FLOTATION RESPONSE OF VANGORDA ORE

DETAILED TESTWORK

VANGORDA PLATEAU - YUKON TERRITORY

006720

SUMMARY

Shown below are the predicted plant results for the treatment of Vangorda ores in the modified Cyprus Anvil Concentrator. The results refer to the plant operation at about 50 μm K_{80} flotation feed. Concentrate grind levels are shown with the predicted metallurgical results.

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KM050

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Predicted Metallurgical Results by Ore Type

Type G - Baritic High Grade Ore

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	2	800	55	-	45	75	84	-
Zinc Concentrate	0.5	65	-	52	-	-	-	85

Lead Concentrate K_{80} 20 µm Zinc Concentrate K_{80} 19 µm * g/tonne

Type E - Pyritic Ore

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	5.5	485	50	-	40	50	78	-
Zinc Concentrate	1.9	65	-	50	-	-	-	82

Lead Concentrate K_{80} 25 µm Zinc Concentrate K_{80} 20 µm * g/tonne

Type A - Graphitic Quartzite

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	3.0	500	45	-	25	65	83	-
Zinc Concentrate	0.8	45	-	51	-	-	-	83

Lead Concentrate K_{80} 20 µm Zinc Concentrate K_{80} 20 µm * g/tonne

Type BCD - Pyritic Quartzite

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	8.9	580	51	-	35	60	86	-
Zinc Concentrate	4.5	33	-	49	-	-	-	83

Lead Concentrate K_{80} 23 µm Zinc Concentrate K_{80} 22 µm * g/tonne

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INTRODUCTION

During 1979 and 1980, preliminary investigations were carried out to determine the probable metallurgical response of the Vangorda ore types 4G, 4E and 4A. The results of the program were detailed in our reports KM007 and KM010 respectively, and showed that at a fine grind acceptable metallurgy could be obtained.

The tests performed in the preliminary program were open circuit cleaner tests. Metallurgical projections were made by re-arrangement of the metal in the cleaner tailings using approximation techniques. A more accurate model for the behavior of an ore in a treatment plant may be obtained by performing cycle tests which simulate the re-circulation of intermediate products.

Accordingly, new composites of the Vangorda ore types were prepared to permit cycle tests to be performed. A new ore type was later included in the suite of samples to be evaluated - type 4BCD, a pyritic quartzite of relatively low grade. A detailed chemical analysis of the ore types involved is shown in Table 1.

TABLE 1

Chemical Composition of Head Sample

Sample	Assays %									
	Au*	Ag*	Pb	Zn	Cu	Fe	Po	Hg*	As	Sb
Type 4A	.69	44	2.85	4.40	.06	11.3	1.2	26	.23	.01
Type 4BCD	.96	33	2.00	3.57	.22	22.6	9.6	22	.12	.01
Type 4E	.69	50	3.15	4.30	.14	31.6	6.7	22	.05	.01
Type 4G	.27	66	3.62	6.90	.05	15.0	3.2	61	.05	.01

* g/tonne

The program objectives were to evaluate the probable performance of the Cyprus Anvil mill when treating the individual ore types. In addition to the cycle tests, some preliminary familiarization tests were needed on all types, especially type BCD which had not previously been examined. Bond tests were required to determine the resistance of the various ore types to grinding, and some ultra-fine sizing tests were also carried out.

Approval for the program was received in February 1981 from Mr. L. P. Taggart of Cyprus Anvil Mining Corporation. Samples were composited, acting on instructions from Mr. D. Hanson of Cyprus Anvil. Test work commenced in April and was completed in October.

ANALYSIS AND DISCUSSION OF RESULTS

The results of the test program are presented in four sections, each dealing with one specific ore type. First the results of the preliminary tests were examined and then the projected results from the cycle testing.

A metallurgical balance for each ore type was developed from the results of the cycle testing using a determinant technique. Distributions of other elements of interest are also shown. These distributions were derived by making use of special assays performed on the cycle test concentrates. (Appendix VI)

Reference is also made to other factors which might influence plant results such as the Bond index of the ore and the effects of regrinding. Sizing data for the grind effects tests are to be found in Appendix IV.

1. Type 4G - Baritic High Grade Ore

Preliminary Tests

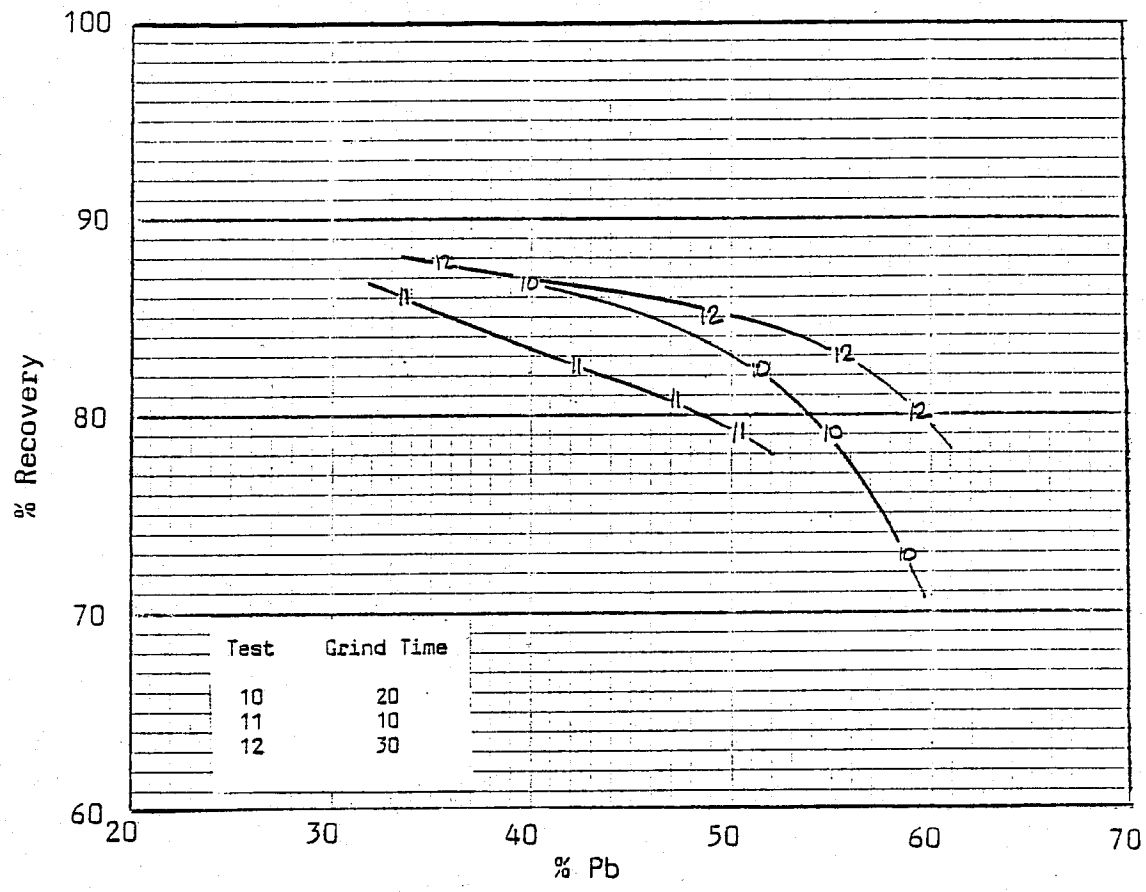
Five preliminary tests examined the effects of primary grind, regrinding and the effects of sodium sulphite. As expected, finer primary grind improved lead and zinc metallurgy significantly, (Graphs 1 and 2), although there are indications that zinc metallurgy reaches an apparent maximum at 20-min. grind.

Increased regrinding also marginally improves lead metallurgy although zinc recovery declines: a normal effect unless collector quantities are increased in the cleaner circuits (Graphs 3 and 4).

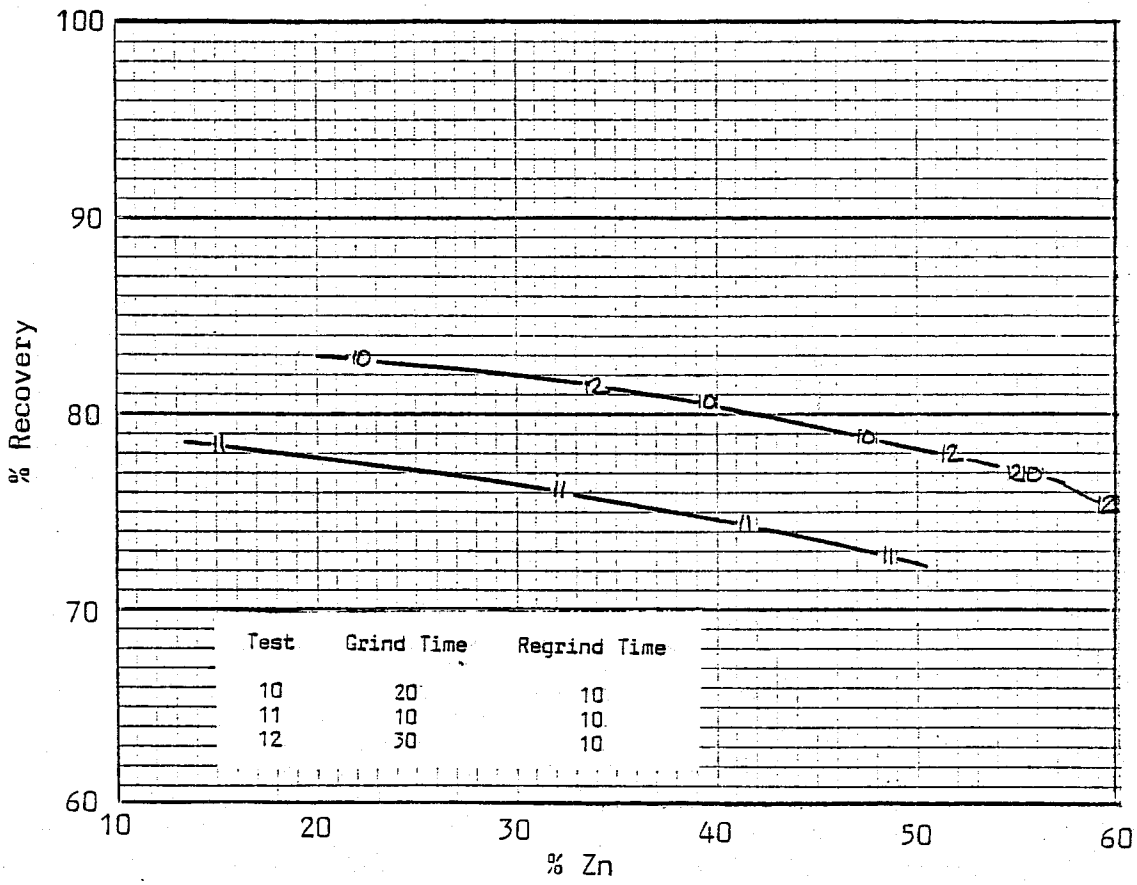
Most of the preliminary tests were carried out with a soda-ash cyanide circuit but in one test sodium sulphite was tested (Graphs 5 and 6). Sodium sulphite appeared to reduce both lead and zinc recovery.

GRAPH 1

Type G - Grind Effects

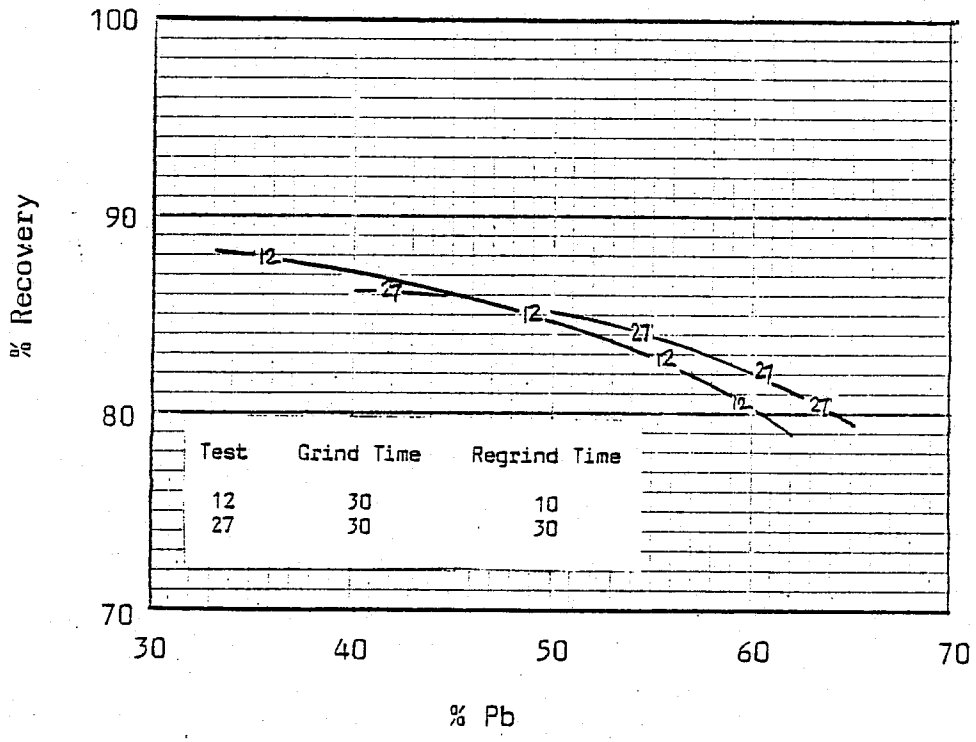


GRAPH 2

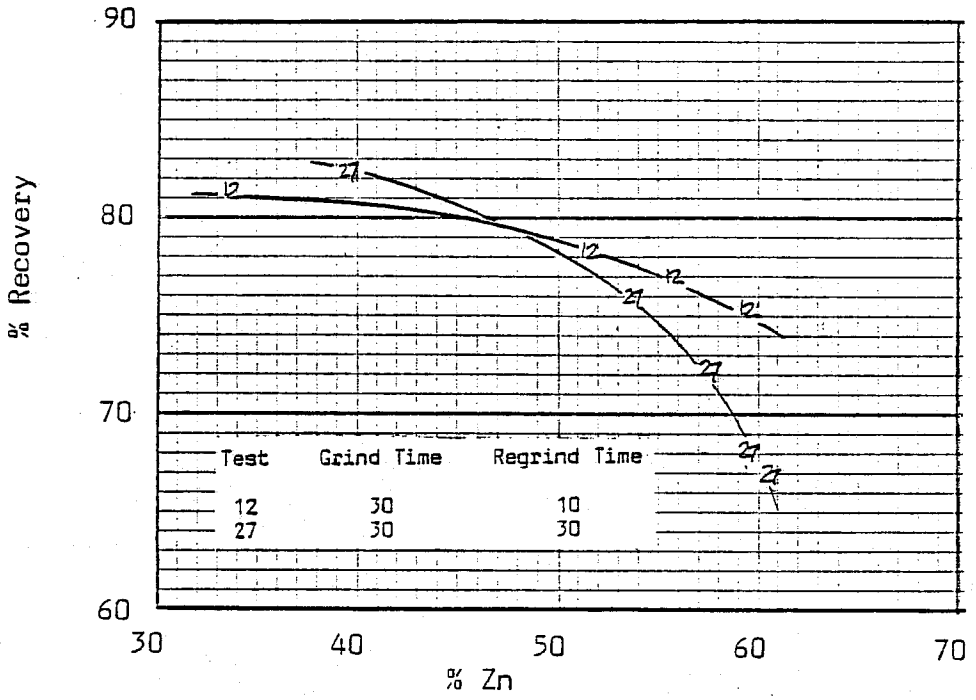


GRAPH 3

Type G - Regrind Effects

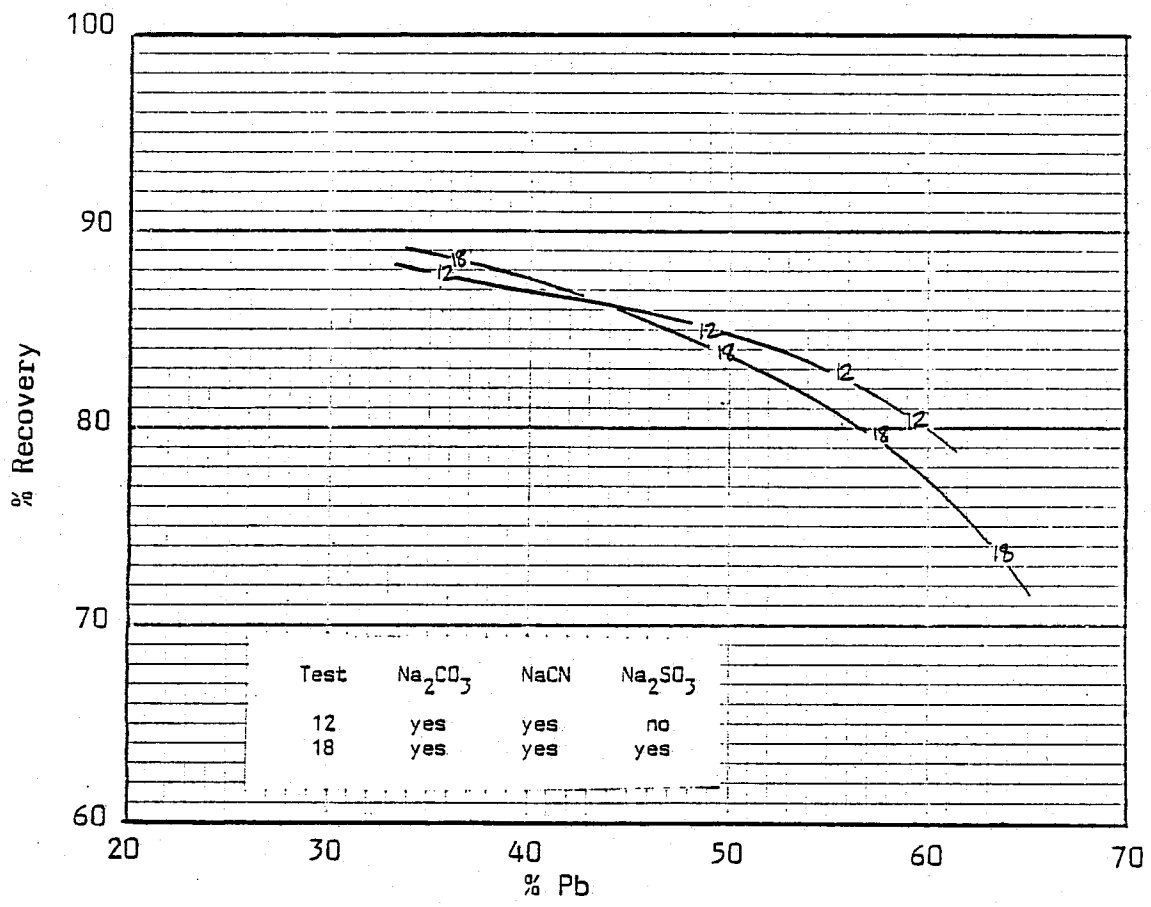


GRAPH 4

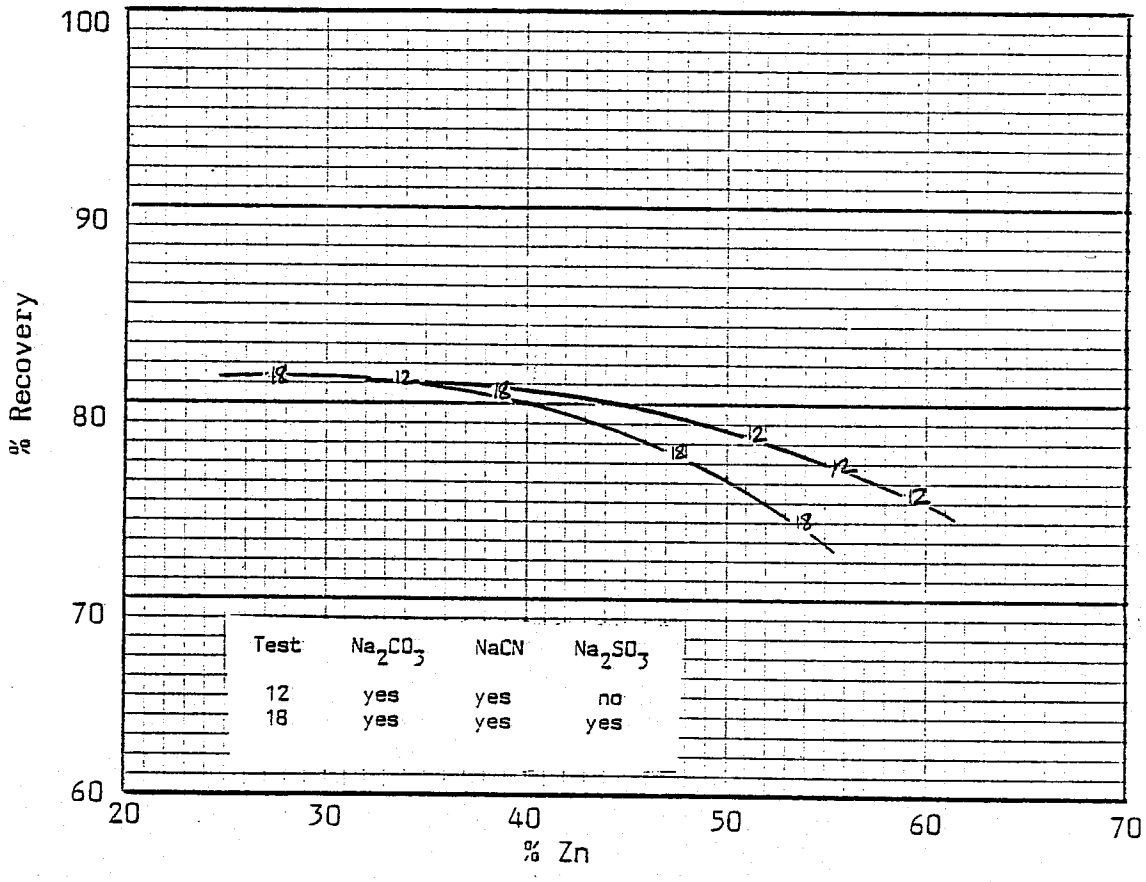


GRAPH 5

Type G - Reagent Effects



GRAPH 6



Cycle Test

Two cycle tests were performed on this sample but only one reached steady state conditions (Test 21). It is believed that the results derived at steady state from this test are somewhat pessimistic, and it would be realistic to anticipate higher lead and possibly zinc concentrate grades.

TABLE 2

Projected Results - Test 21

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	3.56	6.78	100.0	100.0
Lead Concentrate	5.85	50.1	13.5	82.3	11.7
Zinc Concentrate	10.7	1.82	52.1	5.5	82.2
Tails	82.64	0.52	0.50	12.2	6.1

Since plant performance would probably result in slightly better metallurgy (Test 24) the predicted plant results are shown below in Table 3.

TABLE 3

Predicted Plant Results - Type G

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	2	800	55	-	45	75	84	-
Zinc Concentrate	0.5	65	-	52	-	-	-	85

* g/tonne

2. Type 4E - Pyritic Ore

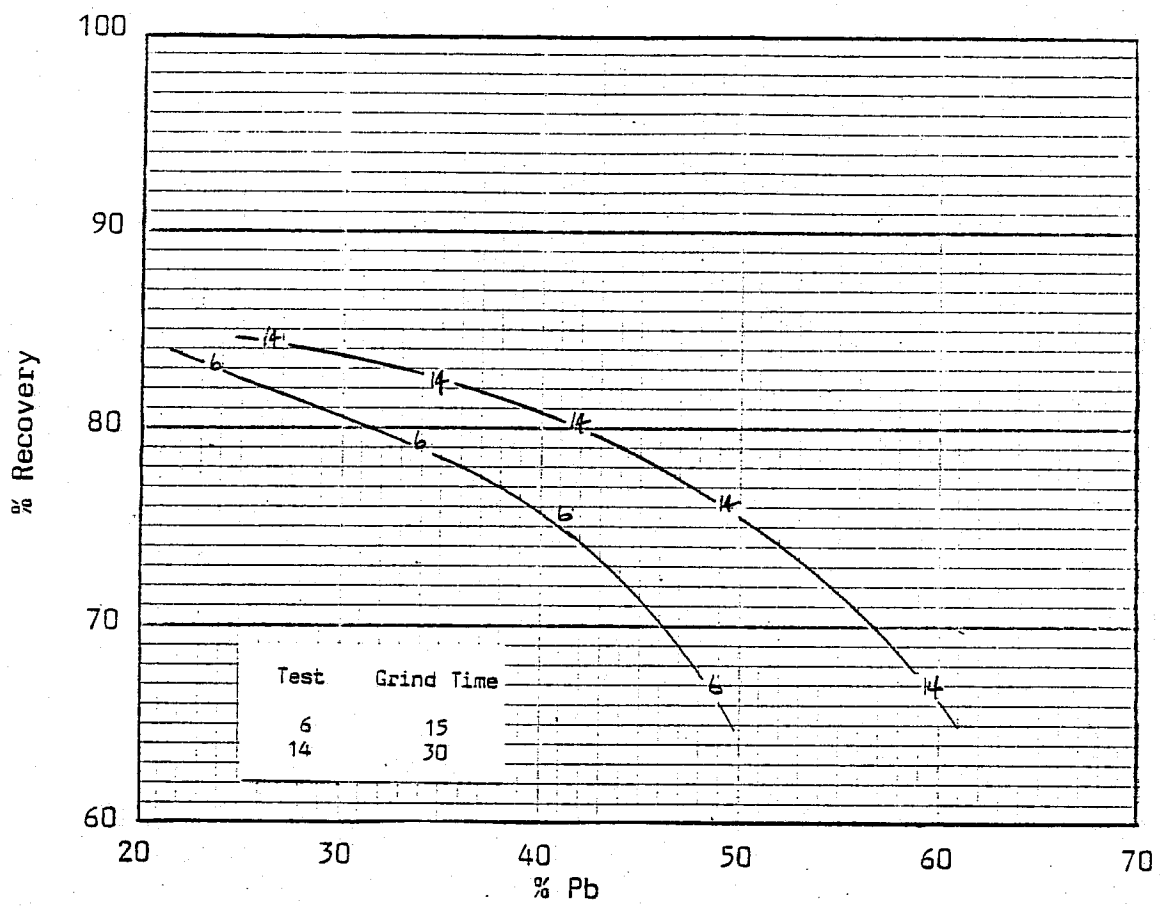
Preliminary Tests

The preliminary tests were carried out on the pyritic ore, principally to determine if the iron pyrite rejection could be improved from the lead concentrate. The grind effects tests showed that the usual improvement occurred as the primary grind became finer (Graphs 7 and 8). The regrinding tests showed that a substantial metallurgical improvement would occur with increased regrinding times - a strong indication that a significant amount of the particles in the rougher concentrate are locked (Graphs 9 and 10).

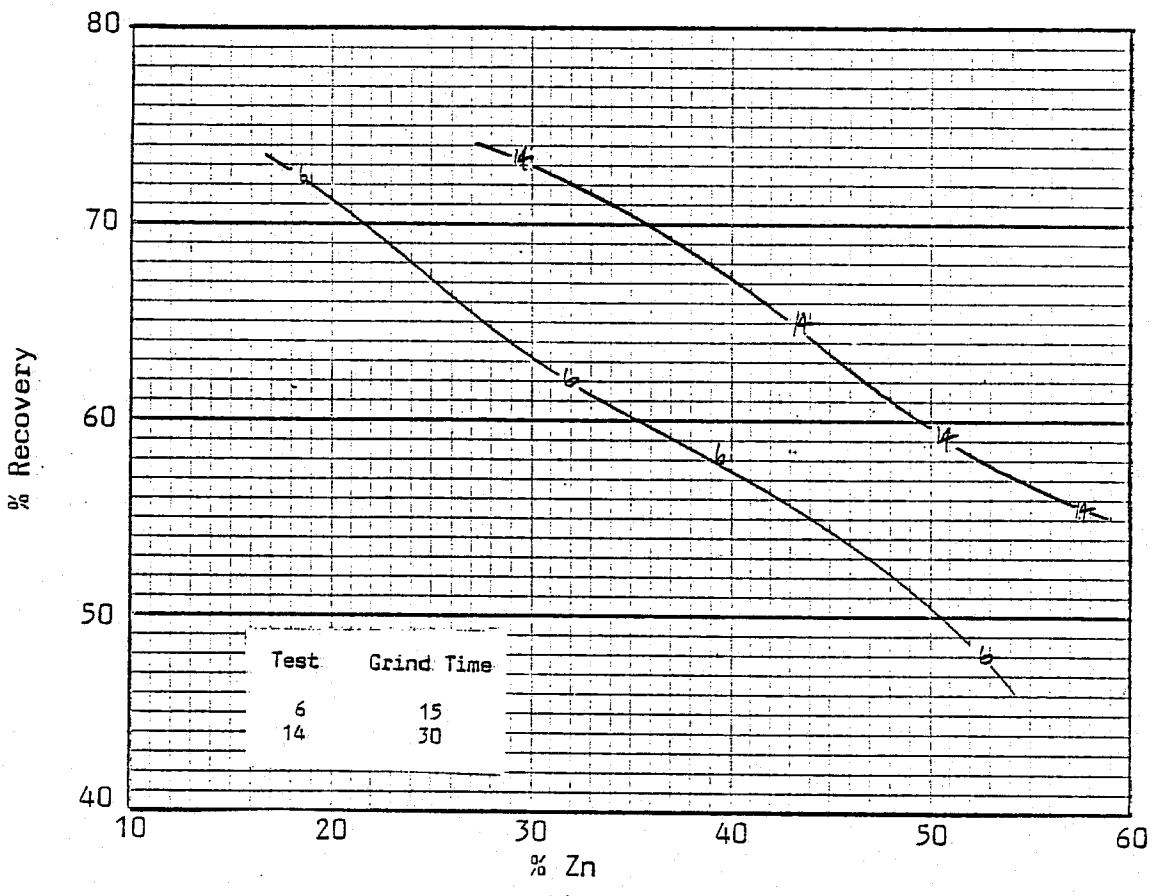
Sodium sulphite testing indicated that metal recoveries would suffer using sulphite in the grinding circuit (Graphs 11 and 12).

GRAPH 7

Type E - Grind Effects

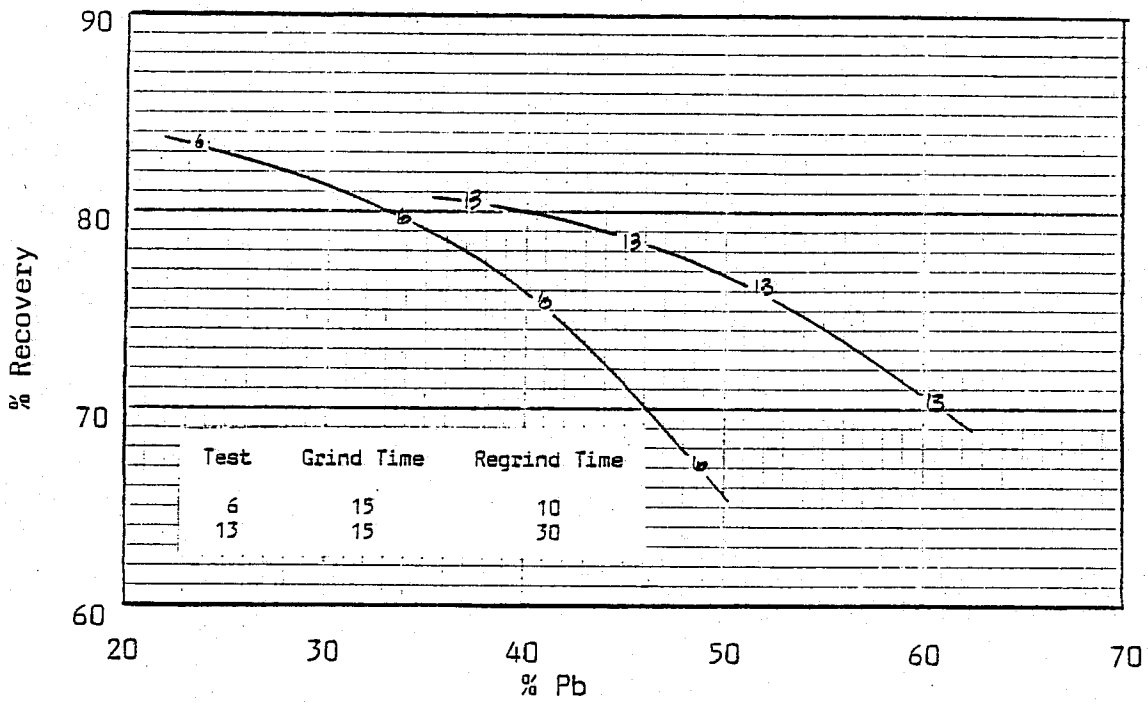


GRAPH 8

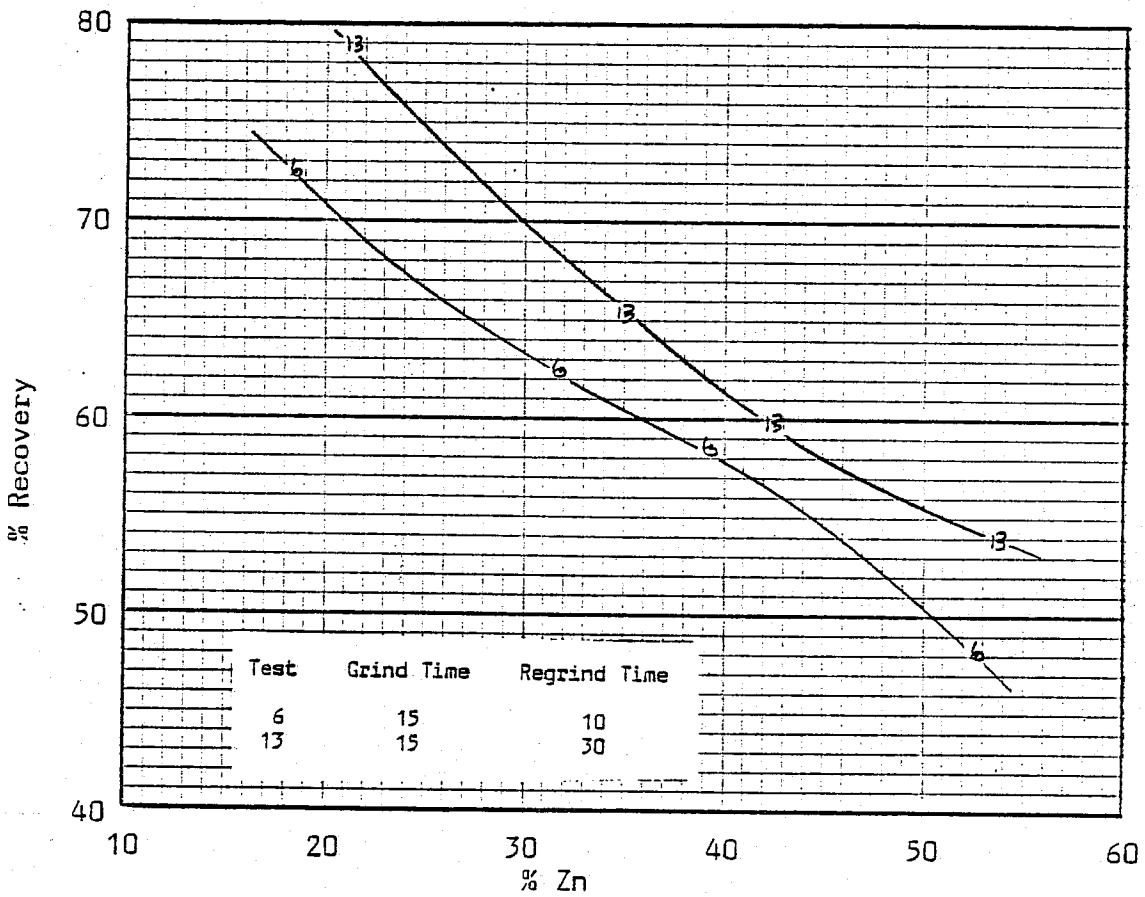


GRAPH 9

Type E - Regrind Effects

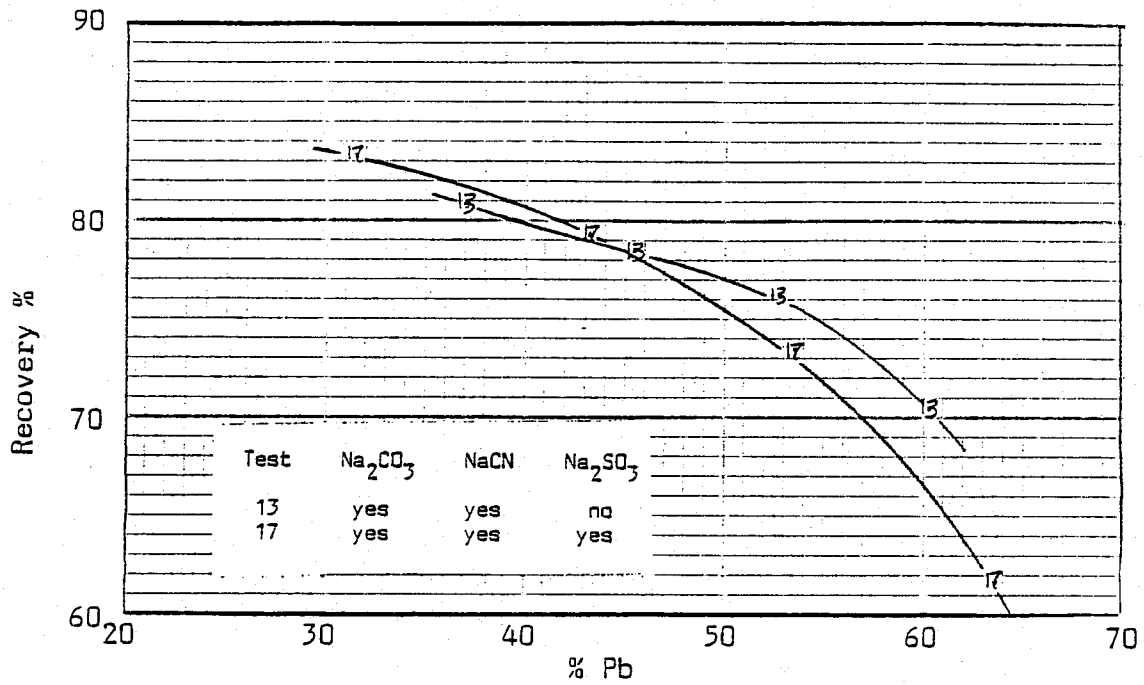


GRAPH 10



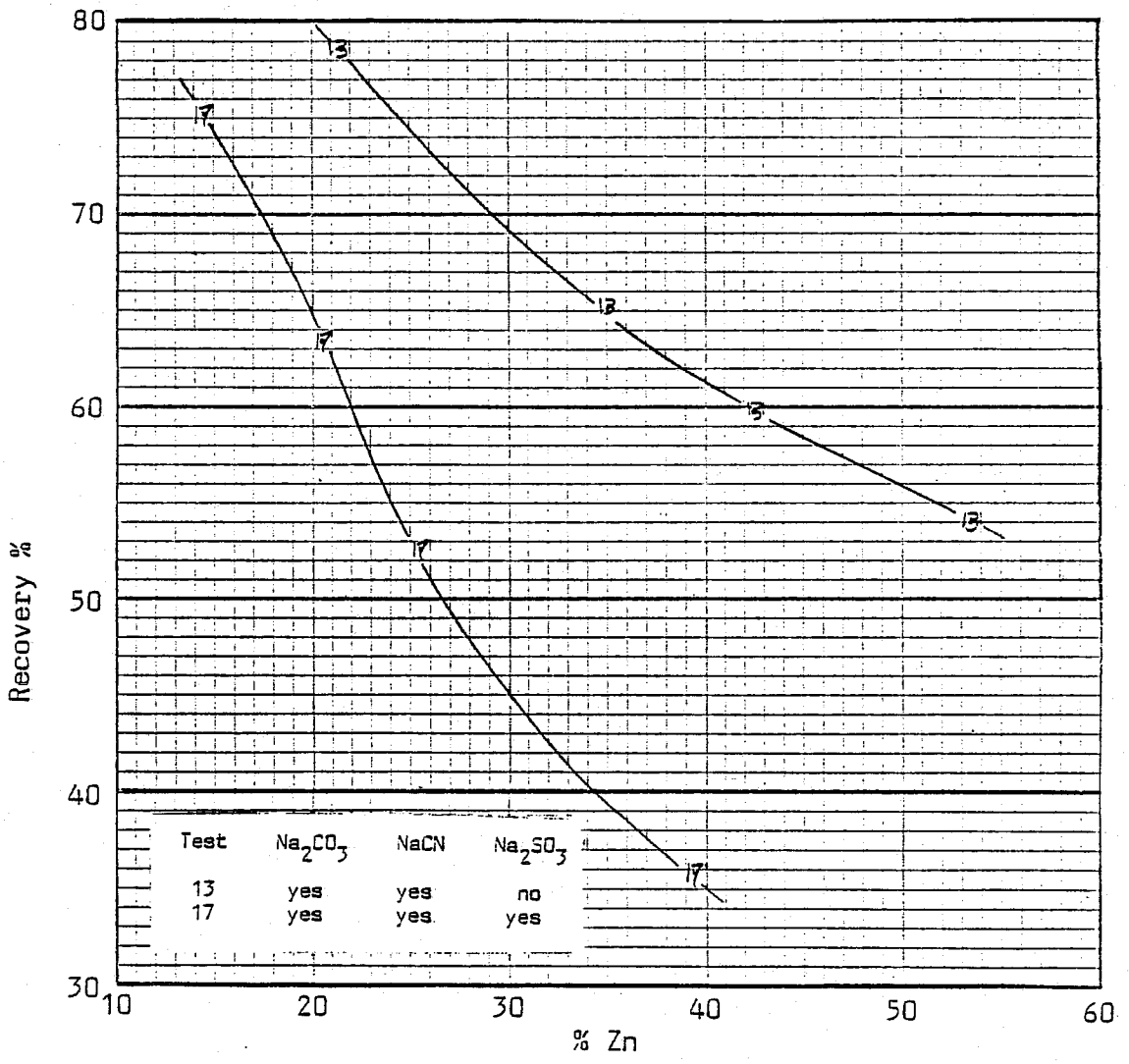
GRAPH 11

Type E - Sodium Sulfite Effects



GRAPH 12

Sodium Sulfite Effect on Zinc Metallurgy



Cycle Test

Stability problems marred the final stages of this test especially in cycle 4. Despite these problems, however, the test was completed and the results are shown below.

TABLE 4

Projected Results - Test 22

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	3.43	4.27	100.0	100.0
Lead Concentrate	5.11	49.8	8.15	74.2	9.8
Zinc Concentrate	6.65	2.46	48.9	4.8	76.2
Tails	88.24	0.82	0.68	21.0	14.0

With a more stable operation and better control of the recirculating loads it would be reasonable to anticipate improvements in lead recovery and zinc grade. Possibly, increasing the regrinding times would significantly improve both concentrate grades.

TABLE 5

Predicted Plant Results - Type E

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	5.5	485	50	-	40	50	78	-
Zinc Concentrate	1.9	65	-	50	-	-	-	82

* g/tonne

The potential for improvements in metallurgy by improving test conditions are considered very high for this ore type.

3. Type 4A - Graphitic Quartzite

Preliminary Tests

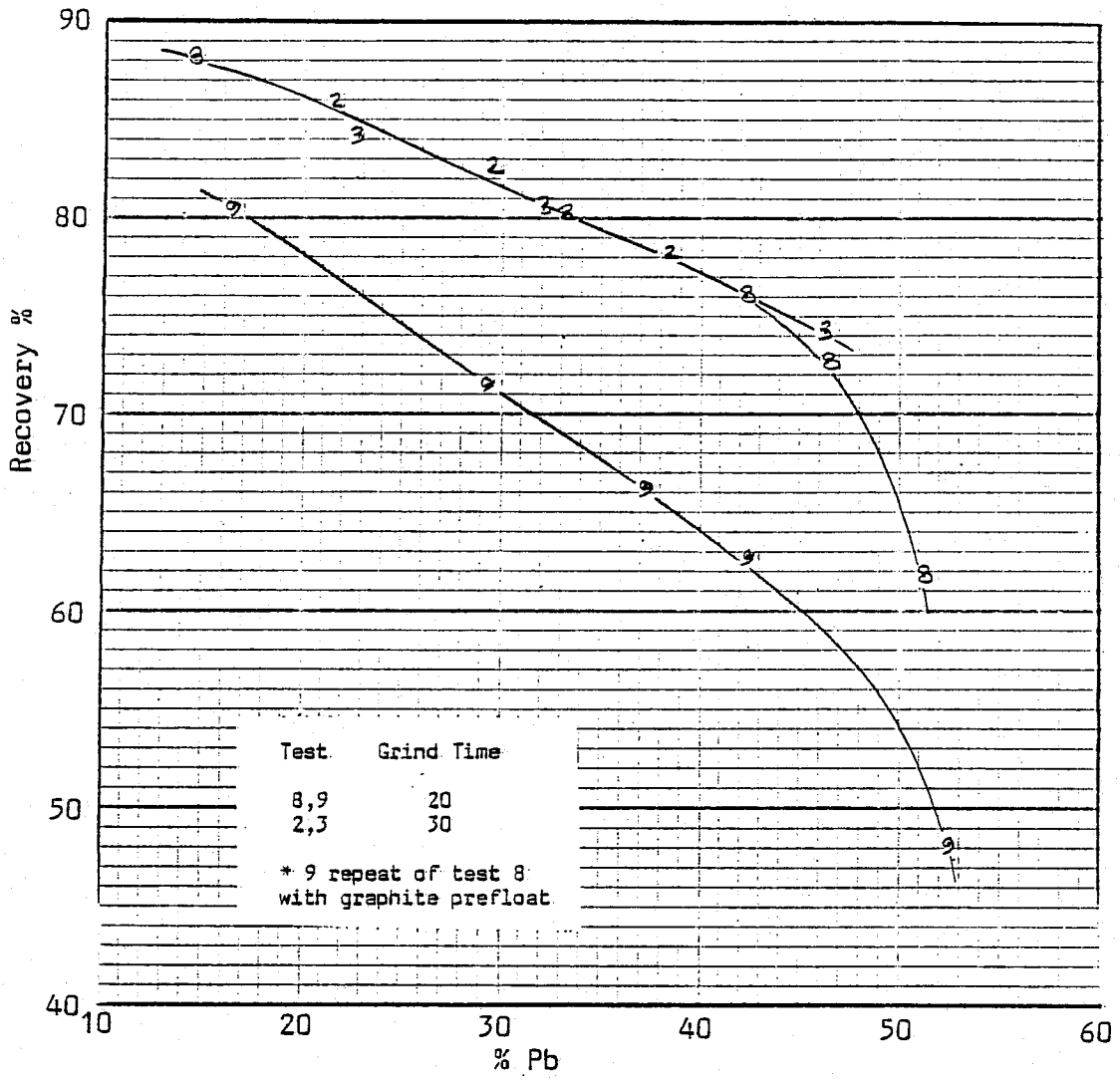
The sample provided for testing was laden with graphite and was representative of the most extreme form of graphitic quartzite. Very high reagent additions were required to maintain adequate froth conditions with subsequent deleterious effects on selectivity.

The effects of finer grinding were masked by the very persistent graphite flotation in the lead circuit. Finer grinding did, however, improve zinc metallurgy slightly (Graphs 13 and 14).

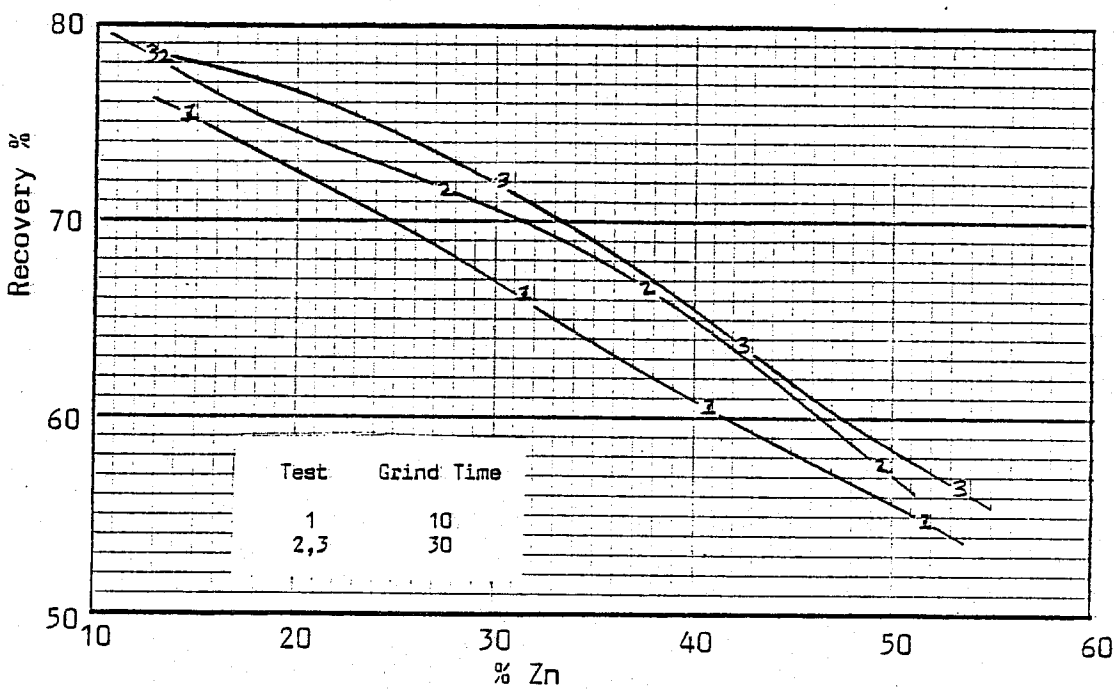
The regrinding effects were very pronounced, again suggesting that at the grind used, much of the rougher concentrate was in the form of locked particles (Graphs 15 and 16).

GRAPH 13

Type A - Grind Effects

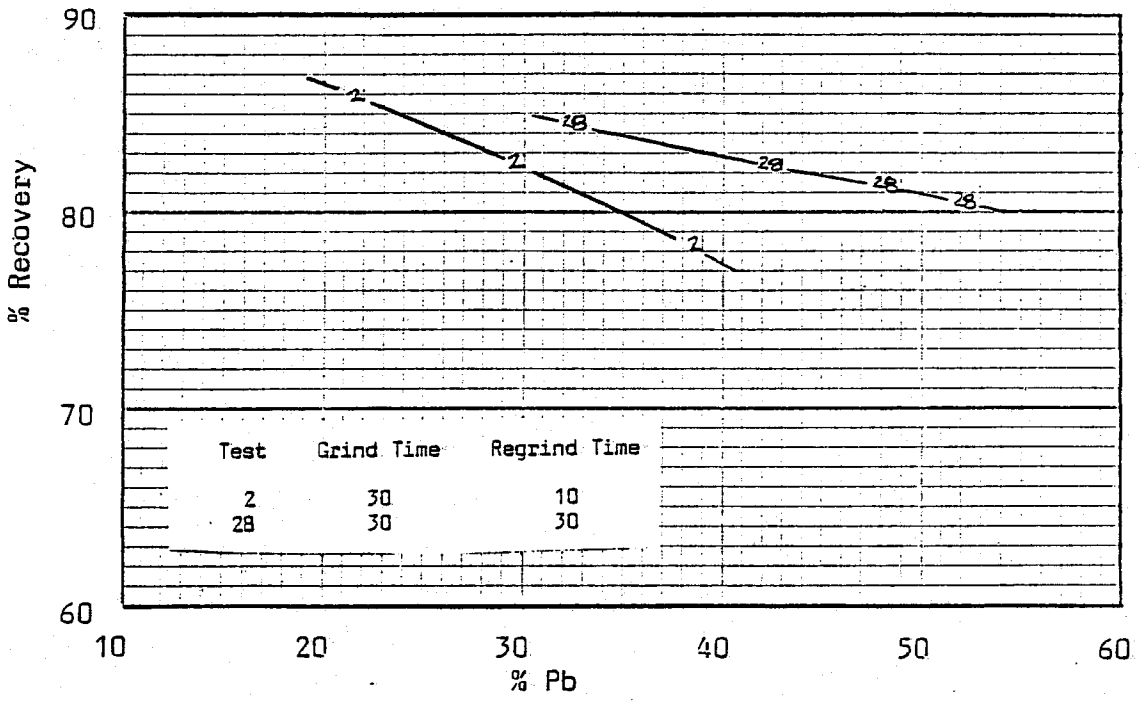


GRAPH 14

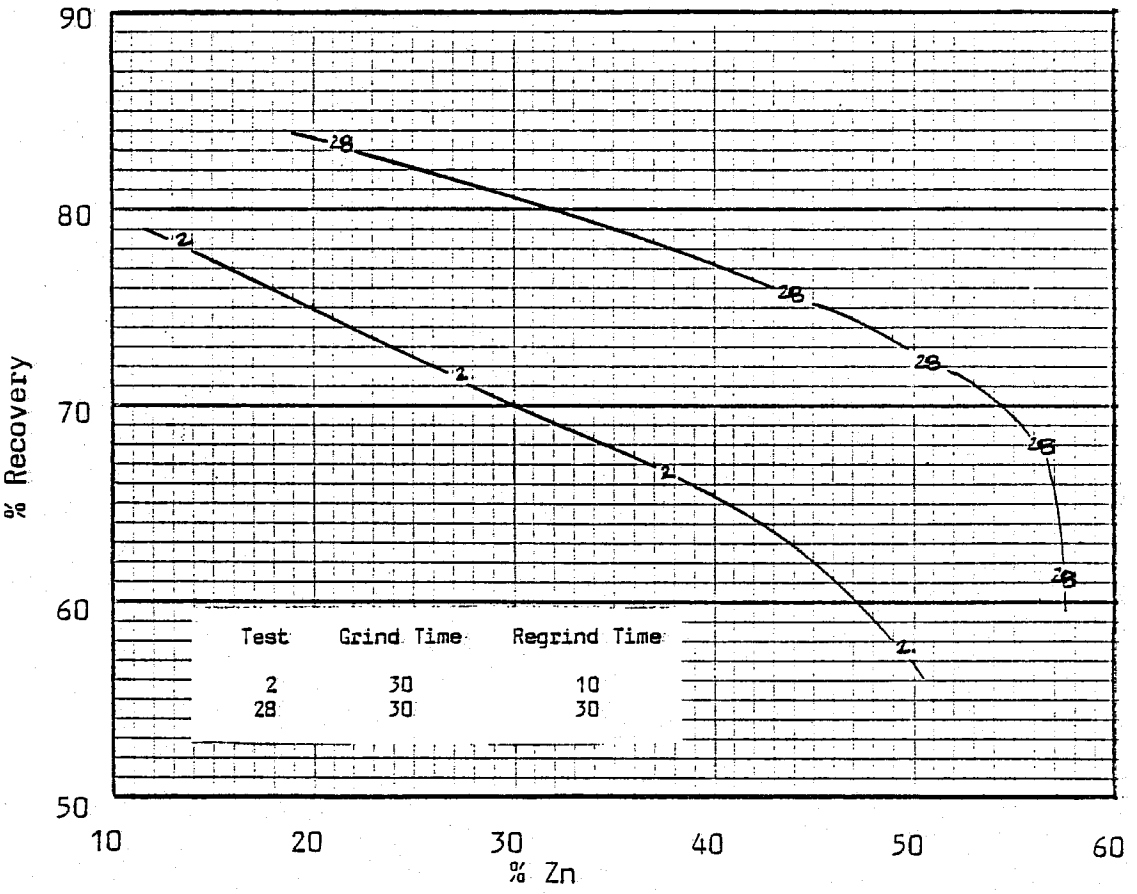


GRAPH 15

Type A - Regrind Effects



GRAPH 16



Cycle Test

Apart from the very severe reagent and froth control problems, due to the graphite component of the ore, the cycle test proceeded quite smoothly.

TABLE 6

Projected Results - Test 23

Product	Weight	Assays %		Distribution	
	%	Pb	Zn	Pb	Zn
Feed	100.0	2.88	4.24	100.0	100.0
Lead Concentrate	5.94	40.2	6.04	82.9	8.5
Zinc Concentrate	6.79	1.32	51.1	3.1	81.8
Tails	87.27	0.46	0.47	14.0	9.7

Assuming that the type 4A which will be treated contains less graphite than the test sample then the predicted plant results will be somewhat better than indicated in Table 6.

TABLE 7

Predicted Plant Results - Type A

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	3.0	500	45	-	25	65	83	-
Zinc Concentrate	0.8	45	-	51	-	-	-	83

* g/tonne

4. Type BCD - Pyritic Quartzite

Preliminary Tests

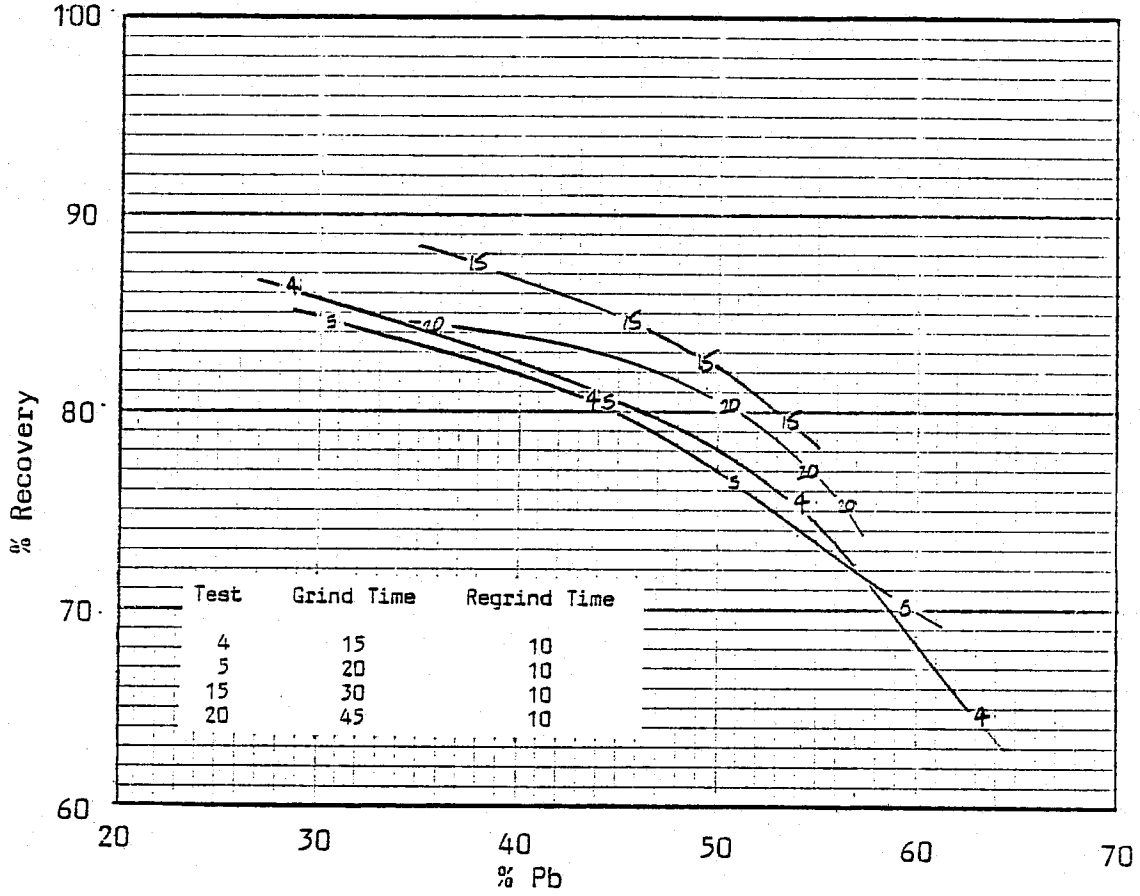
Initial testwork with BCD ore showed quite good mineral separation but yielded very poor concentrate grades. A second sample of BCD was produced but yielded the same sort of results (Tests 29 and 30). All results discussed in the text of this report refer to the sample described in Table 1.

The grind effects tests did not yield encouraging results and finer grinds did not significantly influence metal recoveries (Graphs 17 and 18). Finer regrinding also failed to improve concentrate grades (Graphs 19 and 20).

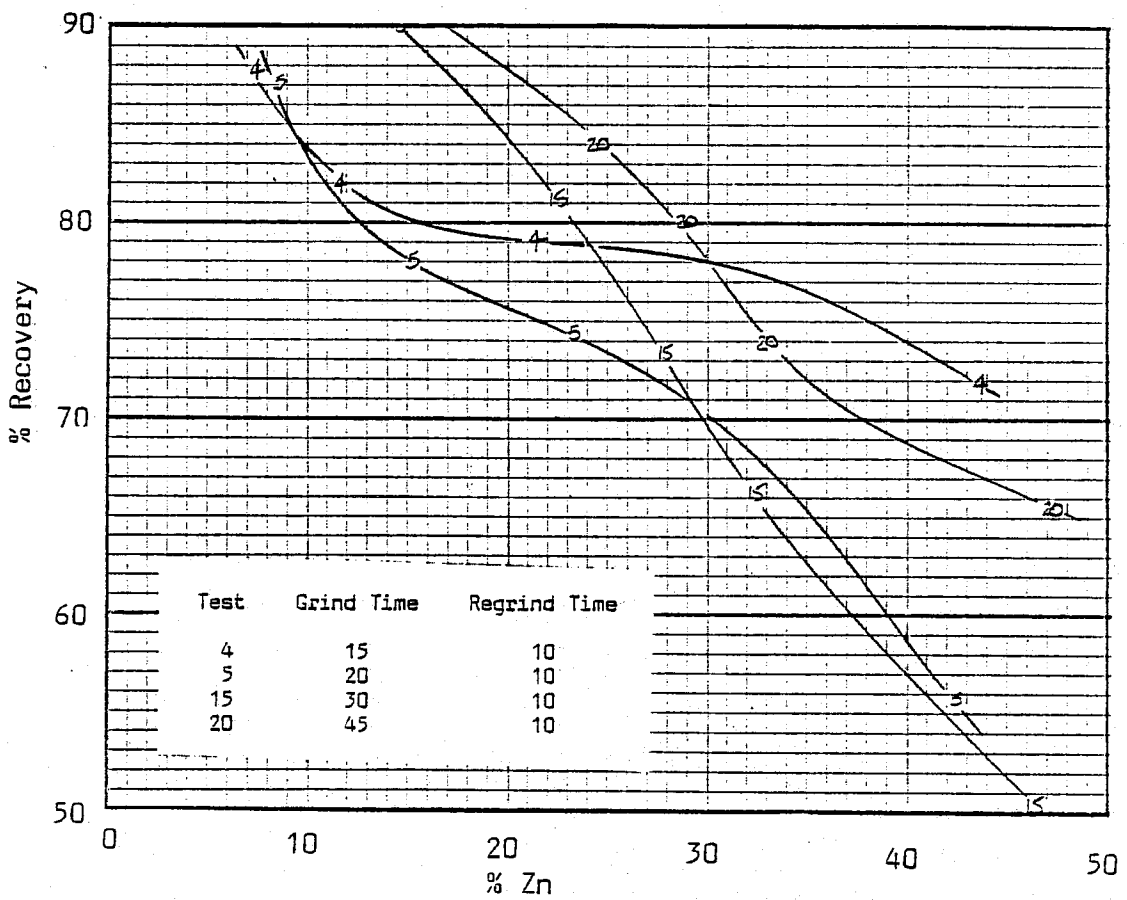
Since some graphite was observed in the ore, a graphite prefloat was attempted. The results of the prefloat test were not greatly different from parallel tests (Graph 17).

GRAPH 17

Type BCD - Grind Effects

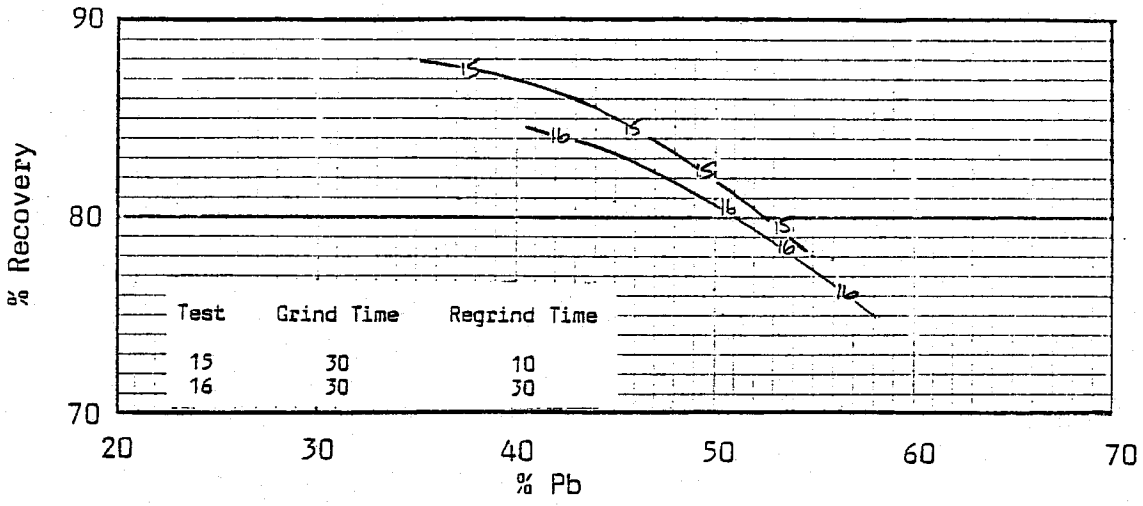


GRAPH 18

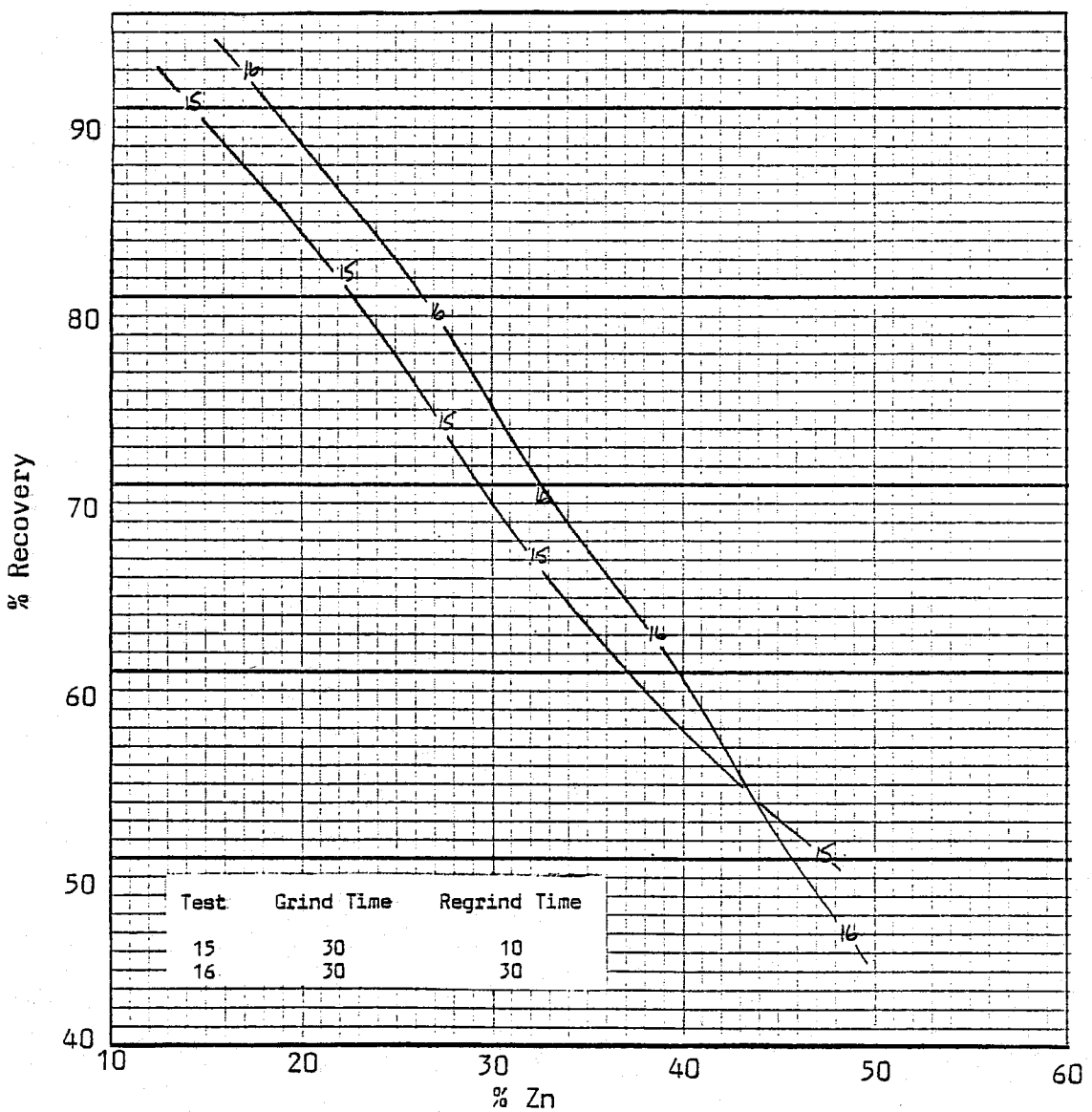


GRAPH 19

Type BCD - Regrind Effects



GRAPH 20



Cycle Test

As a result of a loss of stability in cycle 4, the data shown below should be regarded with some suspicion. Unfortunately, there was not sufficient test sample to permit the cycle test to be repeated.

TABLE 8

Projected Results - Test 25

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	2.06	3.35	100.0	100.0
Lead Concentrate	3.46	51.2	4.11	86.0	4.2
Zinc Concentrate	5.68	0.75	47.5	2.0	80.5
Tails	90.86	0.27	0.56	12.0	15.3

Adjusting the data in an attempt to compensate for the loss of control in cycle 4, the predicted results show an increase in zinc concentrate grade.

TABLE 9

Predicted Plant Results - Type BCD

Product	Assays %				Distribution			
	Au*	Ag*	Pb	Zn	Au	Ag	Pb	Zn
Lead Concentrate	8.9	580	51	-	35	60	86	-
Zinc Concentrate	4.5	33	-	49	-	-	-	83

* g/tonne

APPENDIX I

DETAILS OF EQUIPMENT USED IN TESTWORK

APPENDIX I

Details of Equipment Used in Testwork

A. Grinding

Rod Mill	-Steel container 21.5 cm ø x 40.5 cm. Charge 25 kg steel rods approx. 2.0 cm. ø.
Ball Mill	-Steel container 21.5 cm ø x 18 cm. Charge 5 kg steel balls - graded charge 0.5 - 3.0 cm ø.
Drive for Mill	-Twin rolls, one drive, one idle. Both 12.5 ø x 122 cm.
	-Motor 0.37 KWH at 1725 RPM full load.
	-Mill speed approximately 80 RPM.
Bond Mill	-Standard Bond mill for determination of mean work index of ore.

B. Flotation

Denver D2 Flotation Machine	-Used for roughing and scavenger at 1500 RPM with a 5.5 L stainless steel tank.
	-For first cleaner work with a 2.5 L stainless steel tank.
Denver D1 Flotation Machine	-Used for all cleaning stages at 1500 RPM with a 2.5 L stainless steel tank.
Galigher Agitair LA500	-Used for general purpose work with 5.5 L, 2.5 L and 1.5 L perspex flotation tanks and with 25 L stainless steel tank for large volume work.

C. Instrumentation

Orion Specific Ion Meter 401	-Used for pH control on the rougher and scavenger circuits.
Fisher Digital pH Meter 609	-Used for pH control on the cleaning circuits.
Kalnew 12701 Microscope	-Used for microscopic examination of various minerals.
Swift 80 Microscope	-Used for microscopic examination of various minerals.

D. Particle Sizing

Andreasen Pipet	-Used for determining the distribution of particle sizes less than 74 um.
Warman Cyclosizer	-Used for determining the distribution of particle sizes less than 74 um.

APPENDIX II

TECHNICAL DETAILS OF TESTS 1 - 30 INCLUSIVE

For each test are shown details of reagents used, essential test parameters, assays and a metallurgical balance.

KM050

TEST NO. 1

PURPOSE: Preliminary Test

PROCEDURE: Float lead concentrate and clean three times

Float zinc concentrate and clean three times

FEED: 1 kg. V - 4A Composite

GRIND: 10 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				10				
Lead Ro/Sc			100				2	10	9.5	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			50				2	8	10.3	9.9
Lead 2nd Cleaner			20				2	5	10.3	10.0
Lead 3rd Cleaner			10				2	4	10.3	10.0
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			40				2	5	11.0	11.0
Zinc Regrind					500	10				9.1
Zinc 1st Cleaner			20				2	5	11.5	11.5
Zinc 2nd Cleaner			10				2	4	12.0	12.0
Zinc 3rd Cleaner			-				2	3	12.5	12.5

TEST NO. 1

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 3	1.41	37.56	6.17	8.06		19.24	2.07	1.02	
Pb Cleaner Tails 3	1.76	9.10	7.06	17.80		5.82	2.96	2.81	
Pb Cleaner Tails 2	4.58	4.47	6.29	16.70		7.45	6.87	6.87	
Zn Cleaner Conc. 3	4.45	1.00	51.78	7.37		1.62	54.99	2.95	
Zn Cleaner Tails 3	1.77	1.90	13.70	9.94		1.22	5.77	1.58	
Zn Cleaner Tails 2	2.65	1.89	8.61	19.20		1.83	5.45	4.58	
Zn Cleaner Tails 1	12.76	0.89	2.95	28.40		4.13	8.97	32.53	
Fe Cleaner Conc. 1	3.81	33.90	6.69	11.40		47.01	6.08	3.90	
Tails	66.81	0.48	0.43	7.30		11.67	6.85	43.78	
Calculated Head	100.00	2.75	4.19	11.14		100.00	100.00	100.00	

KM050

TEST NO. 2

PURPOSE: Preliminary Test - Fine Grind

PROCEDURE: Vary Primary Grind

FEED: 1 Kg. V-4A Composite

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				
Lead Ro/Sc			100				2	10	9.5	9.1
Lead Regrind	1000	200				10				10.3
Lead 1st Cleaner			50				2	8	10.3	10.3
Lead 2nd Cleaner			20				2	5	10.3	10.3
Lead 3rd Cleaner			10				2	4	10.3	10.3
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			50				2	5	11.0	11.0
Zinc Regrind					500	10				
Zinc 1st Cleaner			30				2	5	11.5	11.5
Zinc 2nd Cleaner			20				2	4	12.0	12.0
Zinc 3rd Cleaner			30				2	3	12.3	12.3

TEST NO. 2

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 3	5.75	38.25	5.86	10.70		78.03	8.01	5.23	
Pb Cleaner Tails 3	2.12	6.20	7.16	17.50		4.66	3.61	3.16	
Pb Cleaner Tails 2	3.28	2.78	6.58	16.00		3.23	5.13	4.46	
Zn Cleaner Conc. 3	4.87	0.68	49.70	6.31		1.18	57.61	2.61	
Zn Cleaner Tails 3	2.55	1.11	14.60	7.57		1.00	8.85	1.64	
Zn Cleaner Tails 2	3.57	1.63	5.80	22.40		2.07	4.93	6.81	
Zn Cleaner Tails 1	13.38	0.72	2.13	28.20		3.42	6.78	32.09	
Tails	64.48	0.28	0.33	8.02		6.41	5.06	43.99	
Calculated Head	100.00	2.82	4.20	11.76		100.00	100.00	100.00	

KM050

TEST NO. 3

PURPOSE: Preliminary Test - Lime effect on Pb Cleaning

PROCEDURE: Replace lime for soda ash in Pb Cleaning

FEED: 1 Kg. V-4A Composite

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				
Lead Ro/Sc			100				2	10	9.5	9.1
Lead Regrind		200			500	10				
Lead 1st Cleaner			50				2	8	10.3	10.3
Lead 2nd Cleaner			30				2	5	10.5	10.5
Lead 3rd Cleaner			10				2	4	10.5	10.5
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			50				2	5	11.0	11.0
Zinc Regrind					500	10				
Zinc 1st Cleaner			30				2	5	11.5	11.5
Zinc 2nd Cleaner			20				2	4	12.0	12.0
Zinc 3rd Cleaner			50				2	3	12.5	12.5

TEST NO. 3

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 3	4.60	46.10	5.45	8.44		74.37	5.96	3.18	
Pb Cleaner Tails 3	2.58	7.00	7.55	17.40		6.33	4.63	3.67	
Pb Cleaner Tails 2	3.35	3.06	7.16	17.90		3.60	5.70	4.91	
Zn Cleaner Conc. 3	4.45	0.61	53.42	6.70		0.95	56.50	2.44	
Zn Cleaner Tails 3	1.85	1.26	17.00	6.20		0.82	7.47	0.94	
Zn Cleaner Tails 2	3.65	1.99	9.43	18.20		2.55	8.18	5.44	
Zn Cleaner Tails 1	15.90	0.76	1.74	26.70		4.24	6.58	34.77	
Tails	63.63	0.32	0.33	8.57		7.15	4.99	44.65	
Calculated Head	100.00	2.85	4.21	12.21		100.00	100.00	100.00	

KM050

TEST NO. 4

PURPOSE: Grind Effects

PROCEDURE: Vary Primary Grind

FEED: Type 4 BCD

GRIND: 15 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				15				9.5
Lead Ro/Sc			60				2	7	9.5	9.0
Lead Regrind	1000	200				10				10.4
Lead 1st Cleaner			30				2	5	10.4	10.2
Lead 2nd Cleaner			20				2	4	10.6	10.2
Lead 3rd Cleaner			20				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	
Zinc Conditioning				500	X		10		11.0	11.0
Zinc Ro/Sc			50				2	6	11.0	11.0
Zinc Regrind				250	500	10				
Zinc 1st Cleaner			30				2	6	11.5	11.5
Zinc 2nd Cleaner			10				2	4	12.0	12.0
Zinc 3rd Cleaner			10				2	3	12.3	12.4

TEST NO. 4

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.10	63.19	3.15	7.46		64.71	1.98	0.68	
Pb Cleaner Tails 4	0.76	29.20	5.94	22.15		10.85	1.35	0.74	
Pb Cleaner Tails 3	0.91	11.30	6.00	29.60		5.01	1.63	1.18	
Pb Cleaner Tails 2	2.42	4.78	5.20	32.83		5.64	3.77	3.47	
Zn Cleaner Conc. 3	5.49	0.58	43.80	13.92		1.55	71.90	3.33	
Zn Cleaner Tails 3	6.81	0.49	3.50	25.68		1.62	7.12	7.62	
Zn Cleaner Tails 2	11.01	0.41	0.90	40.47		2.20	2.96	19.42	
Zn Cleaner Tails 1	16.10	0.43	1.22	40.57		3.37	5.87	28.47	
Tails	54.40	0.19	0.21	14.80		5.03	3.41	35.09	
Calculated Head	100.00	2.05	3.35	22.94		100.00	100.00	100.00	

KM050

TEST NO. 5

PURPOSE: Grind Effects

PROCEDURE: Vary Primary Grind

FEED: Type 4 BCD

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.1
Lead Ro/Sc			80				2	7	9.6	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			30				2	5	10.6	10.4
Lead 2nd Cleaner			10				2	4	10.6	10.3
Lead 3rd Cleaner			10				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	10.3
Zinc Conditioning				500			10		11.2	11.0
Zinc Ro/Sc			60				2	6	11.0	11.0
Zinc Regrind				250	500	10				
Zinc 1st Cleaner			30				2	6	11.5	11.2
Zinc 2nd Cleaner			20				2	4	12.0	12.0
Zinc 3rd Cleaner			10				2	3	12.3	12.2

TEST NO. 5

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.39	59.32	3.71	8.90		70.01	2.70	0.94	
Pb Cleaner Tails 4	0.69	22.00	7.36	23.91		7.55	1.56	0.73	
Pb Cleaner Tails 3	0.57	11.00	5.30	5.45		3.12	0.93	0.14	
Pb Cleaner Tails 2	1.95	4.03	5.00	5.98		3.89	2.97	0.51	
Zn Cleaner Conc. 3	4.32	0.47	42.51	14.80		1.00	55.91	2.81	
Zn Cleaner Tails 3	6.25	0.48	9.72	18.62		1.48	18.51	5.12	
Zn Cleaner Tails 2	6.30	0.58	1.93	40.18		1.81	3.70	11.14	
Zn Cleaner Tails 1	16.88	0.51	1.77	42.73		4.25	9.10	31.74	
Tails	60.65	0.23	0.25	17.56		6.89	4.62	46.87	
Calculated Head	100.00	2.02	3.28	22.72		100.00	100.00	100.00	

KM050

TEST NO. 6

PURPOSE: Grind Effects

PROCEDURE: Vary Primary Grind

FEED: Type E

GRIND: 15 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				15				8.3
Lead Ro/Sc			60				2	7	9.6	8.9
Lead Regrind	1000	200				10				10.4
Lead 1st Cleaner			30				2	5	10.6	10.4
Lead 2nd Cleaner			20				2	4	10.6	10.4
Lead 3rd Cleaner			10				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	10.4
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc							2	6	11.0	11.0
Zinc Regrind				250	500	10				
Zinc 1st Cleaner			40				2	6	11.5	11.5
Zinc 2nd Cleaner			10				2	4	12.0	12.1
Zinc 3rd Cleaner			10				2	3	12.3	12.4

TEST NO. 6

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.35	48.89	7.12	13.52		67.17	7.56	1.95	
Pb Cleaner Tails 4	1.49	18.20	8.18	28.42		8.57	2.98	1.40	
Pb Cleaner Tails 3	1.60	7.80	7.20	34.50		3.95	2.82	1.83	
Pb Cleaner Tails 2	3.74	3.13	5.70	37.14		3.70	5.20	4.60	
Zn Cleaner Conc. 3	3.73	0.94	52.82	7.24		1.11	48.14	0.90	
Zn Cleaner Tails 3	2.36	1.38	17.80	10.98		1.03	10.24	0.86	
Zn Cleaner Tails 2	2.31	2.04	9.00	25.19		1.25	4.25	1.61	
Zn Cleaner Tails 1	7.96	1.32	5.10	31.56		3.32	9.92	8.33	
Tails	72.84	0.43	0.50	32.54		9.90	8.90	78.53	
Calculated Head	100.00	3.16	4.09	30.18		100.00	100.00	100.00	

KM050

TEST NO. 7

PURPOSE: Grind Effects

PROCEDURE: Vary Primary Grind

FEED: Type E

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11			Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				8.7
Lead Ro/Sc			90				2	8	9.7	9.4
Lead Regrind	1000	400				10				
Lead 1st Cleaner			20				2	5	10.5	10.3
Lead 2nd Cleaner			10				2	4	10.6	10.4
Lead 3rd Cleaner			20				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	10.5

TEST NO. 7

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	3.11	51.77	6.47	13.50		48.41	4.46	1.32	
Pb Cleaner Tails 4	2.63	24.17	8.76	27.40		19.14	5.11	2.28	
Pb Cleaner Tails 3	1.84	9.12	6.20	35.80		5.04	2.52	2.07	
Pb Cleaner Tails 2	5.30	4.10	6.50	38.70		6.54	7.64	6.47	
Pb Cleaner Tails 1	30.41	1.46	6.00	40.40		13.36	40.49	38.78	
Tails	56.72	0.44	3.16	27.40		7.51	39.77	49.07	
Calculated Head	100.00	3.32	4.51	31.67		100.00	100.00	100.00	

KM050

TEST NO. 8

PURPOSE: Grind Effects - 4 stages of cleaning

PROCEDURE: Vary primary grind and add an extra stage of Pb Cleaning

FEED: Type A

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				8.2
Lead Ro/Sc			50				2	8	9.6	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			20				2	5	10.6	10.4
Lead 2nd Cleaner			20				2	4	10.6	10.4
Lead 3rd Cleaner			10				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	10.4

TEST NO. 8

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	3.41	51.17	4.90	6.31		61.89	3.84	1.80	
Pb Cleaner Tails 4	1.00	30.32	7.84	16.70		10.81	1.81	1.40	
Pb Cleaner Tails 3	0.67	13.97	7.20	14.02		3.33	1.11	0.79	
Pb Cleaner Tails 2	1.73	6.65	7.10	17.09		4.08	2.83	2.47	
Pb Cleaner Tails 1	10.46	2.19	6.00	17.47		8.13	14.44	15.26	
Tails	82.73	0.40	3.99	11.33		11.75	75.96	78.28	
Calculated Head	100.00	2.92	4.35	11.97		100.00	100.00	100.00	

KM050

TEST NO. 9

PURPOSE: Repeat Test 8

PROCEDURE: Same as Test No. 8

FEED: Type A

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	Lime		Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				8.3
Graphite Prefloat							2	2	9.5	9.5
Lead Ro/Sc			50				2	6	9.5	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			20				2	5	10.5	10.4
Lead 2nd Cleaner			20				2	4	10.6	10.4
Lead 3rd Cleaner			10				2	3	10.6	10.4
Lead 4th Cleaner			-				2	2	10.6	10.4

TEST NO. 9

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Graphite Conc.	3.59	3.57	5.46	9.39		4.56	4.47	2.87	
Pb Cleaner Conc. 4	2.57	52.66	5.37	6.80		48.11	3.15	1.49	
Pb Cleaner Tails 4	1.59	26.08	8.90	18.24		14.74	3.23	2.47	
Pb Cleaner Tails 3	0.86	10.93	6.70	14.21		3.33	1.31	1.04	
Pb Cleaner Tails 2	1.85	7.98	6.20	15.26		5.26	2.62	2.41	
Pb Cleaner Tails 1	7.06	3.73	6.10	16.99		9.35	9.82	10.21	
Tails	82.47	0.50	4.01	11.33		14.65	75.40	79.52	
Calculated Head	100.00	2.82	4.39	11.75		100.00	100.00	100.00	

KM050

TEST NO. 10

PURPOSE: Preliminary Test

PROCEDURE: Fine Grind

FEED: Vangorda Compo 4G

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.7
Lead Ro/Sc			100				2	10	9.7	9.0
Lead Regrind	1000	200				10				10.3
Lead 1st Cleaner			50				2	7	10.5	10.1
Lead 2nd Cleaner			10				2	5	10.5	10.1
Lead 3rd Cleaner			10				2	4	10.5	10.1
Lead 4th Cleaner			-				2	3	10.5	10.3
Zinc Conditioning				1000			10		11.0	11.0
Zinc Ro/Sc			100				2	12	11.0	11.0
Zinc Regrind				500	1000	10				9.2
Zinc 1st Cleaner			30				2	10	11.5	11.5
Zinc 2nd Cleaner			20				2	7	11.6	11.7
Zinc 3rd Cleaner			10				2	5	12.0	12.0

TEST NO. 10

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.49	58.62	11.10	4.27		72.92	7.20	1.32	
Pb Cleaner Tails 4	0.69	31.20	16.40	14.00		5.98	1.64	0.66	
Pb Cleaner Tails 3	0.61	20.30	14.40	18.50		3.41	1.26	0.77	
Pb Cleaner Tails 2	2.05	7.80	15.30	20.20		4.43	4.54	2.85	
Zn Cleaner Conc. 3	9.61	1.24	55.45	4.79		3.30	77.01	3.16	
Zn Cleaner Tails 3	1.93	1.47	6.40	7.40		0.78	1.78	0.98	
Zn Cleaner Tails 2	2.75	1.63	4.92	16.40		1.24	1.96	3.10	
Zn Cleaner Tails 1	11.50	0.76	1.22	29.00		2.42	2.03	22.91	
Tails	66.36	0.30	0.27	14.10		5.51	2.59	64.25	
Calculated Head	100.00	3.61	6.92	14.56		100.00	100.00	100.00	

KM050

TEST NO. 11

PURPOSE: Preliminary Test Coarse Grind

PROCEDURE:

FEED: Vangorda Compo 4G

GRIND: 10 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				10				
Lead Ro/Sc			100				2	10	9.8	9.4
Lead Regrind	1000	200				10				9.4
Lead 1st Cleaner			50				2	7	10.6	10.4
Lead 2nd Cleaner			30				2	5	10.5	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.2
Lead 4th Cleaner			10				2	3		
Zinc Conditioning				1000			10		11.0	11.0
Zinc Ro/Sc			100				2	9	11.0	11.0
Zinc Regrind				500	1000	10				
Zinc 1st Cleaner			30				2	7	11.5	11.5
Zinc 2nd Cleaner			20				2	5	12.0	12.0
Zinc 3rd Cleaner			10				2	4	12.3	12.3

TEST NO. 11

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	5.72	50.76	13.50	5.97		79.06	10.91	2.29	
Pb Cleaner Tails 4	0.58	12.60	21.20	15.80		2.00	1.75	0.62	
Pb Cleaner Tails 3	0.88	6.20	16.70	17.30		1.49	2.08	1.02	
Pb Cleaner Tails 2	2.18	6.60	16.20	20.40		3.92	4.99	2.98	
Zn Cleaner Conc. 3	10.61	1.20	48.55	11.10		3.46	72.70	7.89	
Zn Cleaner Tails 3	2.11	1.27	5.80	22.90		0.73	1.73	3.24	
Zn Cleaner Tails 2	4.06	1.27	3.08	28.80		1.40	1.77	7.84	
Zn Cleaner Tails 1	20.16	0.57	0.80	33.80		3.13	2.28	45.68	
Tails	53.70	0.33	0.24	7.90		4.82	1.82	28.44	
Calculated Head	100.00	3.68	7.08	14.92		100.00	100.00	100.00	

KM050

TEST NO. 12

PURPOSE: Very fine grind effects

PROCEDURE: Increase primary grind

FEED: Vangorda Compo 4G

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				9.0
Lead Ro/Sc			100				5	10	9.8	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			50				2	7	10.6	10.3
Lead 2nd Cleaner			30				2	5	10.6	10.4
Lead 3rd Cleaner			20				2	4	10.6	10.4
Lead 4th Cleaner			10				2	3	10.6	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Ro/Sc			120				2	8	11.0	11.0
Zinc Regrind				500	2000	10				10.5
Zinc 1st Cleaner			30				2	7	11.7	11.7
Zinc 2nd Cleaner			20				2	5	12.0	12.0
Zinc 3rd Cleaner			10				2	4	12.5	12.5

TEST NO. 12

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.98	59.38	9.35	4.64		80.68	6.70	1.50	
Pb Cleaner Tails 4	0.47	17.70	18.00	17.90		2.29	1.23	0.55	
Pb Cleaner Tails 3	0.93	8.40	14.50	20.00		2.14	1.95	1.21	
Pb Cleaner Tails 2	2.63	3.76	11.00	21.00		2.70	4.17	3.58	
Zn Cleaner Conc. 3	8.87	0.91	59.26	4.19		2.20	75.64	2.41	
Zn Cleaner Tails 3	0.73	1.90	13.60	6.50		0.38	1.43	0.31	
Zn Cleaner Tails 2	0.98	2.14	9.80	16.40		0.57	1.38	1.04	
Zn Cleaner Tails 1	6.13	1.16	3.29	24.10		1.94	2.91	9.57	
Tails	74.27	0.35	0.43	16.60		7.09	4.60	79.84	
Calculated Head	100.00	3.66	6.95	15.44		100.00	100.00	100.00	

KM050

TEST NO. 13

PURPOSE: Regrind effects

PROCEDURE: Increase regrind time

FEED: Vangorda Compo 4E

GRIND: 15 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				15				9.8
Lead Ro/Sc			70				2	7	9.8	9.6
Lead Regrind	1000	200				30				10.4
Lead 1st Cleaner			30				2	7	10.4	10.2
Lead 2nd Cleaner			20				2	5	10.4	10.0
Lead 3rd Cleaner			10				2	4	10.6	10.2
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			70				2	8	11.0	11.0
Zinc Regrind				200	1000	30				9.6
Zinc 1st Cleaner			30				2	7	11.5	11.4
Zinc 2nd Cleaner			70				2	5	12.0	12.0
Zinc 3rd Cleaner			10				2	4	12.5	12.5

TEST NO. 13

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	3.78	60.27	5.95	8.37		70.53	5.45	1.06	
Pb Cleaner Tails 4	0.95	19.72	9.40	26.30		5.83	2.17	0.84	
Pb Cleaner Tails 3	0.86	8.18	8.00	33.00		2.17	1.66	0.95	
Pb Cleaner Tails 2	1.43	5.02	6.70	35.80		2.22	2.32	1.72	
Zn Cleaner Conc. 3	4.15	1.38	53.76	7.24		1.77	54.04	1.01	
Zn Cleaner Tails 3	1.66	1.78	14.30	10.80		0.92	5.76	0.60	
Zn Cleaner Tails 2	1.86	2.12	12.00	22.40		1.22	5.42	1.41	
Zn Cleaner Tails 1	7.46	1.42	7.50	31.00		3.28	13.56	7.79	
Tails	77.84	0.50	0.51	32.30		12.06	9.62	84.61	
Calculated Head	100.00	3.23	4.13	29.72		100.00	100.00	100.00	

KM050

TEST NO. 14

PURPOSE: Primary Grind Effects

PROCEDURE: Vary Primary Grind

FEED: Vangorda E

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				30				9.6
Lead Ro/Sc			90				2	10	9.6	9.3
Lead Regrind	1000	200				10				
Lead 1st Cleaner			50				2	8	10.5	10.2
Lead 2nd Cleaner			20				2	5	10.5	10.3
Lead 3rd Cleaner			10				2	4	10.5	10.3
Lead 4th Cleaner			-				2	3	10.5	10.2
Lead 5th Cleaner			-				2	2	10.5	10.3
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			70				2	8	11.0	11.0
Zinc Regrind				200	1000	10	2			
Zinc 1st Cleaner			30				2	7	11.5	11.4
Zinc 2nd Cleaner			20				2	5	12.0	12.0
Zinc 3rd Cleaner			10				2	4	12.5	12.5

TEST NO. 14

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 5	3.68	59.78	6.03	8.28		67.04	5.29	0.99	
Pb Cleaner Tails 5	1.43	21.39	9.80	25.80		9.31	3.34	1.19	
Pb Cleaner Tails 4	1.21	11.16	7.80	33.10		4.11	2.25	1.30	
Pb Cleaner Tails 3	1.46	4.28	6.10	37.30		1.91	2.13	1.77	
Pb Cleaner Tails 2	2.84	2.63	5.70	35.80		2.28	3.87	3.29	
Zn Cleaner Conc. 3	4.07	0.72	57.48	5.95		0.89	55.77	0.78	
Zn Cleaner Tails 3	0.84	1.04	18.30	8.70		0.27	3.67	0.24	
Zn Cleaner Tails 2	1.36	1.73	17.40	17.00		0.72	5.63	0.75	
Zn Cleaner Tails 1	4.21	1.50	8.40	28.10		1.93	8.45	3.84	
Tails	78.91	0.48	0.51	33.60		11.55	9.60	85.86	
Calculated Head	100.00	3.28	4.19	30.88		100.00	100.00	100.00	

KM050

TEST NO. 15

PURPOSE: Grind Effects

PROCEDURE: Increase Primary Grinding Time

FEED: Type 4 BCD

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	300				30				10.0
Lead Ro/Sc			80				2	7	10.0	9.6
Lead Regrind	1000	300				10				10.7
Lead 1st Cleaner			30				2	7	10.7	10.4
Lead 2nd Cleaner			20				2	5	10.5	10.5
Lead 3rd Cleaner			10				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.5	10.4
Zinc Conditioning				500			10		11.5	11.5
Zinc Ro/Sc			60				2	8	11.5	11.5
Zinc Regrind				250	1000	10				9.6
Zinc 1st Cleaner			40				2	5	12.0	12.0
Zinc 2nd Cleaner			30				2	4	12.0	12.0
Zinc 3rd Cleaner			40				30	3	12.4	12.4
Zinc 4th Cleaner			150				2	2	12.7	12.7

TEST NO. 15

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.91	53.33	3.76	12.60		79.67	3.44	1.60	
Pb Cleaner Tails 4	0.35	16.51	6.20	26.60		3.00	0.69	0.41	
Pb Cleaner Tails 3	0.33	11.14	5.30	29.90		1.88	0.55	0.43	
Pb Cleaner Tails 2	0.93	6.34	5.50	31.40		3.04	1.62	1.28	
Zn Cleaner Conc. 4	3.38	0.32	47.32	8.85		0.56	50.35	1.31	
Zn Cleaner Tails 4	3.16	0.15	16.02	4.60		0.24	15.93	0.63	
Zn Cleaner Tails 3	1.82	0.54	12.30	8.50		0.51	7.06	0.68	
Zn Cleaner Tails 2	3.17	0.84	8.00	16.30		1.37	7.98	2.26	
Zn Cleaner Tails 1	8.36	0.64	3.35	29.20		2.75	8.81	10.66	
Tails	75.58	0.18	0.15	24.45		6.99	3.57	80.74	
Calculated Head	100.00	1.95	3.18	22.89		100.00	100.00	100.00	

KM050

TEST NO. 16

PURPOSE: Regrind effect

PROCEDURE: Vary regrind times

FEED: Vangorda BCD

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	300				30				9.6
Lead Ro/Sc			80				2	8	9.6	9.3
Lead Regrind	1000	300				30				10.4
Lead 1st Cleaner			50				2	6	10.4	10.6
Lead 2nd Cleaner			20				2	5	10.5	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			-				2	3	10.6	10.4
Zinc Conditioning				500			10		11.5	11.5
Zinc Ro/Sc			60				2	8	11.5	11.5
Zinc Regrind				250	3000	30				11.0
Zinc 1st Cleaner			250				2	6	12.0	12.0
Zinc 2nd Cleaner			50				2	4	12.4	12.2
Zinc 3rd Cleaner			50				2	3	12.4	12.2
Zinc 4th Cleaner			100				2	2	12.4	12.2

TEST NO. 16

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.75	56.51	2.99	10.10		76.35	2.46	1.23	
Pb Cleaner Tails 4	0.24	18.91	5.70	26.10		2.19	0.40	0.27	
Pb Cleaner Tails 3	0.26	16.51	5.80	27.00		2.07	0.44	0.30	
Pb Cleaner Tails 2	0.83	8.54	5.70	30.20		3.49	1.42	1.11	
Zn Cleaner Conc. 4	3.16	0.51	48.70	9.40		0.79	46.15	1.31	
Zn Cleaner Tails 4	2.20	0.76	24.13	7.80		0.82	15.92	0.76	
Zn Cleaner Tails 3	1.76	1.28	14.25	11.60		1.11	7.52	0.90	
Zn Cleaner Tails 2	2.68	1.56	12.30	21.00		2.05	9.87	2.48	
Zn Cleaner Tails 1	8.05	0.87	5.20	28.00		3.44	12.54	9.95	
Tails	78.08	0.20	0.14	23.71		7.68	3.27	81.69	
Calculated Head	100.00	2.03	3.34	22.66		100.00	100.00	100.00	

KM050

TEST NO. 17

PURPOSE: Sodium Sulfite Effect

PROCEDURE: Same as Test 13 except add sodium sulfite to grinding circuit

FEED: Vangorda E

GRIND: 15 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne						Time, Minutes			pH	
	Na_2CO_3	NaCN	Na_2SO_3	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200	500				15				10.0
Lead Ro/Sc				70				2	7	10.0	9.8
Lead Regrind	1000	200	100				30				10.3
Lead 1st Cleaner				30				2	7	10.4	10.0
Lead 2nd Cleaner				20				2	5	10.4	10.2
Lead 3rd Cleaner				10				2	3	10.4	10.2
Lead 4th Cleaner				10				2	2	10.4	10.2
Zinc Conditioning					500			10		11.0	11.0
Zinc Ro/Sc				70				2	7	11.0	11.0
Zinc Regrind					200	1000	30				9.0
Zinc 1st Cleaner				30				2	7	11.5	11.5
Zinc 2nd Cleaner				20				2	5	12.0	12.0
Zinc 3rd Cleaner				10				2	4	12.3	12.3

TEST NO. 17

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.89	63.84	6.09	6.70		61.84	4.35	0.65	
Pb Cleaner Tails 4	1.20	29.20	9.70	21.20		11.71	2.87	0.85	
Pb Cleaner Tails 3	1.39	12.30	9.80	28.20		5.73	3.37	1.32	
Pb Cleaner Tails 2	2.37	4.93	8.60	31.50		3.92	5.04	2.51	
Zn Cleaner Conc. 3	3.66	0.90	39.47	7.50		1.11	35.80	0.92	
Zn Cleaner Tails 3	4.62	0.95	14.80	7.90		1.47	16.95	1.23	
Zn Cleaner Tails 2	4.20	1.57	10.20	22.40		2.21	10.62	3.17	
Zn Cleaner Tails 1	8.35	1.21	5.70	31.70		3.39	11.79	8.91	
Tails	71.33	0.36	0.52	33.50		8.62	9.19	80.44	
Calculated Head	100.00	2.98	4.04	29.71		100.00	100.00	100.00	

KM050

TEST NO. 18

PURPOSE: Sodium Sulfite Effect

PROCEDURE: Same as Test 12

FEED: Vangorda 4G

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne						Time, Minutes			pH	
	Na_2CO_3	NaCN	Na_2SO_3	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200	500				30				9.6
Lead Ro/Sc				100				2	10	9.6	9.1
Lead Regrind	1000	200	100				10				10.2
Lead 1st Cleaner				50				2	7	10.5	10.4
Lead 2nd Cleaner				30				2	5	10.5	10.4
Lead 3rd Cleaner				20				2	4	10.6	10.4
Lead 4th Cleaner				10				2	3	10.6	10.4
Zinc Conditioning					500			10		11.0	11.0
Zinc Ro/Sc				120				2	8	11.0	11.0
Zinc Regrind					500	2000	10				10.8
Zinc 1st Cleaner				30				2	7	11.5	11.5
Zinc 2nd Cleaner				20				2	5	12.0	12.0
Zinc 3rd Cleaner				10				2	4	12.5	12.5

TEST NO. 18

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.13	63.94	8.72	4.08		73.81	5.29	1.22	
Pb Cleaner Tails 4	0.81	26.20	17.80	12.70		5.91	2.11	0.74	
Pb Cleaner Tails 3	1.08	13.90	14.90	15.20		4.21	2.37	1.19	
Pb Cleaner Tails 2	2.75	6.00	11.70	16.40		4.62	4.73	3.26	
Zn Cleaner Conc. 3	9.37	0.90	53.88	5.00		2.36	74.20	3.38	
Zn Cleaner Tails 3	1.70	1.48	13.60	8.60		0.70	3.40	1.06	
Zn Cleaner Tails 2	3.03	1.18	6.10	11.00		1.00	2.72	2.41	
Zn Cleaner Tails 1	5.94	0.97	1.62	18.00		1.61	1.41	7.72	
Tails	71.20	0.29	0.36	15.36		5.78	3.77	79.02	
Calculated Head	100.00	3.57	6.80	13.84		100.00	100.00	100.00	

KM050

TEST NO. 19

PURPOSE: Regrind effects

PROCEDURE: Vary regrind time

FEED: Vangorda BCD

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	300				30				9.6
Lead Ro/Sc			80				2	8	9.6	9.2
Lead Regrind	1000	300				30				
Lead 1st Cleaner			50				2	6	10.3	10.1
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.2
Lead 4th Cleaner			20				2	3	10.4	10.3
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			50				2	7	11.0	11.0
Zinc Regrind				250	3000	45				9.0
Zinc 1st Cleaner			100				2	6	11.5	9.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			40				2	4	12.3	12.3
Zinc 4th Cleaner			30				2	3	12.3	12.1

TEST NO. 19

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.56	58.59	2.54	7.98		75.23	2.09	0.89	
Pb Cleaner Tails 4	0.16	33.00	4.15	18.70		2.64	0.21	0.13	
Pb Cleaner Tails 3	0.28	25.20	5.80	22.00		3.54	0.52	0.27	
Pb Cleaner Tails 2	0.93	9.20	5.70	26.30		4.28	1.70	1.06	
Zn Cleaner Conc. 4	1.59	0.35	47.76	8.56		0.28	24.33	0.59	
Zn Cleaner Tails 4	1.87	0.31	16.30	3.16		0.29	9.81	0.26	
Zn Cleaner Tails 3	3.54	0.56	17.10	10.70		0.99	19.47	1.65	
Zn Cleaner Tails 2	3.72	0.79	9.50	27.90		1.47	11.36	4.52	
Zn Cleaner Tails 1	14.29	0.53	5.80	31.70		3.80	26.62	19.72	
Tails	71.06	0.21	0.17	22.91		7.48	3.88	70.90	
Calculated Head	100.00	1.99	3.11	22.96		100.00	100.00	100.00	

KM050

TEST NO. 20

PURPOSE: Primary Grind Effects

PROCEDURE: Vary Primary Grind Time

FEED: Vangorda BCD

GRIND: 45 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	300				45				9.2
Lead Ro/Sc			80				2	8	9.6	9.3
Lead Regrind	1000	300				10				
Lead 1st Cleaner			50				2	6	10.2	10.0
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.5	10.4
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			50				2	7	11.0	11.0
Zinc Regrind				250	3000	10				
Zinc 1st Cleaner			40				2	6	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.2	12.1
Zinc 4th Cleaner			20				2	3	12.2	12.2

TEST NO. 20

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	2.66	56.51	2.76	9.29		75.25	2.29	1.08	
Pb Cleaner Tails 4	0.17	23.80	4.57	23.90		1.99	0.24	0.18	
Pb Cleaner Tails 3	0.38	16.50	5.10	25.50		3.18	0.61	0.43	
Pb Cleaner Tails 2	1.53	5.00	3.80	30.00		3.83	1.82	2.01	
Zn Cleaner Conc. 4	4.45	0.37	47.22	11.20		0.83	65.74	2.19	
Zn Cleaner Tails 4	2.68	0.53	10.40	6.30		0.71	8.73	0.74	
Zn Cleaner Tails 3	1.74	1.34	10.20	13.50		1.17	5.57	1.03	
Zn Cleaner Tails 2	2.03	1.68	6.50	24.50		1.71	4.14	2.19	
Zn Cleaner Tails 1	8.03	0.91	2.80	31.30		3.66	7.03	11.03	
Tails	76.33	0.20	0.16	23.60		7.65	3.82	79.11	
Calculated Head	100.00	1.99	3.20	22.77		100.00	100.00	100.00	

KM050

TEST NO. 21 - Cycle 1

PURPOSE: Locked Cycle Test

PROCEDURE: Standard Locked Cycle Procedure

FEED: Type G - Vangorda

GRIND: Medium

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.8
Lead Rougher			30				2	3		9.6
Lead Scavenger			40				2	5	9.6	9.2
Lead Regrind	1000	200				10				10.7
Lead 1st Cleaner			40				2	7	10.7	10.4
Lead 2nd Cleaner			30				2	5	10.5	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.1
Lead 4th Cleaner			20				2	3	10.5	10.2
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	10				
Zinc 1st Cleaner			30				2	7	11.5	11.4
Zinc 2nd Cleaner			20				2	5	12.0	12.0
Zinc 3rd Cleaner			10				2	4	12.5	12.5

KM050

TEST NO. 21 - Cycle 2

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.4
Lead Rougher			30				2	3	9.5	9.4
Lead Scavenger			40				2	5	9.4	9.2
Lead Regrind	1000	200				10				10.8
Lead 1st Cleaner			40				2	7	10.8	10.5
Lead 2nd Cleaner			30				2	5	10.6	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.5	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	10				11.5
Zinc 1st Cleaner			40				2	7	11.5	11.5
Zinc 2nd Cleaner			20				2	5	12.0	12.0
Zinc 3rd Cleaner			40				2	4	12.4	12.4

KM050

TEST NO. 21 - Cycle 3

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.2
Lead Rougher			30				2	3	9.6	9.6
Lead Scavenger			40				2	5	9.6	9.4
Lead Regrind	1000	200				10				
Lead 1st Cleaner			40				2	7	10.7	10.4
Lead 2nd Cleaner			30				2	5	10.6	10.7
Lead 3rd Cleaner			20				2	4	10.8	10.4
Lead 4th Cleaner			20				2	3	10.5	10.6
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	10				11.5
Zinc 1st Cleaner			50				2	7	11.5	11.5
Zinc 2nd Cleaner			40				2	5	12.0	12.0
Zinc 3rd Cleaner			-				2	4	12.5	12.5

KM050

TEST NO. 21 - Cycle 4

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.0
Lead Rougher			30				2	3	9.6	9.4
Lead Scavenger			40				2	5	9.3	9.4
Lead Regrind	1000	200								
Lead 1st Cleaner			40				2	7	10.6	10.5
Lead 2nd Cleaner			30				2	5	10.7	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			20				2	3	10.5	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	10				
Zinc 1st Cleaner			50				2	7	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

KM050

TEST NO. 21 - Cycle 5

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				20				9.3
Lead Rougher			30				2	3	9.6	9.4
Lead Scavenger			40				2	5	9.4	9.2
Lead Regrind	1000	200				10				10.8
Lead 1st Cleaner			40				2	7	10.5	10.4
Lead 2nd Cleaner			30				2	5	10.6	10.5
Lead 3rd Cleaner			30				2	4	10.7	10.8
Lead 4th Cleaner			20				2	3	10.8	10.6
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	10				
Zinc 1st Cleaner			50				2	7	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

TEST NO. 21

Product	Weight	Assays %			Distribution		
	%	Pb	Zn	Fe	Pb	Zn	Fe
Lead Concentrate 5	1.26	48.60	14.00	7.20	17.18	2.60	0.67
Lead Concentrate 4	1.21	50.10	13.20	6.92	17.01	2.35	0.61
Lead Concentrate 3	1.22	51.70	13.20	6.48	17.69	2.37	0.58
Lead Concentrate 2	0.85	60.40	10.40	4.44	14.34	1.30	0.28
Lead Concentrate 1	0.72	61.00	11.00	4.08	12.27	1.16	0.21
Pb Cleaner Tails 4	0.10	18.90	17.00	15.80	0.52	0.25	0.11
Pb Cleaner Tails 3	0.21	14.10	18.00	18.60	0.82	0.55	0.29
Pb Cleaner Tails 2	0.26	10.70	14.20	19.90	0.78	0.54	0.38
Pb Scavenger Conc.	1.14	3.80	10.60	24.00	1.21	1.78	2.00
Zinc Concentrate 5	2.07	1.64	52.30	5.18	0.95	15.96	0.79
Zinc Concentrate 4	2.41	2.02	50.40	5.68	1.37	17.90	1.00
Zinc Concentrate 3	2.05	1.76	53.80	4.92	1.01	16.26	0.74
Zinc Concentrate 2	1.96	1.70	53.30	4.90	0.93	15.40	0.71
Zinc Concentrate 1	1.73	1.60	52.40	4.76	0.78	13.36	0.60
Zn Cleaner Tails 3	0.72	2.33	8.00	4.92	0.47	0.84	0.26
Zn Cleaner Tails 2	0.83	2.62	5.80	10.20	0.61	0.71	0.62
Zn Cleaner Tails 1 - 5	1.15	1.61	2.03	17.70	0.52	0.34	1.50
Zn Cleaner Tails 1 - 4	1.43	1.53	1.60	13.80	0.61	0.34	1.44
Zn Cleaner Tails 1 - 3	1.26	2.44	3.85	15.90	0.86	0.71	1.47
Zn Cleaner Tails 1 - 2	1.65	2.10	2.72	26.80	0.97	0.66	3.25
Zn Cleaner Tails 1 - 1	0.60	1.94	2.15	20.40	0.33	0.19	0.90
Zn Scavenger Conc.	1.80	1.44	3.08	37.00	0.73	0.82	4.90
Tails 5	15.41	0.43	0.39	15.60	1.86	0.89	16.56
Tails 4	15.21	0.39	0.32	16.40	1.66	0.72	17.19
Tails 3	15.26	0.39	0.29	16.10	1.67	0.65	16.92
Tails 2	14.72	0.40	0.37	15.30	1.65	0.80	15.52
Tails 1	12.81	0.33	0.28	11.90	1.19	0.53	10.49
Calculated Head	100.00	3.57	6.78	14.30	100.00	100.00	100.00

TEST NO. 21

Calculated Grades and Recoveries

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Comb Pb Concentrate	5.26	53.3	12.6	78.5	9.8
Comb Pb Cleaner Tails	1.71	7.00	12.4	3.4	3.1
Comb Zn Concentrate	10.22	1.76	52.4	5.0	78.9
Comb Zn Cleaner Tails	9.44	1.93	3.32	5.1	4.6
Combined Tails	73.41	.39	.33	8.0	3.6

Projected Metallurgical Balance

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	3.56	6.78	100.0	100.0
Lead Concentrate	5.85	50.1	13.5	82.3	11.7
Zinc Concentrate	10.7	1.82	52.1	5.5	82.2
Tails	82.64	.52	.50	12.2	6.1

KM050

TEST NO. 22 - Cycle 1

PURPOSE: Cycle Test

PROCEDURE:

FEED: Vangorda E

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				20				10.3
Lead Rougher			40				2	3	10.3	9.9
Lead Scavenger			40				2	5	9.9	9.8
Lead Regrind	1000	200				10				10.4
Lead 1st Cleaner			50				2	7	10.4	10.1
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.4	10.3
Lead 4th Cleaner			10				2	3	10.4	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	4	11.0	10.8
Zinc Scavenger			40				2	5	11.0	10.8
Zinc Regrind				500	2000	20				
Zinc 1st Cleaner			50				2	7	11.5	11.5
Zinc 2nd Cleaner			40				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

KM050

TEST NO. 22 - Cycle 2

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				20				9.8
Lead Rougher			40				2	4	9.8	9.7
Lead Scavenger			40				2	4	9.7	9.5
Lead Regrind	1000	200				10				10.2
Lead 1st Cleaner			50				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.4	10.4
Lead 4th Cleaner			10				2	3	10.4	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	20				11.2
Zinc 1st Cleaner			50				2	8	11.5	11.2
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.4

KM050

TEST NO. 22 - Cycle 3

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				20				9.6
Lead Rougher			40				2	4	9.6	9.6
Lead Scavenger			40				2	4	9.6	
Lead Regrind	1000	200				10				10.2
Lead 1st Cleaner			50				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.5	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.4	10.5
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	4	11.0	11.0
Zinc Scavenger			30				2	4	11.0	11.0
Zinc Regrind				500	2000	20				10.5
Zinc 1st Cleaner			50				2	8	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.2

KM050

TEST NO. 22 - Cycle 4

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				20				9.6
Lead Rougher			40				2	4	9.6	9.6
Lead Scavenger			40				2	4	9.6	9.5
Lead Regrind	1000	200				10				10.2
Lead 1st Cleaner			50				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.5	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.4	10.2
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	2000	20				
Zinc 1st Cleaner			50				2	8	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

KM050

TEST NO. 22 - Cycle 5

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	4000	200				20				9.4
Lead Rougher			40				2	4	9.6	9.6
Lead Scavenger			40				2	4	9.6	
Lead Regrind	1000	200				10				10.3
Lead 1st Cleaner			50				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.5	10.3
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.5	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				800	2000	20				
Zinc 1st Cleaner			50				2	8	11.5	11.5
Zinc 2nd Cleaner			30				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

TEST NO. 22

Product	Weight	Assays %			Distribution		
	%	Pb	Zn	Fe	Pb	Zn	Fe
Lead Concentrate 5	0.98	51.70	7.94	13.10	14.80	1.80	0.43
Lead Concentrate 4	1.10	46.50	8.94	15.20	14.90	2.30	0.56
Lead Concentrate 3	0.84	51.90	7.36	13.40	12.70	1.40	0.37
Lead Concentrate 2	1.09	48.10	7.58	15.20	15.30	1.90	0.55
Lead Concentrate 1	0.52	67.30	4.94	6.70	10.20	1.30	0.12
Pb Cleaner Tails 4	0.22	21.84	10.50	26.00	1.40	0.50	0.19
Pb Cleaner Tails 3	0.44	13.99	8.50	31.60	1.80	0.90	0.46
Pb Cleaner Tails 2	0.58	9.86	7.20	34.40	1.70	1.00	0.66
Pb Scavenger Conc.	1.71	3.48	5.30	39.10	1.70	2.10	2.22
Zinc Concentrate 5	1.33	2.27	48.82	8.70	0.90	15.20	0.38
Zinc Concentrate 4	1.29	2.31	50.90	7.70	0.90	15.40	0.33
Zinc Concentrate 3	1.38	2.78	47.17	10.02	1.10	15.20	0.46
Zinc Concentrate 2	1.18	1.95	51.73	7.90	0.70	14.30	0.31
Zinc Concentrate 1	0.92	1.40	52.08	6.70	0.40	11.20	0.20
Zn Cleaner Tails 3	0.56	2.69	8.50	7.50	0.40	1.10	0.14
Zn Cleaner Tails 2	0.97	3.15	6.30	12.30	0.90	1.40	0.40
Zn Cleaner Tails 1 - 5	1.86	2.20	2.40	25.00	1.20	1.00	1.55
Zn Cleaner Tails 1 - 4	1.81	2.10	2.10	23.90	1.10	0.90	1.44
Zn Cleaner Tails 1 - 3	1.80	2.42	3.10	25.10	1.30	1.30	1.50
Zn Cleaner Tails 1 - 2	0.80	2.94	4.34	27.10	0.70	0.80	0.72
Zn Cleaner Tails 1 - 1	0.56	2.20	4.86	29.80	0.40	0.60	0.56
Zn Scavenger Conc.	1.39	2.08	0.96	35.50	0.80	0.30	1.64
Tails 5	15.73	0.66	0.45	33.30	3.00	1.70	17.42
Tails 4	15.63	0.68	0.50	33.10	3.10	1.80	17.21
Tails 3	16.93	0.65	0.46	33.40	3.20	1.80	18.81
Tails 2	16.28	0.68	0.47	35.10	3.20	1.80	19.01
Tails 1	12.10	0.66	0.50	30.70	2.30	1.40	12.36
Calculated Head	100.00	3.43	4.27	30.06	100.00	100.00	100.00

TEST NO. 22

Calculated Grades and Recoveries

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Comb Pb Concentrate	4.53	51.4	7.64	67.9	8.7
Comb Pb Cleaner Tails	2.95	7.67	6.54	6.6	4.5
Comb Zn Concentrate	6.10	2.20	49.9	4.0	71.3
Comb Zn Cleaner Tails	9.75	2.39	3.31	6.8	7.4
Combined Tails	76.67	.67	.47	14.8	8.5

Projected Metallurgical Balance

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	3.43	4.27	100.0	100.0
Lead Concentrate	5.11	49.8	8.15	74.2	9.8
Zinc Concentrate	6.65	2.46	48.9	4.8	76.2
Tails	88.24	.82	.68	21.0	14.0

KM050

TEST NO. 23 - Cycle 1

PURPOSE: Locked Cycle Test - Vangorda Phase II

PROCEDURE: Standard Fine Cycle Procedure

FEED: Type 4A - Vangorda

GRIND: 20 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	2000	200				20				10.0
Lead Rougher			30				2	4	10.0	9.8
Lead Scavenger			40				2	4	9.8	9.6
Lead Regrind	1000	200				10				10.4
Lead 1st Cleaner			40				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.4	10.1
Lead 3rd Cleaner			20				2	4	10.5	10.2
Lead 4th Cleaner			10				2	3	10.4	10.5
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	1000	20				9.2
Zinc 1st Cleaner			50				2	7	11.5	11.0
Zinc 2nd Cleaner			40				2	5	12.0	12.0
Zinc 3rd Cleaner			40				2	4	12.2	12.2

KM050

TEST NO. 23 - Cycle 2

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	2000	200				20				9.4
Lead Rougher			50				2	4	9.5	9.4
Lead Scavenger			50				2	4	9.4	9.2
Lead Regrind	2000	200				10				
Lead 1st Cleaner			40				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			10				2	3	10.6	10.5
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	3000	20				9.4
Zinc 1st Cleaner			70				2	7	11.5	11.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.2	12.2

KM050

TEST NO. 23 - Cycle 3

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	2000	200				20				9.4
Lead Rougher			50				2	4	9.4	9.3
Lead Scavenger			50				2	4	9.3	9.3
Lead Regrind	2000	200				10				
Lead 1st Cleaner			40				2	7	10.5	10.4
Lead 2nd Cleaner			30				2	5	10.4	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.3
Lead 4th Cleaner			10				2	3	10.4	10.2
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	4000	20				10.0
Zinc 1st Cleaner			70				2	7	11.5	11.5
Zinc 2nd Cleaner			50				2	6	12.0	12.0
Zinc 3rd Cleaner			30				2	4	12.2	12.2

KM050

TEST NO. 23 - Cycle 4

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	2000	200				20				9.4
Lead Rougher			50				2	4	9.4	9.3
Lead Scavenger			50				2	4	9.3	9.2
Lead Regrind	2000	200				10				10.3
Lead 1st Cleaner			40				2	7	10.4	10.2
Lead 2nd Cleaner			30				2	5	10.4	10.3
Lead 3rd Cleaner			20				2	4	10.4	10.2
Lead 4th Cleaner			10				2	3	10.4	10.3
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	5000					10.7
Zinc 1st Cleaner			70				2	7	11.5	11.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			30				2	4	12.3	12.3

KM050

TEST NO. 23 - Cycle 5

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	2000	200				20				9.4
Lead Rougher			50				2	4	9.4	9.3
Lead Scavenger			50				2	4	9.3	9.2
Lead Regrind						10				
Lead 1st Cleaner			40				2	7	10.4	10.4
Lead 2nd Cleaner			30				2	5	10.3	10.2
Lead 3rd Cleaner			20				2	4	10.4	10.5
Lead 4th Cleaner			10				2	3	10.4	[illegible]
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			40				2	4	11.0	11.0
Zinc Scavenger			40				2	4	11.0	11.0
Zinc Regrind				500	5000	20				
Zinc 1st Cleaner			70				2	7	11.5	11.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			30				2	4	12.5	12.5

TEST NO. 23

Product	Weight	Assays %			Distribution		
	%	Pb	Zn	Fe	Pb	Zn	Fe
Lead Concentrate 5	1.42	34.40	6.36	9.34	16.98	2.13	1.20
Lead Concentrate 4	1.01	45.40	5.66	8.64	15.94	1.35	0.79
Lead Concentrate 3	1.11	42.80	5.98	9.00	16.51	1.57	0.90
Lead Concentrate 2	1.17	41.00	6.36	9.78	16.67	1.76	1.03
Lead Concentrate 1	1.00	41.40	5.80	8.40	14.39	1.37	0.76
Pb Cleaner Tails 4	0.28	4.64	7.59	16.10	0.45	0.50	0.41
Pb Cleaner Tails 3	0.28	3.82	7.12	17.10	0.37	0.47	0.43
Pb Cleaner Tails 2	0.64	2.65	6.44	18.10	0.59	0.97	0.47
Pb Scavenger Conc.	1.97	1.56	4.72	17.00	1.07	2.19	3.02
Zinc Concentrate 5	1.29	1.22	52.70	6.72	0.55	16.04	0.78
Zinc Concentrate 4	1.30	1.08	51.10	6.08	0.49	15.67	0.71
Zinc Concentrate 3	1.40	1.62	49.60	7.80	0.79	16.38	0.98
Zinc Concentrate 2	1.29	1.26	50.00	7.84	0.56	15.22	0.91
Zinc Concentrate 1	0.78	0.38	52.00	5.62	0.10	9.57	0.40
Zn Cleaner Tails 3	0.37	1.49	7.45	3.43	0.19	0.65	0.11
Zn Cleaner Tails 2	0.99	1.70	6.82	9.66	0.59	1.59	0.86
Zn Cleaner Tails 1 - 5	2.23	0.79	1.41	31.80	0.61	0.74	6.40
Zn Cleaner Tails 1 - 4	2.16	0.81	1.78	25.40	0.61	0.91	4.95
Zn Cleaner Tails 1 - 3	3.48	0.64	0.97	32.00	0.77	0.80	10.04
Zn Cleaner Tails 1 - 2	1.84	0.92	2.83	29.00	0.59	1.23	4.81
Zn Cleaner Tails 1 - 1	1.20	1.58	10.00	18.50	0.66	2.83	2.00
Zn Scavenger Conc.	2.59	0.78	1.80	40.40	0.70	1.10	9.44
Tails 5	15.25	0.40	0.33	9.31	2.12	1.19	12.81
Tails 4	14.99	0.42	0.32	8.06	2.19	1.13	10.90
Tails 3	14.51	0.42	0.33	8.51	2.12	1.13	11.14
Tails 2	13.95	0.39	0.28	6.79	1.89	0.92	8.54
Tails 1	11.51	0.37	0.23	4.44	1.48	0.62	4.61
Calculated Head	100.00	2.88	4.24	11.08	100.00	100.00	100.00

TEST NO. 23

Calculated Grades and Recoveries

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Comb Pb Concentrate	5.71	40.6	6.06	80.5	8.2
Comb Pb Cleaner Tails	3.17	2.25	5.53	2.5	4.1
Comb Zn Concentrate	6.06	1.18	50.98	2.5	72.9
Comb Zn Cleaner Tails	14.86	.91	2.63	4.7	8.8
Combined Tails	70.21	.40	.30	9.8	5.0

Projected Metallurgical Balance

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	2.88	4.24	100.0	100.0
Lead Concentrate	5.94	40.2	6.04	82.9	8.5
Zinc Concentrate	6.79	1.32	51.1	3.1	81.8
Tails	87.27	.46	.47	14.0	9.7

KM050

TEST NO. 24 - Cycle 1

PURPOSE: Locked Cycle Test

PROCEDURE: Standard Cycle Procedure

FEED: Vangorda G

GRIND: Fine

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	300				30				9.8
Lead Rougher			40				2	3	9.8	9.2
Lead Scavenger			40				2	5	9.1	8.8
Lead Regrind	1000	300				20				10.6
Lead 1st Cleaner			40				2	7	10.5	10.2
Lead 2nd Cleaner			30				2	5	10.5	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			20				2	3	10.4	10.2
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			50				2	3	11.0	11.0
Zinc Scavenger			40				2	5	11.0	11.0
Zinc Regrind				500	2000	20				9.4
Zinc 1st Cleaner			40				2	7	11.5	11.5
Zinc 2nd Cleaner			30				2	4	12.0	12.0
Zinc 3rd Cleaner			20				2	4	12.5	12.5

KM050

TEST NO. 24 - Cycle 2

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	300				30				9.3
Lead Rougher			40				2	3	9.8	9.7
Lead Scavenger			40				2	5	9.6	9.2
Lead Regrind	1000	300				20				
Lead 1st Cleaner			40				2	7	10.5	10.4
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner			20				2	4	10.5	10.4
Lead 4th Cleaner			20				2	3	10.5	10.2
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			30				2	3	11.0	11.0
Zinc Scavenger			40				2	5	11.0	11.0
Zinc Regrind				500	1000	20				9.4
Zinc 1st Cleaner			140				2	7	11.8	11.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			30				2	4	12.5	12.3

KM050

TEST NO. 24 - Cycle 3

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	300				30				9.7
Lead Rougher			40				2	3	9.7	9.4
Lead Scavenger			40				2	5	9.4	9.2
Lead Regrind	1000	300				20				10.7
Lead 1st Cleaner			40				2	7	10.7	10.6
Lead 2nd Cleaner			30				2	5	10.5	10.4
Lead 3rd Cleaner			20				2	4	10.5	10.5
Lead 4th Cleaner			20				2	3	10.5	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Rougher			50				2	3	11.0	11.0
Zinc Scavenger			40				2	5	11.0	11.0
Zinc Regrind				500	2000	20				
Zinc 1st Cleaner			100				2	7	11.5	11.5
Zinc 2nd Cleaner			50				2	5	12.0	12.0
Zinc 3rd Cleaner			-				2	4	12.5	12.5

TEST NO. 24

Product	Weight	Assays %			Distribution		
	%	Pb	Zn	Fe	Pb	Zn	Fe
Lead Concentrate 3	1.52	64.00	8.44	4.90	27.10	1.80	0.51
Lead Concentrate 2	1.31	66.60	8.60	3.80	24.30	1.60	0.33
Lead Concentrate 1	1.05	66.80	8.16	3.40	19.50	1.20	0.24
Pb Cleaner Tails 4	0.21	37.80	16.82	9.60	2.20	0.50	0.14
Pb Cleaner Tails 3	0.25	33.80	16.05	10.70	2.40	0.60	0.18
Pb Cleaner Tails 2*	0.51	6.25	8.33	34.40	0.90	0.60	1.20
Zinc Concentrate 3	3.80	1.84	52.10	4.70	1.90	28.50	1.22
Zinc Concentrate 2	3.33	1.92	50.60	4.90	1.80	24.30	1.11
Zinc Concentrate 1	2.08	0.74	55.80	4.30	0.40	16.70	0.61
Zn Cleaner Tails 3	1.38	2.62	15.39	4.90	1.00	3.10	0.46
Zn Cleaner Tails 2	2.14	2.97	12.70	7.20	1.80	3.90	1.05
Zn Cleaner Tails 1 - 3	3.14	2.50	7.10	12.00	2.20	3.20	2.58
Zn Cleaner Tails 1 - 2	2.23	2.11	6.70	12.70	1.30	2.20	1.94
Zn Cleaner Tails 1 - 1	1.58	3.16	17.50	10.50	1.40	4.00	1.13
Zn Scavenger Conc.	2.84	3.20	6.16	18.80	2.50	2.50	3.65
Tails 3	25.00	0.48	0.42	16.70	3.30	1.50	28.56
Tails 2	24.48	0.48	0.57	16.90	3.30	2.00	28.30
Tails 1	23.15	0.42	0.51	16.90	2.70	1.70	26.76
Calculated Head	100.00	3.59	6.94	14.62	100.00	100.00	100.00

* calculated estimate

TEST NO. 24

Calculated Grades and Recoveries

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Comb Pb Concentrate	3.88	65.6	8.42	70.9	4.6
Comb Pb Cleaner Tails	.97	20.2	12.16	5.5	1.7
Comb Zn Concentrate	9.21	1.62	52.39	4.1	69.5
Comb Zn Cleaner Tails	13.31	2.75	9.83	10.2	19.0
Combined Tails	72.63	.46	.50	9.3	5.2

Projected Metallurgical Balance

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	3.59	6.94	100.0	100.0
Lead Concentrate	4.36	64.0	8.44	78.4	5.3
Zinc Concentrate	10.71	1.84	52.1	5.5	80.4
Tails	84.93	.71	1.17	16.0	14.3

KM050

TEST NO. 25 - Cycle 1

PURPOSE: Locked Cycle Test

PROCEDURE: Standard Cycle Procedure

FEED: Type BCD

GRIND: Fine

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	200				20				9.5
Lead Rougher			60				2	5	9.5	9.1
Lead Scavenger			60				2	5	9.5	9.1
Lead Regrind	1500	200				10				10.6
Lead 1st Cleaner			30				2	5	10.7	10.5
Lead 2nd Cleaner			20				2	4	10.5	10.4
Lead 3rd Cleaner			10				2	3	10.3	10.0
Lead 4th Cleaner			10				2	2	10.0	10.0
Zinc Conditioning				500			10		11.0	11.0
Zinc Rougher			30				2	3	11.0	11.0
Zinc Scavenger			30				2	3	11.0	11.0
Zinc Regrind				250	1000	20				11.4
Zinc 1st Cleaner			30				2	4	11.5	11.3
Zinc 2nd Cleaner			20				2	3	12.0	11.9
Zinc 3rd Cleaner			20				2	2	12.3	12.2
Zinc 4th Cleaner			-				2	2	12.2	12.2

KM050

TEST NO. 25 - Cycle 2

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	200				20				9.6
Lead Rougher			30				2	2	9.6	9.4
Lead Scavenger			30				2	3	9.6	9.4
Lead Regrind	1000	200				10				
Lead 1st Cleaner			30				2	5	10.6	10.3
Lead 2nd Cleaner			20				2	3	10.2	10.2
Lead 3rd Cleaner			10				2	3	10.2	10.0
Lead 4th Cleaner			-				2	2	9.9	9.8
Zinc Conditioning				500			10		11.0	11.0
Zinc Rougher			30				2	3	11.0	11.0
Zinc Scavenger			30				2	3	11.0	11.0
Zinc Regrind				250	500	20				11.8
Zinc 1st Cleaner			30				2	4	11.8	11.7
Zinc 2nd Cleaner			20				2	3	11.8	11.7
Zinc 3rd Cleaner			20				2	2	12.0	12.0
Zinc 4th Cleaner			-				2	2	12.2	12.2

KM050

TEST NO. 25 - Cycle 3

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	200				20				9.0
Lead Rougher			30				2	3	9.6	9.2
Lead Scavenger			30				2	3	9.6	9.2
Lead Regrind	1000	200				10				
Lead 1st Cleaner			30				2	5	10.7	10.6
Lead 2nd Cleaner			20				2	4	10.3	10.0
Lead 3rd Cleaner			10				2	3	10.3	10.0
Lead 4th Cleaner			-				2	2	10.2	10.1
Zinc Conditioning				500			10		11.0	11.0
Zinc Rougher			30				2	3	12.0	12.0
Zinc Scavenger			30				2	3	12.0	12.0
Zinc Regrind				250	500	20				11.7
Zinc 1st Cleaner			30				2	4	11.7	11.7
Zinc 2nd Cleaner			20				2	3	12.0	11.8
Zinc 3rd Cleaner			20				2	2	12.2	12.3
Zinc 4th Cleaner			-				2	2	12.3	12.2

KM050

TEST NO. 25 - Cycle 4

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	200				20				9.0
Lead Rougher			30				2	3	9.5	9.0
Lead Scavenger			30				2	3	9.5	9.0
Lead Regrind	1000	200				10				10.7
Lead 1st Cleaner			30				2	5	10.7	10.6
Lead 2nd Cleaner			20				2	4	10.3	10.2
Lead 3rd Cleaner			20				2	3	10.3	10.2
Lead 4th Cleaner			-				2	2	10.3	10.3
Zinc Conditioning				500			10		11.5	11.5
Zinc Rougher			30				2	3	11.5	11.5
Zinc Scavenger			30				2	3	11.5	11.5
Zinc Regrind				250	500	10				11.6
Zinc 1st Cleaner			30				2	5	11.8	11.7
Zinc 2nd Cleaner			20				2	4	12.0	11.9
Zinc 3rd Cleaner			20				2	3	12.0	12.0
Zinc 4th Cleaner			-				2	2	12.3	12.3

KM050

TEST NO. 25 - Cycle 5

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	200				20				9.2
Lead Rougher			30				2	3	9.5	9.2
Lead Scavenger			30				2	3	9.5	9.2
Lead Regrind	1000	200				10				10.9
Lead 1st Cleaner			30				2	5	10.9	10.7
Lead 2nd Cleaner			20				2	4	10.4	10.3
Lead 3rd Cleaner			20				2	3	10.3	10.3
Lead 4th Cleaner			-				2	2	10.3	10.3
Zinc Conditioning							10		11.5	11.5
Zinc Rougher			30				2	3	11.5	11.5
Zinc Scavenger			30				2	3	11.5	11.5
Zinc Regrind				250	500	20				
Zinc 1st Cleaner			30				2	5	11.8	11.6
Zinc 2nd Cleaner			20				2	4	12.0	12.0
Zinc 3rd Cleaner			20				2	3	12.2	12.1
Zinc 4th Cleaner			-				2	2	12.3	12.3

TEST NO. 25

Product	Weight	Assays %			Distribution		
	%	Pb	Zn	Fe	Pb	Zn	Fe
Lead Concentrate 5	0.73	47.90	4.72	12.80	16.99	1.03	0.44
Lead Concentrate 4	0.64	52.00	3.79	10.90	16.17	0.73	0.33
Lead Concentrate 3	0.50	55.00	3.64	9.68	13.36	0.54	0.23
Lead Concentrate 2	0.75	47.10	4.56	13.00	17.16	1.02	0.46
Lead Concentrate 1	0.49	54.80	4.64	9.84	13.04	0.68	0.23
Pb Cleaner Tails 4	0.39	17.50	6.90	25.50	3.32	0.80	0.47
Pb Cleaner Tails 3	0.35	12.20	4.86	29.50	2.07	0.51	0.48
Pb Cleaner Tails 2	0.37	7.66	4.74	30.90	1.37	0.52	0.53
Pb Scavenger Conc.	1.01	2.12	3.70	28.70	1.04	1.12	1.36
Zinc Concentrate 5	1.00	0.46	49.40	12.70	0.22	14.77	0.59
Zinc Concentrate 4	1.20	1.20	44.00	18.20	0.70	15.78	1.02
Zinc Concentrate 3	1.00	0.50	49.90	12.60	0.24	14.92	0.59
Zinc Concentrate 2	1.00	0.42	51.20	10.90	0.20	15.30	0.51
Zinc Concentrate 1	0.76	0.38	49.50	10.80	0.14	11.24	0.38
Zn Cleaner Tails 4	0.35	2.51	31.10	25.80	0.43	2.21	0.42
Zn Cleaner Tails 3	0.36	2.78	17.80	28.80	0.49	1.92	0.49
Zn Cleaner Tails 2	0.51	2.05	8.26	36.40	0.51	1.26	0.87
Zn Cleaner Tails 1 - 5	2.17	0.87	2.80	38.80	0.92	1.82	3.94
Zn Cleaner Tails 1 - 4	1.62	0.82	5.72	35.80	0.65	2.77	2.71
Zn Cleaner Tails 1 - 3	1.60	1.20	5.03	35.00	0.93	2.41	2.62
Zn Cleaner Tails 1 - 2	1.29	1.39	5.73	33.80	0.87	2.21	2.04
Zn Cleaner Tails 1 - 1	1.12	1.26	6.18	33.40	0.68	2.07	1.75
Zn Scavenger Conc.	2.68	0.82	0.90	38.90	1.07	0.72	4.88
Tails 5	15.53	0.20	0.15	19.00	1.51	0.70	13.80
Tails 4	15.52	0.19	0.14	19.70	1.43	0.65	14.30
Tails 3	17.60	0.20	0.14	23.00	1.71	0.74	18.94
Tails 2	16.39	0.19	0.17	21.20	1.51	0.83	16.25
Tails 1	13.03	0.20	0.19	15.40	1.27	0.74	9.39
Calculated Head	100.00	2.06	3.35	21.38	100.00	100.00	100.00

TEST NO. 25

Calculated Grades and Recoveries

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Comb Pb Concentrate	3.11	50.8	4.30	76.7	4.0
Comb Pb Cleaner Tails	2.12	7.58	4.66	7.8	3.0
Comb Zn Concentrate	4.96	.63	48.6	1.5	72.0
Comb Zn Cleaner Tails	11.70	1.15	5.27	6.6	17.4
Combined Tails	78.07	.20	.16	7.43	3.7

Projected Metallurgical Balance

Product	Weight %	Assays %		Distribution	
		Pb	Zn	Pb	Zn
Feed	100.0	2.06	3.35	100.0	100.0
Lead Concentrate	3.46	51.2	4.11	86.0	4.2
Zinc Concentrate	5.68	.75	47.5	2.0	80.5
Tails	90.86	.27	.56	12.0	15.3

KM050

TEST NO. 26

PURPOSE: Regrind Test

PROCEDURE: Vary Regrind Time

FEED: Vangorda A

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				8.6
Lead Ro/Sc			100				2	10	9.5	9.1
Lead Regrind	1000	200				30				10.3
Lead 1st Cleaner			50				2	8	10.3	10.1
Lead 2nd Cleaner			20				2	5	10.3	10.1
Lead 3rd Cleaner			10				2	4	10.3	10.1
Lead 4th Cleaner			-				2	3	10.3	10.1
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			50				2	5	11.0	11.0
Zinc Regrind				100	1000	30				
Zinc 1st Cleaner			50				2	8	11.5	11.5
Zinc 2nd Cleaner			20				2	4	12.0	11.9
Zinc 3rd Cleaner			20				2	3	12.0	12.0
Zinc 4th Cleaner			-				2	3	12.0	12.0

TEST NO. 26

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.02	45.10	5.90	8.79		64.75	6.15	2.85	
Pb Cleaner Tails 4	0.92	10.00	6.66	16.10		3.29	1.59	1.20	
Pb Cleaner Tails 3	1.32	6.66	5.96	15.40		3.13	2.03	1.63	
Pb Cleaner Tails 2	2.47	4.10	5.25	17.00		3.61	3.35	3.37	
Zn Cleaner Conc. 4	1.43	1.17	55.60	7.37		0.60	20.63	0.85	
Zn Cleaner Tails 4	0.37	3.03	44.40	9.40		0.40	4.21	0.28	
Zn Cleaner Tails 3	1.01	3.26	40.90	11.10		1.17	10.67	0.90	
Zn Cleaner Tails 2	2.35	2.52	14.60	26.60		2.12	8.90	5.04	
Zn Cleaner Tails 1	20.81	0.97	6.06	34.20		7.20	32.65	57.25	
Tails	65.30	0.59	0.58	5.07		13.74	9.81	26.64	
Calculated Head	100.00	2.80	3.86	12.43		100.00	100.00	100.00	

KM050

TEST NO. 27

PURPOSE: Regrind Test

PROCEDURE: Vary Regrind Time

FEED: Vangorda Compo 4G

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				9.7
Lead Ro/Sc			100				2	10	9.7	9.5
Lead Regrind	1000	200				30				10.4
Lead 1st Cleaner			50				2	7	10.4	10.1
Lead 2nd Cleaner			30				2	5	10.4	10.2
Lead 3rd Cleaner									10.4	10.3
Lead 4th Cleaner									10.4	10.4
Zinc Conditioning				1000			10		11.0	11.0
Zinc Ro/Sc			120				2	9	11.0	11.0
Zinc Regrind				500	2000	30				11.4
Zinc 1st Cleaner			100	100			2	10	11.5	11.3
Zinc 2nd Cleaner			50				2	4	12.0	12.0
Zinc 3rd Cleaner			20				2	3	12.0	12.0
Zinc 4th Cleaner			-				2	3	12.0	12.0

TEST NO. 27

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.97	63.20	8.71	4.65		80.76	6.23	1.44	
Pb Cleaner Tails 4	0.30	18.70	17.20	19.20		1.46	0.75	0.36	
Pb Cleaner Tails 3	0.75	10.40	16.20	21.60		2.01	1.75	1.01	
Pb Cleaner Tails 2	2.01	4.04	12.10	22.70		2.09	3.51	2.85	
Zn Cleaner Conc. 4	7.75	0.58	60.10	4.14		1.16	67.04	2.00	
Zn Cleaner Tails 4	0.22	2.31	38.80	10.10		0.13	1.23	0.14	
Zn Cleaner Tails 3	0.76	1.95	39.10	9.91		0.38	4.27	0.47	
Zn Cleaner Tails 2	1.09	2.34	22.10	15.70		0.66	3.47	1.07	
Zn Cleaner Tails 1	4.75	1.63	9.70	20.50		1.99	6.63	6.08	
Tails	77.40	0.47	0.46	17.50		9.36	5.12	84.57	
Calculated Head	100.00	3.89	6.95	16.02		100.00	100.00	100.00	

KM050

TEST NO. 28

PURPOSE: Regrind Effects

PROCEDURE: Vary Regrind Time

FEED: Vangorda A

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	Lime	Grind	Cond	Froth	Start	Finish
Primary Grind	1000	200				30				8.6
Lead Ro/Sc			100				2	10	9.5	9.0
Lead Regrind	1000	200				30				10.4
Lead 1st Cleaner			50				2	8	10.4	10.1
Lead 2nd Cleaner			20				2	5	10.4	10.2
Lead 3rd Cleaner			10				2	4	10.3	10.0
Lead 4th Cleaner			-				2	3	10.3	10.1
Zinc Conditioning				1000			10		11.0	11.0
Zinc Ro/Sc			70				2	8	11.0	11.0
Zinc Regrind				100	1000	30				11.5
Zinc 1st Cleaner			100				2	7	11.5	11.2
Zinc 2nd Cleaner			30				2	5	11.7	11.6
Zinc 3rd Cleaner			20				2	4	11.9	11.9
Zinc 4th Cleaner			-				2	3	12.0	12.0

Test No. 28

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	4.42	52.10	5.20	7.69		80.42	5.56	3.00	
Pb Cleaner Tails 4	0.42	7.21	8.43	14.80		1.07	0.87	0.55	
Pb Cleaner Tails 3	0.76	4.52	8.43	16.00		1.20	1.55	1.07	
Pb Cleaner Tails 2	1.78	2.96	7.00	19.40		1.84	3.01	3.04	
Zn Cleaner Conc. 4	4.38	0.71	57.80	6.90		1.09	61.29	2.67	
Zn Cleaner Tails 4	0.60	1.90	46.10	8.03		0.40	6.72	0.43	
Zn Cleaner Tails 3	0.89	1.66	20.30	9.27		0.51	4.36	0.73	
Zn Cleaner Tails 2	1.26	1.85	11.50	17.90		0.81	3.51	1.99	
Zn Cleaner Tails 1	9.01	0.97	3.40	19.70		3.05	7.41	15.67	
Tails	76.47	0.36	0.31	10.50		9.61	5.73	70.85	
Calculated Head	100.00	2.86	4.13	11.33		100.00	100.00	100.00	

KM050

TEST NO. 29

PURPOSE: Repeat Test 15

PROCEDURE: Standard soda ash cyanide

FEED: 1 kg. New BCD Vangorda

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	CaO	Grind	Cond	Froth	Start	Finish
Primary Grind	1500	300				30				9.4
Lead Ro/Sc			200				2	7	9.4	8.3
Lead Regrind	1000	300								10.4
Lead 1st Cleaner			40				2	7	10.5	9.8
Lead 2nd Cleaner			20				2	3	10.5	10.3
Lead 3rd Cleaner			20				2	2	10.5	10.3
Lead 4th Cleaner			20				2	2	10.5	10.3

Test 29

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 4	1.94	51.35	4.38	12.67		50.68	3.17	1.09	
Pb Cleaner Tails 4	0.42	29.89	5.82	22.08		6.34	0.91	0.41	
Pb Cleaner Tails 3	0.82	21.27	5.63	26.43		8.90	1.73	0.96	
Pb Cleaner Tails 2	2.36	7.64	3.57	34.25		9.16	3.14	3.56	
Tails	94.45	0.52	2.59	22.47		24.92	91.06	93.95	
Calculated Head	100.00	1.97	2.69	22.59		100.00	100.00	100.00	

KM050

TEST NO. 30

PURPOSE: Repeat Test 15

PROCEDURE: Standard soda ash - cyanide

FEED: 1 kg. New BCD Vangorda

GRIND: 30 minutes in laboratory rod mill at 65% solids

Stage	Reagents added g/tonne					Time, Minutes			pH	
	Na_2CO_3	NaCN	Z-11	$CuSO_4$	CaO	Grind	Cond	Froth	Start	Finish
Primary Grind	200	300				30				9.5
Lead Ro/Sc			200				2	7	9.5	9.0
Lead Regrind	1000	300								10.5
Lead 1st Cleaner			40				2	5	10.5	10.2
Lead 2nd Cleaner			20				2	4	10.5	10.5
Lead 3rd Cleaner			20				2	3	10.5	10.4
Zinc Conditioning				500			10		11.0	11.0
Zinc Ro/Sc			60				2	6	11.3	11.2
Zinc Regrind					1000	15				
Zinc 1st Cleaner			100				2	5	11.5	11.3
Zinc 2nd Cleaner			50				2	4	11.8	11.8
Zinc 3rd Cleaner			30				2	3	12.2	12.2
Zinc 4th Cleaner			20				2	2	12.3	

Test 30

Product	Weight	Assays %				Distribution			
	%	Pb	Zn	Fe		Pb	Zn	Fe	
Pb Cleaner Conc. 3	3.51	40.77	4.23	17.42		73.03	5.58	2.67	
Pb Cleaner Tails 3	0.94	11.76	5.63	32.08		5.63	1.98	1.32	
Pb Cleaner Tails 2	1.89	5.29	3.89	35.24		5.10	2.76	2.91	
Zn Cleaner Conc. 4	4.74	1.14	42.80	16.63		2.76	76.21	3.45	
Zn Cleaner Tails 4	0.47	3.42	14.50	29.50		0.82	2.56	0.61	
Zn Cleaner Tails 3	0.71	2.76	8.15	34.45		1.00	2.18	1.07	
Zn Cleaner Tails 2	1.10	1.99	4.08	34.05		1.12	1.69	1.64	
Zn Cleaner Tails 1	3.67	0.88	1.49	33.86		1.65	2.05	5.44	
Tails	82.98	0.21	0.16	22.28		8.90	4.99	80.89	
Calculated Head	100.00	1.96	2.66	22.85		100.00	100.00	100.00	

APPENDIX III

BOND TEST DATA

Ore Type	Bond Index
4G	5.7
4E	6.7
4A	9.7
4BCD	8.5

KAMLOOPS RESEARCH & ASSAY

LABORATORY LIMITED

BOND BALL MILL GRINDABILITY TEST

TEST NO.	KM050
ORE SAMPLE	Vangorda 4A
SIEVE SIZE TESTED	150 Mesh
WEIGHT OF 700 ML. SAMPLE	1570.1
1/3.5 OF WEIGHT	448.6
% MINUS SIEVE SIZE TESTED	19% - 150 Mesh

Cycle	New Feed (g)	No. of Rev	Grams of -150 Mesh			
			In Product	In Feed	Net Product	Net Per Rev
1	1570.1	100	413.1	298.3	114.8	1.15
2	413.1	322	531.0	78.5	452.5	1.41
3	531.0	247	530.1	100.9	429.2	1.74
4	530.1	200	478.1	100.7	377.4	1.89
5	478.1	189	441.4	90.8	350.6	1.86
6	441.4	196	473.0	83.9	389.1	1.99
7						
8						
9						
10						

BONDS WORK INDEX FORMULA

$$Wi = 44.5/(Pi^{.23} \times Gbp^{.82} (10/\sqrt{P} - 10/\sqrt{F}))$$

Where:

Wi = Work Index (KWH/Ton)	=	9.7	KWH/Ton
Pi = Screen Size Tested (microns)	=	106	µm
Gbp = Net grams u/s produced per rev of test mill	=	1.86	g
P = 80% passing size of test product (microns)	=	76	µm
F = 80% passing size of test feed (microns)	=	2400	µm

NOTES:
1. Test results based on submitted sample.
2. Bond Formula by Bond, Fred C. "Crushing and Grinding Calculations Part I eq'n 8" in British Chemical Engineering.
3. Through experimentation accuracy of result is believed to be within 10%.

KAMLOOPS RESEARCH & ASSAY

LABORATORY LIMITED

BOND BALL MILL GRINDABILITY TEST

TEST NO.	KM050
ORE SAMPLE	Vangorda 4BCD
SIEVE SIZE TESTED	150 Mesh
WEIGHT OF 700 ML. SAMPLE	1733
1/3.5 OF WEIGHT	495.1
% MINUS SIEVE SIZE TESTED	26.9% - 150 Mesh

Cycle	New Feed (g)	No. of Rev	Grams of -150 Mesh			
			In Product	In Feed	Net Product	Net Per Rev
1	1733.0	100	627.7	466.2	161.5	1.62
2	627.7	201	588.1	168.9	419.2	2.09
3	588.1	161	524.2	158.2	366.0	2.27
4	524.2	156	510.0	141.0	369.0	2.37
5	510.0	151	496.7	137.2	359.5	2.38
6						
7						
8						
9						
10						

BONDS WORK INDEX FORMULA

$$Wi = 44.5/(Pi^{.23} \times Gbp^{.82} (10/\sqrt{P} - 10/\sqrt{F}))$$

Where:

Wi	= Work Index (KWH/Ton)	= 8.5	KWH/Ton
Pi	= Screen Size Tested (microns)	= 106	µm
Gbp	= Net grams u/s produced per rev of test mill	= 2.38	g
P	= 80% passing size of test product (microns)	= 76	µm
F	= 80% passing size of test feed (microns)	= 1350	µm

NOTES:
1. Test results based on submitted sample.
2. Bond Formula by Bond, Fred C. "Crushing and Grinding Calculations Part I eq'n 8" in British Chemical Engineering.
3. Through experimentation accuracy of result is believed to be within 10%.

KAMLOOPS RESEARCH & ASSAY

LABORATORY LIMITED

BOND BALL MILL GRINDABILITY TEST

TEST NO.	KM050
ORE SAMPLE	Vangorda 4E
SIEVE SIZE TESTED	150 Mesh
WEIGHT OF 700 ML. SAMPLE	2163.4
1/3.5 OF WEIGHT	618.1
% MINUS SIEVE SIZE TESTED	25.9% - 150 Mesh

Cycle	New Feed (g)	No. of Rev	Grams of -150 Mesh			
			In Product	In Feed	Net Product	Net Per Rev
1	2163.4	100	776.9	560.3	216.6	2.17
2	776.9	192	752.2	201.2	551.0	2.87
3	752.2	147	628.7	194.8	433.9	2.95
4	628.7	154	634.9	162.8	472.1	3.07
5	634.9	148	612.7	164.4	448.3	3.03
6						
7						
8						
9						
10						

BONDS WORK INDEX FORMULA

$$Wi = 44.5/(Pi^{.23} \times Gbp^{.82} (10/\sqrt{P} - 10/\sqrt{F}))$$

Where:

Wi = Work Index (KWH/Ton)	=	6.7	KWH/Ton
Pi = Screen Size Tested (microns)	=	106	µm
Gbp = Net grams u/s produced per rev of test mill	=	3.03	g
P = 80% passing size of test product (microns)	=	76	µm
F = 80% passing size of test feed (microns)	=	1950	µm

NOTES:
1. Test results based on submitted sample.
2. Bond Formula by Bond, Fred C. "Crushing and Grinding Calculations Part I eq'n 8" in British Chemical Engineering.
3. Through experimentation accuracy of result is believed to be within 10%.

KAMLOOPS RESEARCH & ASSAY

LABORATORY LIMITED

BOND BALL MILL GRINDABILITY TEST

TEST NO.	KM050
ORE SAMPLE	Vangorda 4G
SIEVE SIZE TESTED	150 Mesh
WEIGHT OF 700 ML. SAMPLE	2294
1/3.5 OF WEIGHT	655.4
% MINUS SIEVE SIZE TESTED	25.7% - 150 Mesh

Cycle	New Feed (g)	No. of Rev	Grams of -150 Mesh			
			In Product	In Feed	Net Product	Net Per Rev
1	2294.0	100	892.6	589.6	303.0	3.03
2	892.6	141	743.8	229.4	514.4	3.65
3	743.8	127	667.8	191.2	476.6	3.75
4	667.8	129	655.7	171.6	484.1	3.75
5						
6						
7						
8						
9						
10						

BONDS WORK INDEX FORMULA

$$Wi = 44.5/(Pi^{.23} \times Gbp^{.82} (10/\sqrt{P} - 10/\sqrt{F}))$$

Where:

Wi = Work Index (KWH/Ton)	=	5.7	KWH/Ton
Pi = Screen Size Tested (microns)	=	106	µm
Gbp = Net grams u/s produced per rev of test mill	=	3.75	g
P = 80% passing size of test product (microns)	=	76	µm
F = 80% passing size of test feed (microns)	=	1800	µm

NOTES:
1. Test results based on submitted sample.
2. Bond Formula by Bond, Fred C. "Crushing and Grinding Calculations Part I eq'n 8" in British Chemical Engineering.
3. Through experimentation accuracy of result is believed to be within 10%.

APPENDIX IV

WARMAN CYCLOSIZER DATA

KAMLOOPS RESEARCH AND ASSAY LABORATORY LTD.

WARMAN CYCLOSIZER RESULTS

CLIENT Cyprus Anvil Vangorda KM050 DATE December 31, 1981

SAMPLE NUMBER	050-21 TLS	050-22 TLS	050-23 TLS	050-25 TLS
SAMPLE WEIGHT *L 200 Mesh	61.84	56.56	52.65	58.54
TEMPERATURE °C	9.0	9.0	9.0	9.0
SAMPLE SPECIFIC GRAVITY	3.93	3.97	2.78	3.20
FLOWRATE mm	180	180	180	180
ELUTRIATION TIME min	20	20	20	20
CORRECTION FACTORS (temp)	1.16	1.16	1.16	1.16
(sp. gr.)	.750	.750	.960	.87
(flow)	1.012	1.012	1.012	1.012
(time)	.955	.955	.955	.955
OVERALL CORRECTION FACTOR	.841	.841	1.076	.975
SAMPLE WT CYCLONE NO. 1	3.40	8.26	3.91	7.73
NO. 2	7.20	10.42	7.95	10.12
NO. 3	12.49	11.52	11.41	13.24
NO. 4	10.61	7.65	8.19	9.05
NO. 5	5.94	3.90	4.34	4.48
% RETAINED CYCLONE NO. 1	5.41	14.1	7.27	12.8
NO. 2	11.4	17.7	14.8	16.7
NO. 3	19.9	19.7	21.3	21.9
NO. 4	16.9	13.0	15.3	15.0
NO. 5	9.44	6.65	8.07	7.40
% PASSING CYCLONE NO. 1	92.9	82.3	90.6	84.0
NO. 2	81.5	64.6	75.8	67.3
NO. 3	61.6	44.9	54.5	45.4
NO. 4	44.7	31.9	39.2	30.4
NO. 5	35.3	25.3	31.2	23.0
de CYCLONE NO. 1	37.6	37.6	48.1	43.6
NO. 2	26.3	26.3	33.7	30.5
NO. 3	18.2	18.2	23.3	21.2
NO. 4	12.6	12.8	16.4	14.6
NO. 5	10.0	10.0	12.8	12.5

CALIBRATION DATA	
di CYCLONE NO. 1 =	44.7
NO. 2 =	31.3
NO. 3 =	21.7
NO. 4 =	15.2
NO. 5 =	11.9

REMARKS: *L means "Less than"
T-21 - 98.3% L 200 Mesh
- 96.4% L 200 Mesh
- 97.9% L 200 Mesh
- 96.8% L 200 Mesh

KAMLOOPS RESEARCH AND ASSAY LABORATORY LTD.

WARMAN CYCLOSIZER RESULTS

CLIENT Cyprus Anvil Vangorda KM050 DATE December 31, 1981

SAMPLE NUMBER	050-21 Pb	050-22 Pb	050-23 Pb	050-25 Pb
SAMPLE WEIGHT	51.22	47.71	50.86	40.53
TEMPERATURE °C	10.0	10.0	10.0	10.0
SAMPLE SPECIFIC GRAVITY	5.22	5.33	4.45	5.27
FLOWRATE mm	200	200	180	200
ELUTRIATION TIME min	20	20	20	20
CORRECTION FACTORS (temp)	1.14	1.14	1.14	1.14
(sp. gr.)	.63	.62	.69	.62
(flow)	.94	.94	1.012	.94
(time)	.955	.955	.955	.955
OVERALL CORRECTION FACTOR	.645	.634	.760	.634
SAMPLE WT CYCLONE NO. 1	3.08	6.19	2.99	4.50
NO. 2	7.73	8.98	4.73	6.42
NO. 3	12.73	10.57	8.21	8.85
NO. 4	10.36	7.96	8.75	7.49
NO. 5	5.13	3.97	5.63	3.51
% RETAINED CYCLONE NO. 1	6.01	13.0	5.88	11.1
NO. 2	15.1	18.8	9.30	15.8
NO. 3	24.9	22.1	16.1	21.8
NO. 4	20.2	16.7	17.2	18.5
NO. 5	10.0	8.32	11.1	8.66
% PASSING CYCLONE NO. 1	94.0	87.0	94.1	88.9
NO. 2	78.9	68.2	84.8	73.1
NO. 3	54.0	46.1	68.7	51.3
NO. 4	33.8	29.4	51.5	32.8
NO. 5	23.8	21.1	40.4	24.1
de CYCLONE NO. 1	28.8	28.3	34.0	28.3
NO. 2	20.2	19.8	23.8	19.8
NO. 3	14.0	13.8	16.5	13.8
NO. 4	9.80	9.64	11.6	9.64
NO. 5	7.68	7.54	9.04	7.54

CALIBRATION DATA	
di CYCLONE NO. 1 =	44.7
NO. 2 =	31.3
NO. 3 =	21.7
NO. 4 =	15.2
NO. 5 =	11.9

REMARKS:

KAMLOOPS RESEARCH AND ASSAY LABORATORY LTD.

WARMAN CYCLOSIZER RESULTS

CLIENT Cyprus Anvil Vangorda KM050 DATE December 31, 1981

SAMPLE NUMBER	050-21 Zn	050-22 Zn	050-23 Zn	050-25 Zn
SAMPLE WEIGHT	50.31	50.12	45.92	50.72
TEMPERATURE °C	9.5	9.5	9.5	9.5
SAMPLE SPECIFIC GRAVITY	3.78	3.79	3.77	3.96
FLOWRATE mm	180	180	180	180
ELUTRIATION TIME min	20	25	20	20
CORRECTION FACTORS (temp)	1.15	1.15	1.15	1.15
(sp. gr.)	.77	.77	.77	.75
(flow)	1.012	1.012	1.012	1.012
(time)	.955	.964	.955	.955
OVERALL CORRECTION FACTOR	.856	.864	.856	.834
SAMPLE WT CYCLONE NO. 1	0.98	1.21	1.60	1.34
NO. 2	2.46	3.27	2.95	4.24
NO. 3	6.60	7.33	5.70	9.08
NO. 4	8.19	8.08	6.77	10.13
NO. 5	5.46	5.34	4.95	6.20
% RETAINED CYCLONE NO. 1	1.95	2.41	3.48	2.64
NO. 2	4.89	6.52	6.42	8.36
NO. 3	13.1	14.6	12.4	17.9
NO. 4	16.3	16.1	14.7	20.0
NO. 5	10.9	10.7	10.8	12.2
% PASSING CYCLONE NO. 1	98.1	97.6	96.5	97.4
NO. 2	93.2	91.1	90.1	89.0
NO. 3	80.1	76.5	77.7	71.1
NO. 4	63.8	60.4	63.0	51.1
NO. 5	52.9	49.7	52.2	38.9
de CYCLONE NO. 1	38.3	38.6	38.3	37.3
NO. 2	26.8	27.0	26.8	26.1
NO. 3	18.6	18.7	18.6	18.1
NO. 4	13.0	13.1	13.0	12.7
NO. 5	10.2	10.3	10.2	9.92

CALIBRATION DATA	REMARKS:
di CYCLONE NO. 1 = 44.7	
NO. 2 = 31.3	
NO. 3 = 21.7	
NO. 4 = 15.2	
NO. 5 = 11.9	

APPENDIX V

COMPARISON OF ASSAYED AND CALCULATED HEADS

APPENDIX VI

SPECIAL ASSAYS ON CYCLE TEST PRODUCTS

TABLE VI - 1

Special Assays on Cycle Test Products

Test	Product	Assays %						
		Au*	Ag*	Mo	Hg*	As	Sb	Insol
050-21	Pb Conc.	1.8	740	.003	93	.02	.13	4.63
050-22	Pb Conc.	5.2	478	.002	45	.03	.08	.88
050-23	Pb Conc.	2.9	470	.008	27	.70	.14	14.4
050-25	Pb Conc.	8.9	580	.002	25	.06	.12	4.29
050-21	Zn Conc.	.5	66	.001	360	.01	.03	1.82
050-22	Zn Conc.	1.9	63	.002	167	.01	.03	.94
050-23	Zn Conc.	.8	45	.001	198	.16	.03	1.70
050-25	Zn Conc.	4.5	33	.001	193	.01	.03	.80

* g/tonne