.24	92.22	57.46	92.96
HEADS			4.15	.27	1.33						

PB CUMULATIVE GRADES	CUMULATIVE RECOVERIES
16.20	2.27
12.35	7.78
12.35	7.78
12.35	7.78
12.35	7.78

Cu CUMULATIVE GRADES	CUMULATIVE RECOVERIES
16.50	35.34
4.41	42.54
4.41	42.54
4.41	42.54
4.41	42.54

2EF Cu Pre-float

A-15

duplicate of A-8

PROD.	WEIGHTS GM.	%	ASSAYS PB	ZN	FE	UNITS PB	ZN	FE	DISTRIBUTION PB	ZN	FE
PBRC1	5.80	.01	.01	6.66	23.60	.00	.04	.14	.58	.66	.37
PBRC2	20.30	.02	.01	9.91	31.00	.00	.20	.63	2.03	3.46	1.70
PBSC1	0.00	0.00	.01	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00
PBSC2	0.00	0.00	.01	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00
PBSC3	0.00	0.00	.01	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00
PB ST	972.40	.97	.01	5.73	37.20	.01	5.58	36.23	97.39	95.87	97.93
HEADS			.01	5.82	36.99						

PB CUMULATIVE GRADES	CUMULATIVE RECOVERIES
.01	.58
.01	2.61

A-15

5.53
2.98
8.51
1.50
.00

July 13/83

E-3 | as E-1 with Minerec 1661 in place of Z-11 in grind only

"1972"

Cu Ro Conc	31.0	8.32	7.06	32.0	6.87	2.85
Cu Sc Conc	28.2	25.40	8.50	24.0	3.71	6.99
Pb Ro Conc	85.9	61.00	3.34	11.3	0.06	15.34
Pb Sc Conc	26.8	22.80	8.41	28.0	0.10	6.35
Tls	1835.7	0.61	5.49	40.2	0.05	0.51
TAILHEAD		3.96	5.50	38.5	0.21	1.35

3.25	1.98	1.29	51.05	3.26
9.02	2.17	0.88	25.08	7.27
65.95	2.60	1.26	1.24	48.63
7.69	2.04	0.97	0.64	6.28
14.09	91.21	95.61	22.00	34.55
100.0	100.0	100.0	100.0	100.0

PROD.	WEIGHTS GM.	%	ASSAYS PB	Cu	Ag	UNITS PB	Cu	Ag	DISTRIBUTION PB	Cu	Ag
Cu Ro Conc	45.90	.02	8.50	4.16	2.81	.19	.10	.06	4.64	38.06	3.95
Sc Conc	43.00	.02	17.70	1.79	4.85	.38	.04	.10	9.04	15.34	6.39
Pb Ro Conc	110.70	.06	54.60	.13	13.22	3.02	.01	.73	71.82	2.87	44.84
Sc Conc	58.40	.03	7.75	.17	2.33	.23	.00	.07	5.38	1.98	4.17
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Sc Tls	1746.00	.87	.44	.12	.76	.38	.10	.66	9.13	41.76	40.65
HEADS			4.20	.25	1.63						

PB CUMULATIVE GRADES	CUMULATIVE RECOVERIES
8.50	4.64
12.95	13.68
36.05	85.49
29.64	90.87
29.64	90.87

Cu CUMULATIVE GRADES	CUMULATIVE RECOVERIES
4.16	38.06
3.01	53.40
1.41	56.26
1.13	58.24
1.13	58.24

2EF Cu test

E-6
duplicate of E-3
Minerec 1661/Z-11

PROD.	WEIGHTS GM.	%	ASSAYS PB	ZN	FE	UNITS PB	ZN	FE	DISTRIBUTION PB	ZN	FE
PBRC1	45.90	.02	.01	8.18	32.50	.00	.19	.74	2.29	3.32	2.04
PBRC2	43.00	.02	.01	9.41	27.10	.00	.20	.58	2.15	3.58	1.59
PBSC1	110.70	.06	.01	4.19	13.10	.00	.23	.72	5.52	4.11	1.98
PBSC2	58.40	.03	.01	9.77	33.40	.00	.28	.97	2.91	5.05	2.67
PBSC3	0.00	0.00	.01	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PB ST	1746.00	.87	.01	5.43	38.40	.01	4.73	33.46	87.13	83.94	91.71
HEADS			.01	5.64	36.48						

PB CUMULATIVE GRADES CUMULATIVE RECOVERIES

B

ZEF Cu Pre-float, Large Scale

July 3-8

ORETYPE and Test Description	SAMPLE	ASSAYS WT	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 ScTls P80 ≈ 52 μ	CuRoConc	113.8	5.50	5.86	27.8	4.39	2.71	2.0	1.5	1.3	23.0	2.7
	CuROTls	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
B-2 8kg ore: LARGESCALE 66% -s.lids grind: 1kg/tonne Na_2SO_3 no NaCN 100g/tonne Z-11 rougher: 50 g/tonne Z-11 pH=9.5	Cu Ro Conc	131.8	15.30	5.79	25.9	6.98	4.78	7.54	2.14	1.39	68.27	7.63
	Cu Ro Tls	7127.1	3.47	4.90	34.1	0.06	1.07	92.46	97.86	98.61	31.73	92.37
	CALCHEAD	7258.9	3.68	4.92	34.0	0.19	1.14	100.0	100.0	100.0	100.0	100.0
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	CuRoConc	115.5	5.96	6.84	32.6	6.67	2.53	2.23	1.84	1.33	44.38	3.03
	CuROTls	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					

July 20, 198

NEW BALL CHA
SHORTER GRIND
P_{80} < 44 μ

PROD.	WEIGHTS GM.	%	ASSAYS PB	Cu	Ag	UNITS			DISTRIBUTION PB	Cu	Ag
	1.16	.00	8.05	20.35	3.05	.00	.01	.00	.11	4.53	.13
CuCC2	14.80	.01	20.10	8.49	5.75	.15	.06	.04	3.42	24.10	3.19
CuCT2	179.80	.09	28.50	.85	7.35	2.53	.08	.65	58.89	29.32	49.48
CuCT1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
CuRotls	1827.00	.90	1.79	.12	.69	1.62	.11	.62	37.58	42.05	47.20
			4.30	.26	1.32						

HEADS

PB CUMULATIVE GRADES: 8.05, 19.22, 27.74, 27.74, 27.74

CUMULATIVE RECOVERIES: .11, 3.53, 62.42, 62.42, 62.42

Cu CUMULATIVE GRADES: 20.35, 9.35, 1.54, 1.54, 1.54

CUMULATIVE RECOVERIES: 4.53, 28.63, 57.95, 57.95, 57.95

2EF Cu test E-5

Lakefield 1979

- Best test

XAX/350\=1/1

PROD.	WEIGHTS GM.	%	ASSAYS PB	ZN	FE	UNITS			DISTRIBUTION PB	ZN	FE
	1.16	.00	.01	4.98	25.10	.00	.00	.01	.06	.05	.04
PBRC1	14.80	.01	.01	8.33	24.40	.00	.06	.18	.73	.98	.48
PBRC2	179.80	.09	.01	7.41	23.70	.00	.66	2.11	8.89	10.63	5.67
PBSC1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PBSC2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
PBSC3	0.00	.90	.01	6.06	38.60	.01	5.47	34.86	90.32	88.34	93.81
PB ST	1827.00		.01	6.20	37.16						

HEADS

PB CUMULATIVE GRADES: .01, .01, .01, .01, .01

CUMULATIVE RECOVERIES: .06, .79, 9.68, 9.68, 9.68

ZN CUMULATIVE GRADES: 4.98, 8.09, 7.47, 7.47, 7.47

CUMULATIVE RECOVERIES: .05, 1.03, 11.66, 11.66, 11.66

E-5

Zn & Fe

2EF Air Addition tests - Std Pb circuit (3kg/tonne Na_2CO_3, 200g/tonne NaCN, 60g/tonne Z-11 tog. Call on Denver D-2 with 2kg charge in 5l cell at 900 rpm)

ORE TYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
normal (2l/min)	Pb Ro Conc	144.8	46.40	4.37	16.0	0.85	11.60	87.88	5.76	3.12	30.68	68.33
	Pb Ro Tls	1854.0	0.50	5.58	38.8	0.15	0.42	12.12	94.24	96.88	69.32	31.67
	CALCHEAD	1998.8	3.83	5.49	37.1	0.20	1.23	100.0	100.0	100.0	100.0	100.0
6l/min	Pb Ro Conc	153.1	47.10	4.86	15.7	0.66	11.69	90.27	7.39	3.23	29.58	73.43
	Pb Ro Tls	1850.4	0.42	5.04	38.9	0.13	0.35	9.73	92.61	96.77	70.42	26.57
	CALCHEAD	2003.5	3.99	5.03	37.1	0.17	1.22	100.0	100.0	100.0	100.0	100.0
10l/min	Pb Ro Conc	167.7	40.20	4.91	18.4	0.89	10.07	89.98	8.44	4.15	40.44	71.36
	Pb Ro Tls	1831.5	0.41	4.88	38.9	0.12	0.37	10.02	91.56	95.85	59.56	28.64
	CALCHEAD	1999.2	3.75	4.88	37.2	0.18	1.18	100.0	100.0	100.0	100.0	100.0
4l/min	Pb Ro/Sc Conc	155.8	48.40	5.57	15.6	0.40	11.86	88.79	7.55	3.29	13.40	70.61
	Pb Ro/Sc Tls	1831.1	0.52	5.80	39.0	0.22	0.42	11.21	92.45	96.71	86.60	29.39
	CALCHEAD	1986.9	4.27	5.78	37.2	0.23	1.32					

METALLURGICAL BALANCE Cu Prefloat – MEGGEN SCHEME (vs Lakefield 1980)

ORETYPE and Test Description	SAMPLE	WT3	ASSAYS (%)					DISTRIBUTION (%)				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
A-23 2EF ore – 2kg	Cu Conc	100.7	45.60	3.71	17.9	1.65	11.05	56.89	3.51	2.45	37.42	41.12
grind: 1kg/tonne lime	Pb Ro_1	26.5	4.36	8.89	34.9	0.23	1.52	1.43	2.21	1.25	1.37	1.49
1kg/tonne $ZnSO_4$	Pb Ro_2	19.0	3.52	8.47	35.6	0.20	1.25	0.83	1.51	0.92	0.86	0.88
150g/tonne Z-11	Pb Ro_3	16.4	3.90	9.40	35.0	0.21	1.40	0.79	1.45	6.78	0.78	0.89
Cu rougher: pH = 9.5 (lime)	Pb Ro_4	36.4	37.10	6.65	21.1	0.17	9.05	16.93	2.27	1.04	1.39	12.17
Pb rougher: pH = 11.8 (lime)	Pb Ro_5	52.3	21.20	10.23	26.4	0.23	5.68	13.74	5.03	1.87	2.71	10.98
Ro_1: 2min, 0 Z-11	TAILS	1759.8	0.44	5.08	38.4	0.14	0.50	9.59	84.01	91.69	55.48	32.52
Ro_2: 2min, 5g/tonne Z-11												
Ro_3: 2min, 15g/tonne Z-11												
Ro_4: 2min, 50g/tonne Z-11												
Ro_5: 2min, 100g/tonne Z-11	CALCHEAD	2011.1	4.01	5.29	36.6	0.22	1.35					

Test procedure

Test: 2 / 3810

Stage	Reagent g/t	Cond. Time min	Flot. Time min	pH
Grinding	150 SIPX			
	1.750 CaO			12,6
	1.000 $ZnSO_4$	5		12,5
Pb-rougher - 4 l cell	Flotol		10	12,2
Pb-rougher conc. Regrinding	Regrinding 24 min. in laboratory ball mill			
Pb-cleaner 1 - 2 l cell	150 CaO	1		11,9
	250 $ZnSO_4$	5		11,5
	15 SIPX			
	Flotol		2,5	
	10 SIPX		3,5	10,4
Pb-cleaner 2	100 CaO	1		11,8
	125 $ZnSO_4$			11,6
	Flotol		5	10,9
Pb-cleaner 3	100 CaO	1		11,7
	125 $ZnSO_4$			8,5
	Flotol			
	5 SIPX		1	
	5 SIPX		3	8,3
Pb-cleaner 4	150 CaO	1		11,8
	Flotol			
	10 SIPX		1	
	5 SIPX			
	Flotol		3	11,5

METALLURGICAL BALANCE

Sept 20/83

DUPLICATE Cu ROUGHERS of 2EF ORE — Scheme used like test A-8

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%)					DISTRIBUTION (%)				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
A-25	Cu Ro Conc	31.9	14.96	8.28	26.2	4.31	4.36	12.92	5.27	2.32	73.89	11.70
	Cu Ro Tls	971.9	3.31	4.89	36.2	0.05	1.08	87.08	94.73	97.68	26.11	88.30
	CALCHEAD	1003.8	3.68	5.00	35.9	0.19	1.18	100.0	100.0	100.0	100.0	100.0
A-26	Cu Ro Conc	31.0	12.23	8.10	27.6	4.34	3.66	10.18	4.95	2.41	73.46	9.29
	Cu Ro Tls	972.0	3.44	4.96	35.6	0.05	1.14	89.82	95.05	97.59	26.54	90.71
	CALCHEAD	1003.0	3.71	5.06	35.4	0.18	1.22	100.0	100.0	100.0	100.0	100.0
A-27	Cu Ro Conc	34.2	11.33	8.15	27.8	4.01	3.50	10.26	5.37	2.63	73.80	8.58
	Cu Ro Tls	973.5	3.48	5.05	36.2	0.05	1.31	89.74	94.63	97.37	26.20	91.42
	CALCHEAD	1007.7	3.75	5.16	35.9	0.18	1.38	100.0	100.0	100.0	100.0	100.0
A-28	Cu Ro Conc	34.1	9.99	8.11	28.7	4.09	3.17	9.30	5.41	2.81	74.22	8.08
	Cu Ro Tls	968.8	3.43	4.99	34.9	0.05	1.27	90.70	94.59	97.19	25.78	91.92
	CALCHEAD	1002.9	3.65	5.10	34.7	0.19	1.33	100.0	100.0	100.0	100.0	100.0

NOTE ON P_{80}'s of tests A-8, A-15 and A-24

P_{80} = 33.1 μ for A-8

= 31.6 μ for A-15

= 32.5 μ for A-24

METALLURGICAL BALANCE

2EF Cu Locked Cycle Test C-2

- bulk grind and rougher - first cleaner open

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%)					DISTRIBUTION (%)				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
2EF locked cycle test	Cu_{CC_3} I	3.01	5.60	1.05	33.3	6.55	1.62	0.08	0.01	0.05	2.27	0.07
	II	4.64	7.43	0.96	32.9	6.74	2.28	0.17	0.02	0.08	3.60	0.14
-6 cycles	III	8.87	4.22	0.79	33.8	6.63	1.56	0.18	0.02	0.16	6.77	0.19
BULK GRIND:	IV	7.68	4.43	0.90	33.9	7.47	2.10	0.16	0.02	0.14	6.60	0.22
	V	9.13	4.66	0.98	33.4	7.19	2.09	0.20	0.03	0.16	7.56	0.26
8 kg ore	VI	7.89	6.95	1.23	31.7	8.34	2.86	0.26	0.03	0.13	7.57	0.30
66% solids												
1 kg/tonne Na_2SO_3	Cu_{CT_1} I	18.76	4.91	8.04	31.6	1.96	1.81	0.44	0.53	0.31	4.23	0.46
3 kg/tonne Na_2CO_3	II	16.92	3.98	8.84	31.2	1.71	1.54	0.32	0.52	0.28	3.33	0.35
100 g/tonne Z-11	III	9.98	2.75	13.54	29.3	1.51	1.30	0.13	0.47	0.15	1.73	0.17
75 min grind	IV	12.47	4.09	10.29	30.6	0.99	1.65	0.24	0.45	0.20	1.42	0.28
BULK ROUGHER:	V	16.77	4.01	10.12	30.2	0.98	1.55	0.32	0.59	0.26	1.89	0.35
	VI	16.32	4.43	8.84	31.4	0.77	1.63	0.35	0.50	0.27	1.45	0.36
50 g/tonne Z-11												
pH = 9.5	Cu_{RoTs} (total)	5043.5†	3.99	5.48	37.0	0.08	1.42	96.47	96.61	97.31	46.44	96.20
85.4 g of bulk conc sent to assay, rest used in 6 parts for locked cycle test												
1st clnr: 23 g/tonne Z-11 pH = 9.8	Cu_{CT_2}	15.76	5.20	2.34	34.4	0.90	1.77	0.39	0.13	0.28	1.63	0.37
2nd clnr: 6 g/tonne Z-11 pH = 9.8	Cu_{CT_3}	12.60	4.54	1.15	35.2	2.42	1.73	0.31	0.05	0.23	3.51	0.29
3rd clnr: no Z-11 pH = 9.8	CALCHEAD	52043	4.01	5.50	36.8	0.17	1.43	100.0	100.0	100.0	100.0	100.0
†calculated weight												
average of last two cycles	Cu_{CC_3}	8.51	5.72	1.10	32.6	7.72	2.45	1.40	0.20	0.87	44.54	1.68
	Cu_{CT_1}	16.55	4.22	9.49	30.8	0.88	1.59	2.01	3.29	1.60	9.87	2.12
	Cu_{RoTs}	840.6	3.99	5.48	37.0	0.08	1.42	96.59	96.51	97.53	45.59	96.20
	CALCHEAD	865.7	4.01	5.51	36.8	0.17	1.43	100.0	100.0	100.0	100.0	100.0

METALLURGICAL BALANCE

C-2

2EF Cu Locked Cycle Test - Average by Cycle

ORETYPE and Test Description	SAMPLE	WT%	ASSAYS (%) Pb	Zn	Fe	Cu	Ag	DISTRIBUTION (%) Pb	Zn	Fe	Cu	Ag
cycle I	$CuCC_3$	3.01	5.60	1.05	33.3	6.55	1.62	0.49	0.07	0.32	15.93	0.40
	$CuCT_1$	18.76	4.91	8.04	31.6	1.96	1.81	2.66	3.17	1.86	29.72	2.76
	$CuRoTls$	840.6*	3.99	5.48	37.0	0.08	1.42	96.85	96.77	97.82	54.35	96.85
	CALCHEAD	862.4	4.02	5.52	36.9	0.14	1.43	100.0	100.0	100.0	100.0	100.0
cycle II	$CuCC_3$	4.64	7.43	0.96	32.9	6.74	2.28	1.00	0.09	0.48	24.54	0.86
	$CuCT_1$	16.92	3.98	8.84	31.2	1.71	1.54	1.95	3.14	1.66	22.70	2.12
	$CuRoTls$	840.6*	3.99	5.48	37.0	0.08	1.42	97.05	96.76	97.86	52.76	97.02
	CALCHEAD	862.2	4.01	5.52	36.9	0.15	1.43	100.0	100.0	100.0	100.0	100.0
cycle III	$CuCC_3$	8.87	4.22	0.79	33.8	6.63	1.56	1.09	0.15	0.95	41.67	1.13
	$CuCT_1$	9.98	2.75	13.54	29.3	1.51	1.30	0.80	2.85	0.92	10.68	1.06
	$CuRoTls$	840.6*	3.99	5.48	37.0	0.08	1.42	98.10	97.01	98.13	47.65	97.80
	CALCHEAD	859.5	3.98	5.53	36.9	0.16	1.42	100.0	100.0	100.0	100.0	100.0
cycle IV	$CuCC_3$	7.68	4.43	0.90	33.9	7.17	2.10	0.99	0.15	0.82	41.89	1.31
	$CuCT_1$	12.47	4.09	10.29	30.6	0.99	1.65	1.48	2.71	1.20	9.01	1.67
	$CuRoTls$	840.6*	3.99	5.48	37.0	0.08	1.42	97.53	97.15	97.98	49.10	97.02
	CALCHEAD	860.8	4.00	5.51	36.9	0.16	1.43	100.0	100.0	100.0	100.0	100.0
cycle V	$CuCC_3$	9.13	4.66	0.98	33.4	7.19	2.09	1.23	0.19	0.96	43.96	1.54
	$CuCT_1$	16.77	4.01	10.12	30.2	0.98	1.55	1.94	3.55	1.59	11.01	2.10
	$CuRoTls$	840.6*	3.99	5.48	37.0	0.08	1.42	96.83	96.27	97.46	45.03	96.36
	CALCHEAD	866.5	4.00	5.52	36.9	0.17	1.43	100.0	100.0	100.0	100.0	100.0

* % of calc. $CuRoTls$ weight

METALLURGICAL BALANCE

C-2

2EF Cu Locked Cycle Test - Last Cycle Met. Balance and Bulk Rougher Met. Balance

ORETYPE and Test Description	SAMPLE	WTS	ASSAYS (%)					DISTRIBUTION (%)				
			Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
cycle VI	$CuCC_3$	7.89	6.95	1.23	31.7	8.34	2.86	1.58	0.20	0.78	45.19	1.82
	$CuCT_1$	16.32	4.43	8.84	31.4	0.77	1.63	2.08	3.03	1.61	8.63	2.14
	CuRoTls	840.6*	3.99	5.48	37.0	0.08	1.42	96.35	96.77	97.61	46.18	96.04
+ 1/6 of calc. CuRoTls weight	CALCHEAD	864.8	4.03	5.50	36.8	0.17	1.44	100.0	100.0	100.0	100.0	100.0
BULK test B-4: 8kg 2EF ore Bulk grind Bulk rougher for test C-2 above	CuRoConc	*246.2	4.74	5.94	34.8	3.16	2.00	3.65	3.34	2.91	55.74	4.30
	CuRoTls	7722.0	3.99	5.48	37.0	0.08	1.42	96.35	96.66	97.09	44.26	95.70
*calculated weight	CALCHEAD	7968.2	4.01	5.49	36.9	0.18	1.44	100.0	100.0	100.0	100.0	100.0

NOTE: calculated weights

8.0 kg ore ground

7722.0g collected as CuRoTls

246.2g collected as CuRoConc

-85.4g of this conc → assay

-160.8g (remainder) used in 6 parts for the C-2 locked cycle test

AND $\frac{160.8}{246.2}$ = ratio used to calculate CuRoTls weight

D. Cu/Pb Separation From Cu/Pb Rougher Conc — June 2, 1983

Pb Cleaning

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Ag	Cu	DISTRIBUTION Pb	Zn	Fe	Ag	Cu
1.	2BCD Std. Pb cleaning circuit. – No NaCN to regrind	$PbCC_3$	7.7	57.70	4.17	6.6	22.09	4.83	16.50	7.17	3.11	16.87	21.62
		$PbCT_3$	8.3	44.10	6.91	9.8	16.91	4.87	13.58	12.81	4.97	13.92	23.49
		*$PbCC_2$	16.0	50.65	5.54	8.26	19.40	4.85	30.09	19.98	8.08	30.79	45.11
		$PbCT_2$	13.3	31.10	5.90	14.1	11.78	2.40	15.36	17.52	11.47	15.54	18.55
		*$PbCC_1$	29.3	41.77	5.73	10.9	15.94	3.74	45.45	37.50	19.55	46.33	63.66
		$PbCT_1$	72.7	20.20	3.85	18.1	7.44	.86	54.54	62.50	80.45	53.66	36.34
		Heads	102.0	26.40	4.39	16.03	9.88	1.69	100.00	100.00	100.00	100.00	100.00
2.	2BCD Std Pb cleaning circuit – 50 g/t NaCN to regrind	$PbCC_3$	6.6	71.70	1.03	2.9	26.11	1.47	17.74	1.55	1.19	17.55	5.59
		$PbCT_3$	7.2	55.60	2.09	7.2	20.58	2.80	15.01	3.44	3.23	15.09	11.62
		*$PbCC_2$	13.8	63.30	1.58	5.14	23.22	2.16	32.75	4.99	4.42	32.64	17.21
		$PbCT_2$	9.2	31.80	4.11	14.5	11.77	2.56	10.47	8.64	8.31	11.03	13.57
		*$PbCC_1$	23.0	50.70	2.59	8.89	18.64	2.32	43.72	13.63	12.73	43.67	30.78
		$PbCT_1$	77.0	19.50	4.91	18.2	7.18	1.56	56.29	86.37	87.27	56.32	69.22
		Heads	100.0	26.68	4.38	16.06	9.82	1.74	100.00	100.00	100.0	100.00	100.00
3.	2BCD Std Pb cleaning circuit – 100 g/t NaCN to regrind.	$PbCC_3$	7.6	74.00	1.00	2.4	26.06	1.05	21.07	1.68	1.14	20.24	4.72
		$PbCT_3$	6.6	55.20	2.06	6.9	20.16	2.37	13.65	3.00	2.84	13.60	9.26
		*$PbCC_2$	14.2	65.26	1.49	4.44	23.32	1.10	34.72	4.68	3.48	33.84	13.98
		$PbCT_2$	9.5	31.40	4.03	14.2	11.71	2.44	11.18	8.44	8.41	11.32	13.72
		*$PbCC_1$	23.7	51.69	2.51	8.38	18.66	1.64	45.90	13.12	12.39	45.16	27.70
		$PbCT_1$	76.8	18.90	5.13	18.3	6.98	1.59	54.10	86.88	87.61	54.79	72.29
		Heads	100.50	26.56	4.51	15.96	9.74	1.68	100.00	100.00	100.00	100.00	100.00

* Calculated

D. Cu/Pb Separation from Cu/Pb Conc (Ro) June 2, 1983

Pb Cleaning

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Ag	Cu	DISTRIBUTION Pb	Zn	Fe	Ag	Cu
4.	2BCD Std Pb Cleaning circuit - 200 g/T NaCN to regrind	$PbCC_3$	6.4	75.50	1.09	2.0	26.19	.42	17.77	1.56	~80	16.72	1.55
		$PbCT_3$	7.3	61.90	1.87	4.9	22.18	1.13	16.62	3.06	2.25	16.15	4.75
		*$PbCC_2$	13.7	68.25	1.50	3.5	24.05	0.80					
		$PbCT_2$	9.3	31.40	4.18	14.0	11.98	2.28	10.74	8.71	8.171	11.11	12.22
		*$PbCC_1$	23.0	53.35	2.58								
		$PbCT_1$	77.7	19.20	4.51	18.2	7.23	1.82	54.87	86.67	88.78	56.02	81.48
		Heads	100.7	27.00	4.43	15.82	9.94	1.72	100.00	100.00	100.00	100.00	100.00
5.	2BCD Std Pb Cleaning circuit - 500 g/T NaCN to regrind.	$PbCC_3$	6.8	61.40	1.21	1.9	26.08	.33	16.46	1.87	.81	17.97	1.33
		$PbCT_3$	5.1	58.60	3.02	5.5	20.45	.94	11.78	3.50	1.77	10.57	3.00
		*$PbCC_2$	11.9										
		$PbCT_2$	10.2	33.40	6.04	12.7	12.50	1.88	13.43	14.01	8.16	12.92	11.40
		*$PbCC_1$	22.1										
		$PbCT_1$	77.9	19.00	4.55	18.2	7.42	1.82	58.34	80.61	89.26	58.55	84.27
		Heads	100.0	25.37	4.40	15.88	9.87	1.68	102.00	100.00	100.00	100.00	100.00
	2BCD Cu/Pb RoConc generation for tests no D1-D5 Using B-7 scheme	Cu/Pb RoConc	570.60	26.40	4.63	16.0	1.69	10.37	62.82	4.87	9.08	44.79	44.74
		Cu/Pb RoTls	7429.4	1.20	6.94	12.3	.16	.83	37.18	95.13	90.92	55.21	55.21
		Heads	8000.0	3.00	6.78	12.56	.27		100.00	100.00	100.00	100.00	100.00
	2BCD Cu/Pb RoConc generation (not used yet) 1 kg/T Na_2SO_3 150 g/T 2-11 to grind 75 g/T 2-11 to Ro.	Cu/Pb RoConc	753.6	23.40	6.21	15.4	9.19	1.39	76.44	8.58	11.95	60.27	45.96
		Cu/Pb RoTls	7246.4	.75	6.88	11.8	.63	.17	23.56	91.42	88.05	39.73	54.04
		Heads	8000.0	2.88	6.82	12.14	1.44		100.00	100.00	100.00	100.00	100.00

* Calculated

B

Cu Pre-float

June 1, 1983

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
9.	2BCD	CuCC1	12.2	11.70	12.58	15.1	9.49	7.20	4.69	2.17	1.45	40.65	1.22
	-same as no.7	CuCT1	36.9	8.09	9.61	10.4	.46	3.16	9.80	5.02	3.01	5.96	3.64
	but no $K_2Cr_2O_7$	*CuRoConc	49.1	8.99	10.35	11.6	2.70	4.16	14.49	7.19	4.46	46.61	4.91
	-low Z-11 used (70 g/T in whole circuit)	CuROTls	950.3	2.74	6.90	12.8	.16	1.50	85.51	92.81	95.54	53.39	95.09
		Heads	999.4	3.05	7.07	12.74	.28	1.63	100.00	100.00	100.00	100.00	100.00
10.	2BCD	CuCC1	17.5	11.90	11.48	15.2	7.01	6.76	6.90	2.84	2.17	40.74	7.32
	-same as no.7	CuCT1	112.1	19.60	8.15	13.4	.28	7.43	72.77	12.93	12.28	10.42	51.50
	but with 2 kg/T Na_2SO_3	*CuRoCon	129.6	18.56	8.60	13.6	1.19	7.34	79.67	15.77	14.45	51.16	5882
	No $K_2Cr_2O_7$	CuROTls	864.9	.71	6.88	12.1	.17	.77	20.34	84.22	8555	48.83	41.18
		Heads	994.5	3.04	7.10	12.3	.30	1.63	100.00	100.00	100.00	100.00	100.00

* calculated

2EF Cu Tests to "Duplicate" 1972 and 1977 tests

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
E-1	2kg ore	Cu Ro Conc	23.3	8.88	7.94	33.4	1.19	2.62	2.67	1.79	1.01	7.37	2.45
	grind: 1250g/tonne Na_2CO_3	Cu Sc Conc	48.5	14.98	7.09	30.1	3.57	4.25	9.39	3.34	1.89	46.04	8.26
	1250g/tonne Na_2SO_3	Pb Ro Conc	102.9	45.20	4.23	19.1	0.18	11.32	60.09	4.22	2.54	4.93	46.61
"1972"	50g/tonne Z-11	Pb Sc Conc	38.3	29.10	6.77	24.8	0.34	8.05	14.40	2.51	1.23	3.46	12.36
	Cu Ro Conc 1 min at pH = 9.5	TIs	179.58	0.58	5.06	40.2	0.08	0.42	13.46	88.13	93.34	38.20	30.24
	Cu Sc Conc 4 min												
	Pb Ro Conc: 75g/tonne NaCN, 17.5g/tonne Z-11, 4.5 min												
	Pb Sc Conc: 12.5g/tonne Z-11, 5 min	CALCHEAD		3.85	5.13	38.5	0.19	1.24	100.0	100.0	100.0	100.0	100.0
E-2	as E-1 with	Cu Ro Conc	32.8	8.63	7.04	31.8	6.23	3.01	3.74	2.23	1.35	47.77	4.13
	Minerec 1661	Cu Sc Conc	31.0	25.10	8.28	24.7	3.39	6.82	10.29	2.48	0.99	24.57	8.85
	in place of Z-11	Pb Ro Conc	29.8	28.30	6.50	26.0	0.10	7.16	11.16	1.87	1.00	0.70	8.93
"1972"	throughout.	Pb Sc Conc	27.5	26.70	6.49	26.7	0.08	6.80	9.71	1.72	0.95	0.51	7.83
		TIs	188.54	2.61	5.04	39.3	0.06	0.89	65.09	91.70	95.71	26.45	70.25
		CALCHEAD		3.77	5.16	38.6	0.21	1.19	100.0	100.0	100.0	100.0	100.0
E-3	as E-1 with	Cu Ro Conc	31.0	8.32	7.06	32.0	6.87	2.85	3.25	1.98	1.29	51.05	3.26
	Minerec 1661	Cu Sc Conc	28.2	25.40	8.50	24.0	3.71	6.99	9.02	2.17	0.88	25.08	7.27
"1972"	in place of Z-11	Pb Ro Conc	85.9	61.00	3.34	11.3	0.06	15.34	65.95	2.60	1.26	1.24	48.63
	in grind only	Pb Sc Conc	26.8	22.80	8.41	28.0	0.10	6.35	7.69	2.04	0.97	0.64	6.28
		TIs	1835.7	0.61	5.49	40.2	0.05	0.51	14.09	91.21	95.61	22.00	34.55
		CALCHEAD		3.96	5.50	38.5	0.21	1.35	100.0	100.0	100.0	100.0	100.0

2EF Cu Tests to "Duplicate" 1972 and 1977 tests

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS Pb	Zn	Fe	Cu	Ag	DISTRIBUTION Pb	Zn	Fe	Cu	Ag
E-4	2kg ore												
	grind: 1.75kg/tonne Na_2CO_3 1.0kg/tonne Na_2SO_3 35g/tonne Z-11	PbR_1	21.2	18.60	6.51	29.5	2.02	4.98	4.90	1.34	0.82	11.27	3.83
	PbR_1: 1min at pH=10.1	PbR_2	56.6	33.90	5.44	22.9	2.47	8.82	23.86	2.98	1.70	36.80	18.12
	PbR_2: 4min	$PbSc_1$	24.4	45.20	4.44	18.2	0.39	11.70	13.72	1.05	0.58	2.51	10.36
"1977"	$PbSc_1$: 20g/tonne NaCN 10g/tonne Z-11 1min	$PbSc_2$	34.7	30.70	6.06	25.1	0.46	8.04	13.25	2.04	1.14	4.20	10.13
	$PbSc_2$: 3min	$PbSc_3$	33.8	27.00	6.56	25.9	0.76	7.47	11.35	2.15	1.15	6.76	9.17
	$PbSc_3$: 10g/tonne Z-11 3min	PbScTls	1825.9	1.45	5.11	39.5	0.08	0.73	32.92	90.44	94.61	38.45	48.39
		CALCHEAD		4.03	5.17	38.2	0.19	1.38	100.0	100.0	100.0	100.0	100.0

2EF Cu Pre-float tests

	ORETYPE and Test Description	SAMPLE	WTS	ASSAYS					DISTRIBUTION				
				Pb	Zn	Fe	Cu	Ag	Pb	Zn	Fe	Cu	Ag
A-13	2kg ore at 66% solids grind: 3kg/tonne Na_2CO_3 1kg/tonne Na_2SO_3 100g/tonne Z-11 rougher: 50g/tonne Z-11 pH = 9.9 1st cleaner: 30g/tonne Z-11 pH = 9.6	Cu CC1	63.4	60.90	2.22	9.6	4.18	15.29	50.51	1.34	0.82	61.82	37.56
		Cu CT1	26.8	14.32	10.55	28.4	1.09	4.23	5.02	2.70	1.03	6.81	4.39
		calc Cu Ro Conc	90.2	47.06	4.70	15.2	3.26	12.00	55.53	4.04	1.85	68.63	41.95
		Cu Ro Tls	1920.5	1.77	5.23	37.8	0.07	0.78	44.47	95.95	98.15	31.36	58.04
		CALCHEAD	2010.7	3.80	5.21	36.8	0.21	1.28	100.0	100.0	100.0	100.0	100.0
A-14	as A-13 with KAX in place of Z-11												
		Cu CC1	106.8	51.70	3.04	13.4	2.70	13.44	72.20	3.05	1.94	68.13	56.90
		Cu CT1	45.9	14.27	8.64	29.7	0.91	4.22	8.56	3.73	1.85	9.87	7.68
		calc Cu Ro Conc	152.7	40.45	4.72	18.3	2.16	10.67	80.76	6.78	3.79	78.00	64.58
		Cu Ro Tls	1861.8	0.79	5.33	38.1	0.05	0.48	19.23	93.22	96.21	22.00	35.42
		CALCHEAD	2014.5	3.80	5.28	36.6	0.21	1.25	100.0	100.0	100.0	100.0	100.0