An Investigation of

THE RECOVERY OF LEAD, ZINC & SILVER

from Faro Tailing samples
submitted by

CURRAGH RESOURCES INC

Progress Report No. 2

Project No. L.R. 4390

NOTE:

This report refers to the samples as received.

LAKEFIELD RESEARCH
A DIVISION OF FALCONBRIDGE LIMITED
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ABSTRACT

Preliminary laboratory testwork was conducted on Faro Tailing composite samples to recover lead, zinc and silver values in a marketable bulk concentrate. The major objective of this testwork was to evaluate the effect of high intensity conditioning on bulk flotation. The flotation feeds used in the laboratory testwork were Down Valley tailings representing a composite with pH <7 and a composite with pH >7. The average feed assays were 0.72% Pb, 1.16% Zn and 13.0 g/t Ag for both composites.

The laboratory testwork, performed with a conventional reagent scheme and with staged high intensity conditioning, indicated that a marketable grade bulk concentrate with respectable metal recoveries may be produced after detailed development and optimization testwork. Table No. 1 shows bulk flotation results obtained in the preliminary testwork.

TABLE NO. 1 :
Preliminary Upgrading Tests on Faro Tailing Composites

Test No.	Composite	Product	Weight %	Assays %, g/t		% Distribution	
				Pb	Zn	Pb	Zn
6	DV pH>7	Bulk 4th Cl Conc	1.74	10.2	37.4	25.4	58.2
		Bulk 1st Cl Conc	3.70	7.4	21.0	39.0	69.7
		Bulk Rougher Conc	14.43	2.88	6.1	59.5	78.6
		Bulk Rougher Tail	85.57	0.33	0.28	40.5	21.4
		Feed (Calc)	100.00	0.70	1.12	100.0	100.0
21	DV pH<7	Bulk 4th Cl Conc	1.92	5.13	31.2	15.8	57.9
		Bulk 1st Cl Conc	8.66	3.03	8.7	42.2	73.0
		Bulk Rougher Conc	22.03	1.73	3.81	61.2	81.2
		Bulk Rougher Tail	77.97	0.31	0.25	38.8	18.8
		Feed (Calc)	100.00	0.62	1.03	100.0	100.0

The reagent scheme used in these tests included the following: lime and an organic based depressant for iron sulphide rejection, $CuSO_4$ for sphalerite activation and collectors xanthate A317 and Minerec M2030.

Staged high intensity conditioning with depressant, activator and collectors was the determining factor in achieving high bulk recoveries.

INTRODUCTION

Faro tailings, generated since 1966, have been deposited in a 1 km wide and 8 km long valley below the mill. At the end of the mine life, the tailings will be reclaimed and pumped to the Faro open pit. The tailings contain significant metal values which, if recovered in a marketable bulk concentrate, would cover the tailing reclamation cost.

Previous testwork showed that using conventional treatment methods, production of a high grade bulk concentrate is not feasible. Further preliminary testwork was designed at the request of Mr. G. McDonald of Curragh Resources (authorized in a letter dated November 7th, 1992), to examine new technology available at Lakefield for treatment of Faro tailings by flotation.

The results of the testwork were discussed with Mr. McDonald in regular telephone conversations. Periodic letter reports were also issued.

LAKEFIELD RESEARCH

S. Bulatovic, P. Eng.,
Consulting Metallurgist

C.A. Fleming, Ph. D.,
Vice-President, General Manager

Experimental Work By: S. Bulatovic
T. Jessup
D. Newman

Report Preparation By: S. McKenzie

SUMMARY AND CONCLUSIONS

1. Description of Samples Used in the Laboratory Testwork

The samples used in the preliminary laboratory testwork were composited from Faro Down Valley hole samples E and F. The tailing samples were separated according to pH into composite pH >7 and composite pH <7. The low pH composite (i.e. pH <7) represented Upper Zone tailings and composite pH >7 represented Lower Zone tailings. The head analyses of the tailing composites are shown in Table No. 2.

TABLE NO. 2 :
Head Assays

Element		Assays %, g/t	
		Down Valley pH>7	Down Valley pH<7
Lead	Pb	0.72	0.73
Zinc	Zn	1.16	1.17
Iron	Fe	30.9	31.0
Sulphur	S	25.9	26.7
Sliver	Ag	12.9	13.1
%-200 mesh		87.0	66.9

The head analyses of the two composites were similar but the size analyses were significantly different.

2. Laboratory Testwork

2.1. Preliminary Tests

Preliminary tests were conducted to determine the effect of high intensity conditioning on lead-zinc bulk flotation. The flowsheet used in these tests is shown in Figure No. 1.

In the first test (Table 3), conventional conditioning with depressant, activator and collectors was used. In the second test, the conventional conditioning was replaced with high intensity conditioning. The use of high intensity conditioning increased lead and zinc recoveries and bulk concentrate grade.

FIGURE NO. 1
Preliminary Bulk Flotation Flowsheet

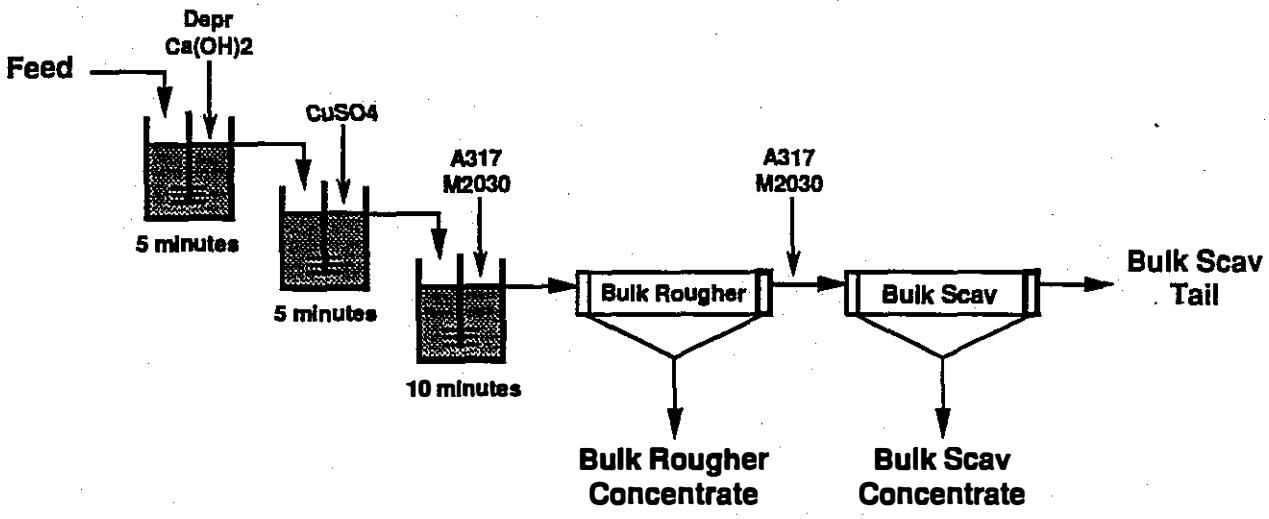


TABLE NO. 3 :
Preliminary Tests with Conventional and High Intensity Conditioning

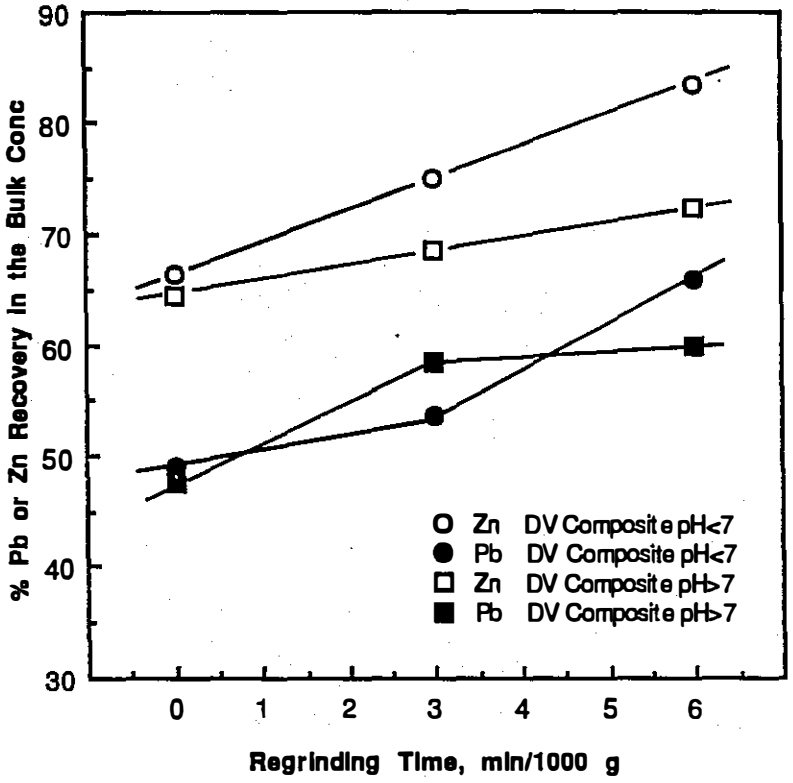
Test No.	Comp	Conditions	Product	Weight %	Assays %		% Distribution	
					Pb	Zn	Pb	Zn
1	>7pH	Conventional conditioning	Bulk Rougher Conc	18.28	1.52	2.77	38.2	42.2
			Bulk Scav Tail	81.72	0.55	0.85	61.8	57.8
			Feed (Calc)	100.00	0.73	1.20	100.0	100.0
2	>7pH	H.I.C.	Bulk Rougher Conc	7.36	4.23	10.7	43.4	66.0
			Bulk Ro + Scav Conc	18.17	2.42	5.21	61.3	79.4
			Bulk Scav Tail	81.83	0.34	0.30	38.7	20.6
			Feed (Calc)	100.00	0.72	1.19	100.0	100.0

2.2. Effect of Regrind on Bulk Flotation

Series of tests were performed on both ore composites to examine the effect of regrinding of the tailing on bulk flotation. In these tests, the lime conditioning step was replaced with a regrind and times of 3 and 6 minutes were evaluated. The results obtained showed that with slight regrinding of the pH <7 composite, bulk lead and zinc recoveries in the bulk concentrate increased significantly (Figure No. 2). The effect of regrinding of the pH >7 composite on lead and zinc flotation was less pronounced.

Composite pH <7, however, was much coarser than composite pH >7 tailing and this may have contributed to the differences in flotation response. It therefore appeared that a "polishing" regrind would be beneficial for lead and zinc recoveries in the bulk concentrate.

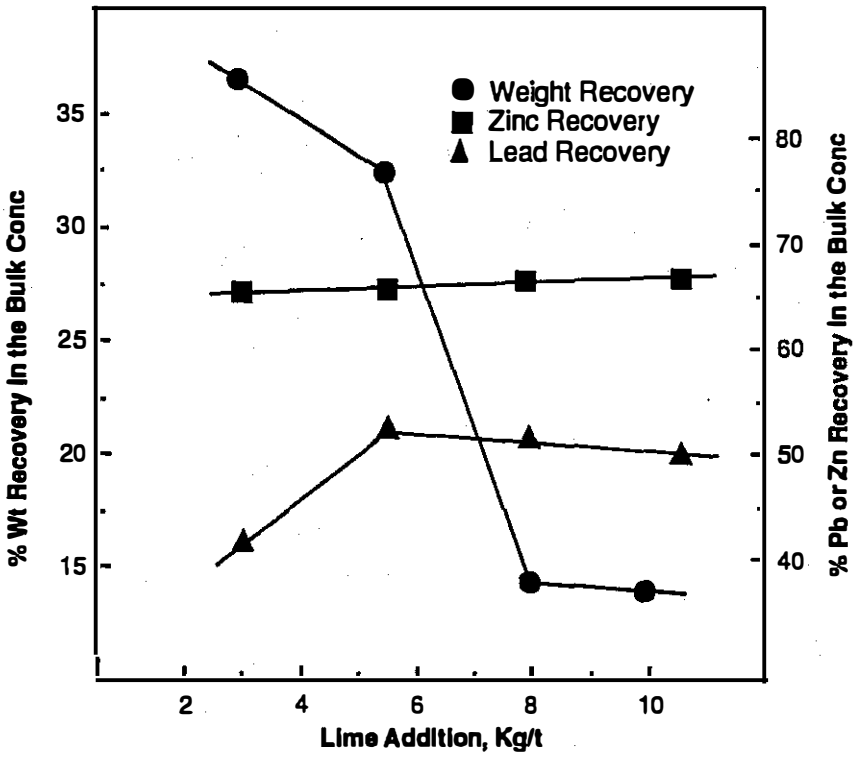
FIGURE NO. 2
Regrinding Time vs Lead and Zinc Recoveries in the Bulk Concentrate



2.3. Effect of Level of Lime Additions on Bulk Lead-Zinc Flotation from Composite pH <7

Because the Faro tailing composite pH <7 was acidic with a natural pH of 4.5, the pyrite was highly active after conditioning with reagents. A series of tests was therefore performed (Figure No. 3) with different levels of lime addition (i.e. pH).

FIGURE NO. 3
Effect of Level of Lime Addition on Bulk Pb-Zn Flotation



From the results obtained, the following conclusions are made:

- An addition of about 8 kg/t of lime was required to obtain a pH of 11.2. Ten kg/t of lime gave a pH of 11.8.

- Higher lime additions reduced flotability of pyrite significantly, but did not affect zinc and lead recoveries in the bulk concentrate.

2.4. Effect of Organic Depressant Addition In Bulk Flotation

During the course of the testwork, organic depressants BPW and SW2 were examined. The effect of these depressants on bulk rougher flotation was not clarified in this testwork. However, the use of these depressants in bulk cleaning was beneficial in improving selectivity between iron sulphide and lead-zinc minerals. Table No. 4 shows the effect of depressant SW2 on bulk concentrate upgrading on tailing composite pH <7.

TABLE NO. 4 :
Effect of Depressant SW2 on Bulk Concentrate Cleaning from Composite pH ≤7

Test No.	Test Conditions	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
18	lime only	Bulk 4th Cleaner Conc	3.21	7.72	23.2	40.4	70.6
		Bulk 1st Cleaner Conc	4.88	6.37	16.8	50.7	77.8
		Bulk Rougher Conc	18.18	2.20	4.90	65.3	84.5
		Bulk Rougher Tailing	81.82	0.26	0.20	34.7	15.5
		Feed (Calc)	100.00	0.61	1.05	100.0	100.0
21	lime + depressant SW2 to the cleaners	Bulk 4th Cleaner Conc	1.92	5.13	31.2	15.8	57.9
		Bulk 1st Cleaner Conc	8.66	3.03	8.7	42.2	73.0
		Bulk Rougher Conc	22.03	1.73	3.81	61.2	81.2
		Bulk Rougher Tailing	77.97	0.31	0.25	38.8	18.8
		Feed (Calc)	100.00	0.62	1.03	100.0	100.0

2.5. Evaluation of High Intensity Conditioning

Since improvement in bulk flotation recovery was mainly attributed to the use of high intensity conditioning, detailed examination of HIC was performed. The main variables examined included:

- Collector high intensity conditioning time at fixed conventional depressant and activator conditioning times.

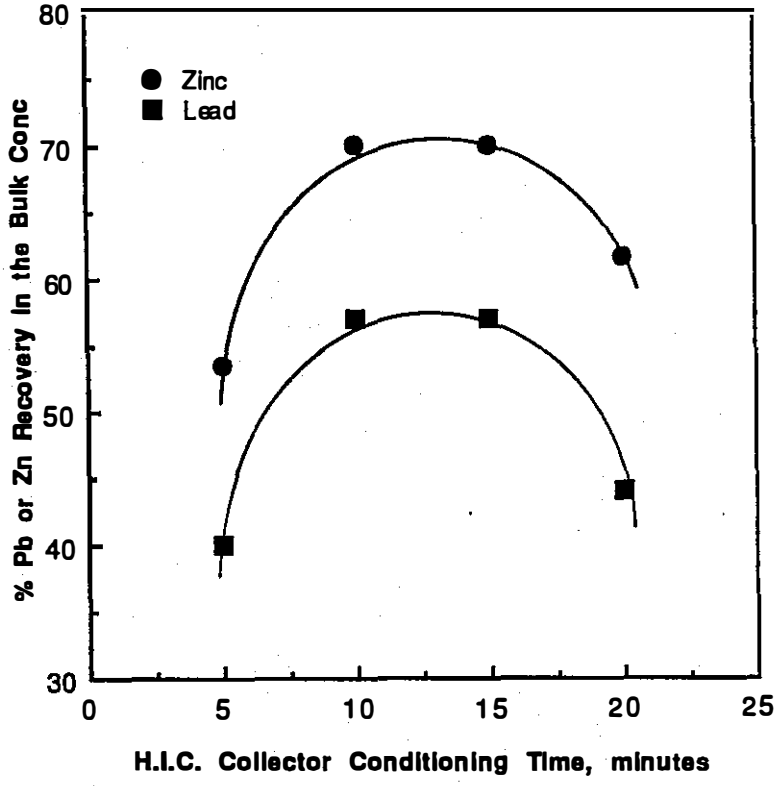
- Collector high intensity conditioning time at fixed high intensity conditioning times with depressant and activator.

- High intensity collector conditioning speed.

With fixed conventional depressant and activator conditioning times and varied collector high intensity conditioning times, the maximum lead and zinc recoveries in the bulk concentrate were obtained between 10 minutes and 15 minutes of high intensity conditioning time (Figure 4).

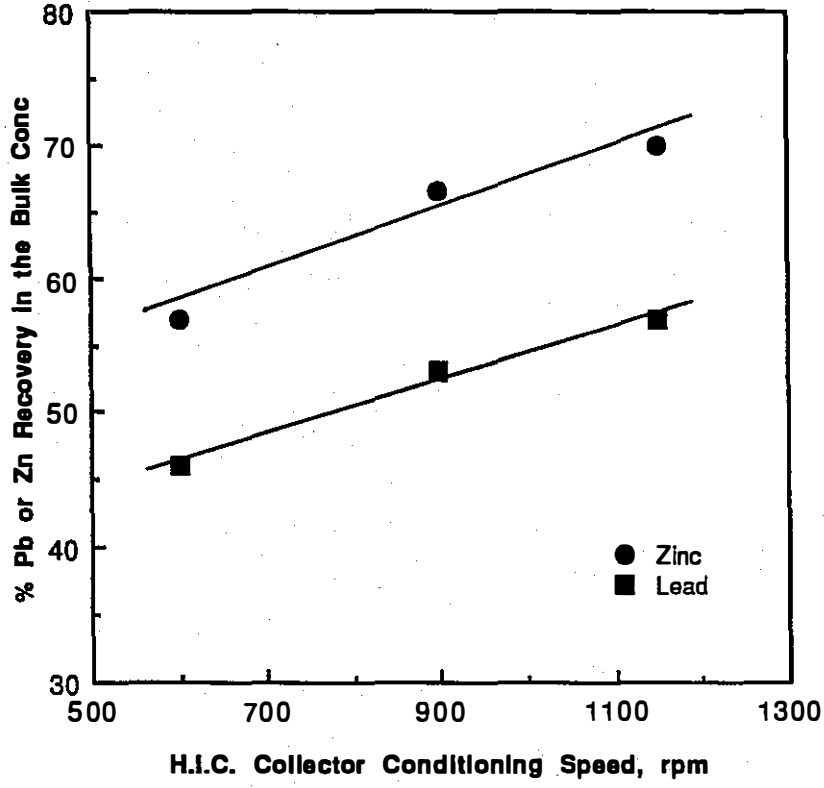
At 20 minutes of conditioning time, both lead and zinc recoveries in the bulk concentrate were reduced.

FIGURE NO. 4
Effect of Collector High Intensity Conditioning Time on Pb-Zn
Bulk Flotation at Fixed Conventional Depressant and Activator Conditioning Times



Varying the collector conditioning speed but using a fixed conditioning time (10 minutes) had a significant effect on lead and zinc recoveries in the bulk concentrate. Figure No. 5 shows the relationship between high intensity conditioning speed and lead and zinc recoveries.

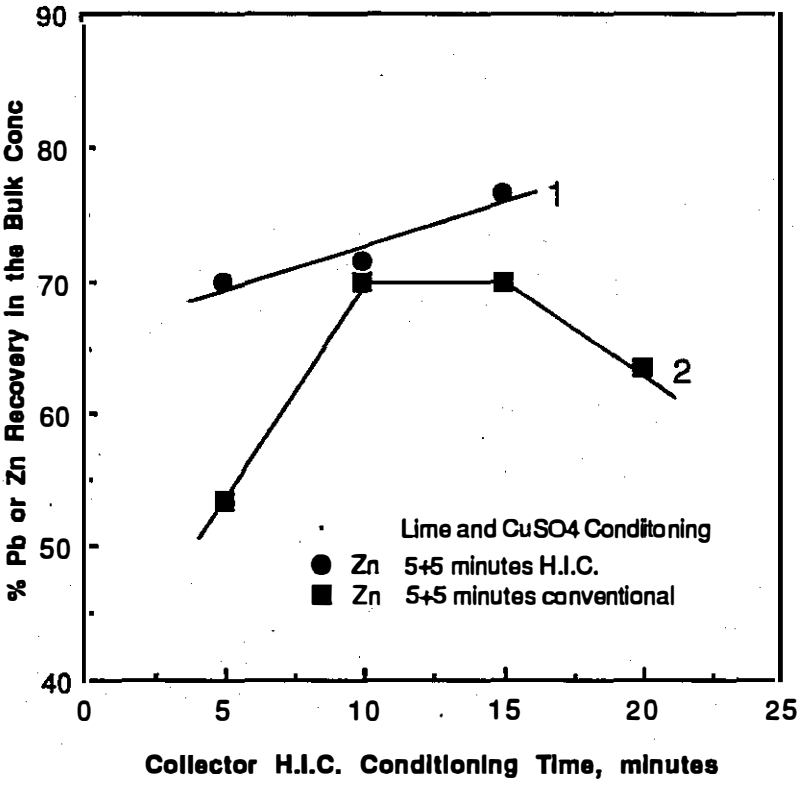
FIGURE NO. 5
Effect of Collector HIC Speed on Lead & Zinc Recoveries in the Bulk Concentrate - Composite pH >7



Stage high intensity conditioning with depressant, activator and collector (where collector conditioning time was varied at fixed depressant and activator HIC times) gave much better recoveries (Curve 1) than when conventional conditioning with depressant and activator was used (Curve 2, Figure 6).

FIGURE NO. 6

Effect of Different Conditioning Configurations on Zinc Recovery in the Bulk Concentrate



It has been established from the testwork that, with the introduction of high intensity conditioning, the recovery of lead and zinc in the bulk concentrate increased by 20%.

2.6. Preliminary Upgrading Tests

Several preliminary tests were carried out to determine whether upgrading of the bulk concentrate is possible. The results of these preliminary tests are shown in Table No. 5.

TABLE NO. 5 :
Preliminary Upgrading Tests on Faro Tailing Composites

Test No.	Composite	Product	Weight %	Assays %, g/t		% Distribution	
				Pb	Zn	Pb	Zn
6	DV pH>7	Bulk 4th Cl Conc	1.74	10.2	37.4	25.4	58.2
		Bulk 1st Cl Conc	3.70	7.4	21.0	39.0	69.7
		Bulk Rougher Conc	14.43	2.88	6.1	59.5	78.6
		Bulk Rougher Tail	85.57	0.33	0.28	40.5	21.4
		Feed (Calc)	100.00	0.70	1.12	100.0	100.0
21	DV pH<7	Bulk 4th Cl Conc	1.92	5.13	31.2	15.8	57.9
		Bulk 1st Cl Conc	8.66	3.03	8.7	42.2	73.0
		Bulk Rougher Conc	22.03	1.73	3.81	61.2	81.2
		Bulk Rougher Tail	77.97	0.31	0.25	38.8	18.8
		Feed (Calc)	100.00	0.62	1.03	100.0	100.0

The results obtained showed that commercial grade bulk concentrates may be produced with reasonably good zinc recoveries. On both composites, however, lead recoveries in the bulk concentrate were low, mainly because of the high lime additions in the bulk cleaners.

3. Conclusions

- The two Faro tailing composites used in the laboratory testwork represented Down Valley tailings from the Lower (alkaline) and Upper (acidic) zones. Both tailing samples had similar head assays but significantly different size analyses. The Upper Zone composite also had a high pyrrhotite content.

- In the preliminary testwork, it was demonstrated that marketable grade bulk concentrates can be produced after the treatment process is fully developed and optimized.

- Relatively high lead and zinc recoveries in the bulk concentrate were obtained after introduction of high intensity conditioning with depressant-activators and collector. High intensity conditioning with only collector gave reasonably good recoveries but with prolonged conditioning times.

- Limited regrinding of the tailings before HIC and flotation improved lead and zinc recoveries on the pH <7 composite (I.e. Upper Zone).

RECOMMENDATIONS

Recommendations proposed in this section are based on the results obtained in this preliminary laboratory testwork and on testwork reported in Progress Report No. 1, LR 4208. In order to fully develop a process for the recovery of metal values from the Faro tailings, detailed laboratory development testwork has to be conducted. This development testwork would include the following tasks:

1. Reagent Scheme Development

With respect to reagent scheme development, the following parameters should be evaluated and optimized:

- optimize the type and level of collector
- determine the need for the use of a secondary lead collector in the bulk rougher and in cleaning.
- evaluate and select suitable depressants for bulk cleaning. Two major contaminants in the bulk cleaner concentrate were identified as pyrrhotite and stained quartz.

Pyrrhotite flotation in the cleaners was controlled with additions of organic depressant and some of these depressants also showed a depressing effect on stained silica. Formulation and evaluation of such depressants should be performed.

2. Pulp Preparation

Pulp preparation refers to high intensity conditioning (HIC). For determination of scale up parameters for industrial unit design, the following laboratory testwork is required:

- Carry out laboratory tests using a 25L HIC unit to determine the relationship between power input and overall metallurgical results. The variables that would be examined in this testwork will include:
  - conditioning time
  - positioning of impellers
  - conditioning speed.

- Conduct laboratory tests using a 5L HIC unit with the variables used with the 25L unit.

3. Flowsheet Evaluation

Variables that would need detailed evaluation would include the following:

- requirement for "polishing" grinding
- regrinding of bulk concentrate prior to cleaning.
- requirement for staged HIC with depressant-activator-collector.

DISCUSSION

1. Description of Samples Used in the Laboratory Testwork

A total of four 25L pails containing tailing samples from Area E were received on November 6th, 1992 for laboratory testwork. The tailings were identified as Down Valley Tailings (Appendix 2).

As per the instructions of Mr. G. McDonald of Curragh Resources, the two following composites were prepared:

- Composite Down Valley (DV) pH >7. These were mainly Lower Zone samples.
- Composite Down Valley (DV) pH <7. These were mainly Upper Zone tailing samples.

The composites were prepared by repulping the samples at 65% solids in a 50L container and removing slurry test charges equivalent to dry weights of 1kg and 2kg.

The head analyses of the composite samples are shown in Table No. 6. Size analyses and the metal distributions in size fractions are shown in Table 7(a) and (b).

TABLE NO. 6 :
Head Assays of the Tailing Composites Used in Laboratory Testwork

Element		Assays %, g/t	
		Down Valley pH >7	Down Valley pH <7
Lead	Pb	0.72	0.73
Zinc	Zn	1.16	1.17
Iron	Fe	30.9	31.0
Sulphur	S	25.9	26.7
Silver	Ag	12.9	13.1

Note that composite pH >7 was much finer than composite pH <7 and that composite pH <7 was higher in pyrrhotite.

TABLE NO. 7 :
Size Analyses & Metal Distributions in the Size Fractions of the Faro Tailing Composites

A. Faro Tails pH <7 Composite

Microns	Mesh	Ind. Wt %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
417	35	2.4	0.42	0.84	1.8	1.9
295	48	2.4	0.43	1.04	1.8	2.3
208	65	2.9	0.46	1.22	2.3	3.3
147	100	6.8	0.42	1.29	4.9	8.0
104	150	8.5	0.36	1.23	5.3	9.6
74	200	10.1	0.29	0.97	5.0	9.0
53	270	11.3	0.25	0.80	4.9	8.3
38	400	10.0	0.26	0.70	4.5	6.4
-38	-400	45.6	0.88	1.22	69.5	51.2
	Total	100.0	0.58	1.09	100.0	100.0

B. Faro Tails pH >7 Composite

Microns	Mesh	Ind. Wt %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
295	48	0.8	0.35	1.33	0.3	1.0
208	65	0.7	0.44	1.88	0.4	1.4
147	100	1.7	0.36	1.55	0.8	2.6
104	150	4.0	0.30	1.13	1.5	4.4
74	200	5.7	0.34	0.94	2.4	5.2
53	270	9.1	0.39	0.81	4.4	7.2
38	400	9.0	0.45	0.74	5.0	6.5
-38	-400	69.1	0.99	1.06	85.2	71.7
	Total	100.0	0.80	1.02	100.0	100.0

2. Initial Testwork

Initially, comparative tests using conventional conditioning and high intensity conditioning were performed to determine whether high zinc and lead recoveries can be obtained. The results of the preliminary tests are shown in Table No. 8.

TABLE NO. 8 :
Initial Laboratory Test Bulk Flotation Results

Test No.	Comp	Conditions	Product	Weight %	Assays %		% Distribution	
					Pb	Zn	Pb	Zn
1	>7pH lower zone	standard	Bulk Rougher Conc	18.28	1.52	2.77	38.2	42.2
			Bulk Scav Tail	81.72	0.55	0.85	61.8	57.8
			Feed (Calc)	100.00	0.73	1.20	100.0	100.0
2	>7pH lower zone	H.I.C. Dep BPW	Bulk Rougher Conc	7.36	4.23	10.7	43.4	66.0
			Bulk Ro + Scav Conc	18.17	2.42	5.21	61.3	79.4
			Bulk Scav Tail	81.83	0.34	0.30	38.7	20.6
			Feed (Calc)	100.00	0.72	1.19	100.0	100.0
3	<7 pH upper zone	H.I.C. DepBPW	Bulk Rougher Conc	6.75	4.12	10.0	38.7	55.5
			Bulk Ro + Scav Conc	16.23	2.60	5.70	58.0	75.9
			Bulk Scav Tail	83.77	0.36	0.35	42.0	24.1
			Feed (Calc)	100.00	0.72	1.22	100.0	100.0

The results obtained showed that the use of staged high intensity conditioning with depressants, $CuSO_4$ and collector improved Pb and Zn bulk recovery significantly.

3. Laboratory Testwork on DV pH <7 Composite

The variables examined using composite DV pH <7 included the following:

- effect of pH
- effect of organic depressant BPW in the bulk rougher
- effect of regrind
- preliminary cleaning tests.

3.1. Effect of pH

Because composite DV pH <7 had an acid pH (i.e. 5.5), a series of tests was carried out to examine the effect of pH on bulk lead-zinc flotation.

TABLE NO. 9 :
Effect of Level of Lime on Bulk Flotation from Faro Tailing DV Composite pH <7

Test No.	Lime, Added g/t	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
11	3,000 pH 7.2	Bulk Rougher Conc	27.0	0.74	1.92	30.8	48.3
		Bulk Ro+Scav Conc	38.75	0.70	1.80	43.7	64.8
		Bulk Scavenger Tail	61.25	0.60	0.62	56.3	35.2
		Feed (Calc)	100.00	0.65	1.08	100.0	100.0
12	5,000 pH 9.8	Bulk Rougher Conc	17.89	1.42	3.4	39.7	52.6
		Bulk Ro+Scav Conc	40.26	0.80	1.9	53.3	66.9
		Bulk Scavenger Tail	59.74	0.50	0.64	46.7	33.1
		Feed (Calc)	100.00	0.64	1.16	100.0	100.0
13	8,000 pH 11.3	Bulk Rougher Conc	9.74	2.79	6.76	43.4	60.4
		Bulk Ro+Scav Conc	13.69	2.4	5.3	51.7	66.8
		Bulk Scavenger Tail	86.31	0.35	0.42	48.3	33.2
		Feed (Calc)	100.00	0.63	1.09	100.0	100.0
14	10,000 pH 11.8	Bulk Rougher Conc	8.14	2.88	7.87	38.3	58.3
		Bulk Ro+Scav Conc	14.02	2.20	5.40	50.9	68.7
		Bulk Scavenger Tail	85.98	0.35	0.40	49.1	31.3
		Feed (Calc)	100.00	0.61	1.10	100.0	100.0

The conditions and results of these tests are summarized in Table No. 9. From the results obtained, the following conclusions are made:

- Higher pH (i.e. above 9.8) resulted in improved selectivity between lead-zinc and iron sulphide minerals with no loss in recovery.

- With changes in pH, the lead and zinc recoveries were not affected. In fact, at very high pH, the lead and zinc assays of the rougher tailing were much lower than those obtained at low pH.

3.2. Effect of Organic BPW Depressant on Bulk Lead and Zinc Flotation

The BPW reagent is an organic-based depressant designed for pyrite-pyrrhotite depression during lead and zinc flotation. A series of comparative tests was conducted to determine the effect of BPW on lead and zinc bulk rougher-scavenger flotation.

The conditions and results of these tests are summarized in Table No. 10.

TABLE NO. 10 :
Effect of Depressant BPW on Bulk Rougher Flotation

Test No.	BPW Additions g/t	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
14	400	Bulk Rougher Conc	8.14	2.88	7.87	38.3	58.3
		Bulk Ro+Scav Conc	14.02	2.20	5.40	50.9	68.7
		Bulk Scavenger Tail	85.98	0.35	0.40	49.1	31.3
		Feed (Calc)	100.00	0.61	1.10	100.0	100.0
15	200	Bulk Rougher Conc	8.11	3.11	8.24	40.5	59.8
		Bulk Ro+Scav Conc	12.86	2.50	6.00	50.9	68.8
		Bulk Scavenger Tail	87.14	0.35	0.40	49.1	31.2
		Feed (Calc)	100.00	0.62	1.12	100.0	100.0
16	0	Bulk Rougher Conc	6.03	3.92	10.6	38.0	57.4
		Bulk Ro+Scav Conc	10.34	2.90	7.30	48.2	67.8
		Bulk Scavenger Tail	89.66	0.36	0.40	57.8	32.2
		Feed (Calc)	100.00	0.62	1.11	100.0	100.0

From the results obtained, it did not appear that addition of depressant BPW is required in bulk flotation.

3.3. Effect of Regrinding of the Tailing before High Intensity Conditioning

Because the pH <7 composite gave lower lead and zinc recoveries than composite pH >7 and due to the fact that composite pH <7 was much coarser than composite pH >7, tests were performed to examine the effect of regrinding of the tailing before treatment and flotation.

Note that in tests where regrinding was used, the lime was added to the grind and lime in the high intensity conditioner was omitted.

The results of the comparative tests are shown in Table No. 11.

The results showed that slight regrinding of the tailing before flotation significantly improved lead and zinc recoveries in the bulk concentrate. When the flotation feed was reground for 6 minutes per 1000 grams, the lead recovery increased from 46% to 66% Pb while zinc recovery increased from 67% Zn to 83% Zn.

TABLE NO. 11 :
Effect of Regrind of the Tailing on Bulk Flotation

Test No.	Regrind Time min/1000 g	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
16	0	Bulk Rougher Conc	6.03	3.92	10.6	38.0	57.4
		Bulk Ro+Scav Conc	10.34	2.90	7.30	48.2	67.8
		Bulk Scavenger Tail	89.66	0.36	0.40	57.8	32.2
		Feed (Calc)	100.00	0.62	1.11	100.0	100.0
12	3	Bulk Rougher Conc	8.80	3.32	8.8	46.3	69.7
		Bulk Ro+Scav Conc	12.17	2.80	6.82	54.1	74.8
		Bulk Scavenger Tail	87.83	0.33	0.32	45.9	25.3
		Feed (Calc)	100.00	0.63	1.11	100.0	100.0
17	6	Bulk Rougher Conc	9.88	3.69	8.79	57.3	78.6
		Bulk Ro+Scav Conc	14.33	2.94	6.45	66.3	83.7
		Bulk Scavenger Tail	85.67	0.25	0.21	33.7	16.3
		Feed (Calc)	100.00	0.64	1.10	100.0	100.0

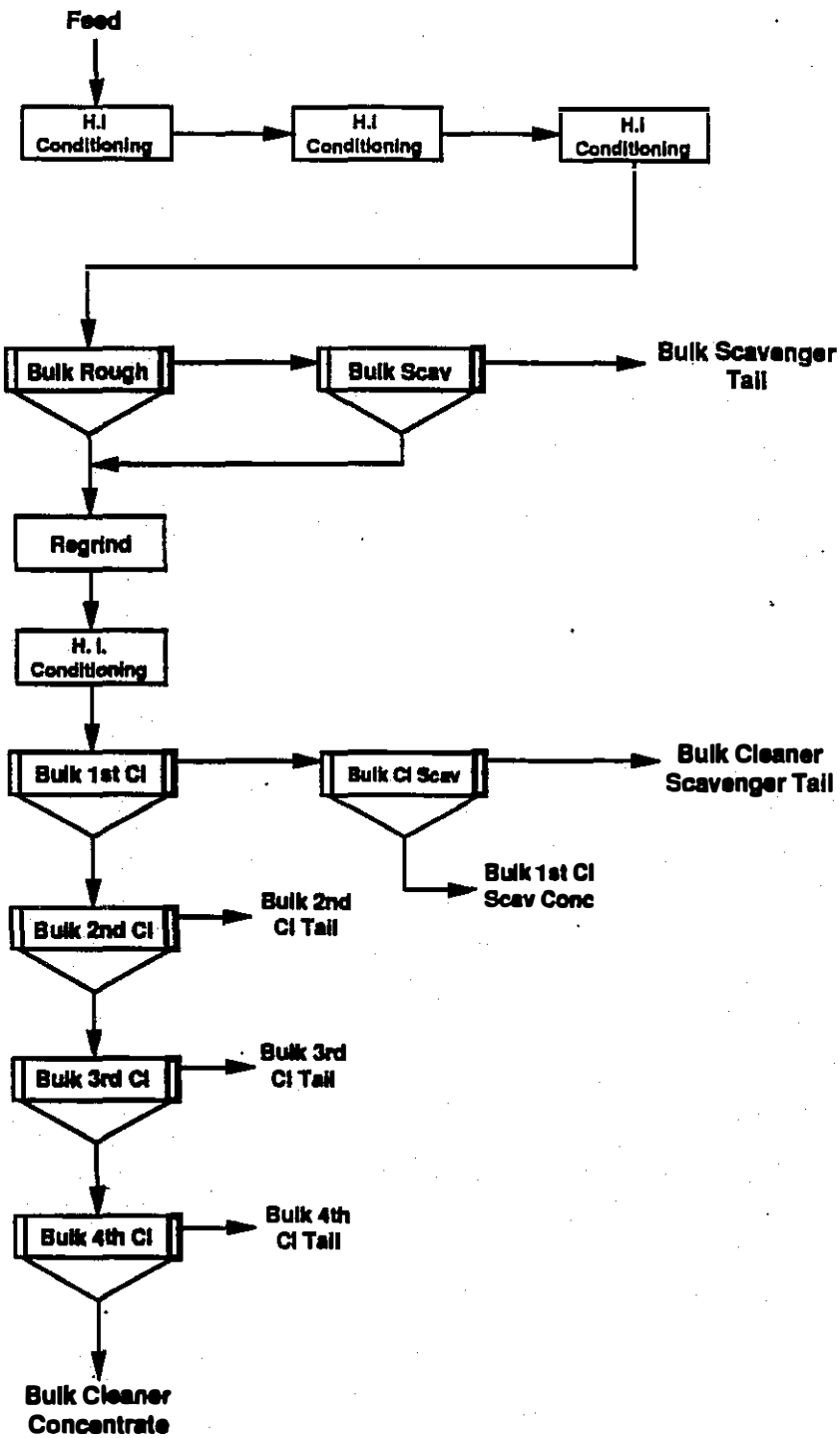
3.4. Preliminary Cleaning Tests

Preliminary cleaning tests were carried out with the use of lime only and with lime and depressant SW2. The results of these tests are summarized in Table No. 12 and the flowsheet used is shown in Figure No. 7.

TABLE NO. 12 :
Preliminary Upgrading Tests

Test No.	Test Conditions	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
18	lime only	Bulk 4th Cleaner Conc	3.21	7.72	23.2	40.4	70.6
		Bulk 1st Cleaner Conc	4.88	6.37	16.8	50.7	77.8
		Bulk Rougher Conc	18.18	2.20	4.90	65.3	84.5
		Bulk Rougher Tailing	81.82	0.26	0.20	34.7	15.5
		Feed (Calc)	100.00	0.61	1.05	100.0	100.0
21	lime + depressant SW2 to the cleaners	Bulk 4th Cleaner Conc	1.92	5.13	31.2	15.8	57.9
		Bulk 1st Cleaner Conc	8.66	3.03	8.7	42.2	73.0
		Bulk Rougher Conc	22.03	1.73	3.81	61.2	81.2
		Bulk Rougher Tailing	77.97	0.31	0.25	38.8	18.8
		Feed (Calc)	100.00	0.62	1.03	100.0	100.0

FIGURE NO. 7
Preliminary Faro Tailing Flowsheet



Using lime only, upgrading of the bulk concentrate was not satisfactory (Test No. 18). Additions of depressant SW2 to the cleaners improved concentrate grade significantly (Test 21) but the concentrate was still below marketable grade. However, production of a high grade bulk concentrate would be possible with adjustment in cleaning conditions.

4. Laboratory Testwork on DV pH >7 Composite

4.1. Effect of Regrinding of the Tailing Before Treatment and Bulk Flotation

As with the DV pH <7 composite, tests were conducted to examine the effect of regrinding of the tailing before treatment and separation. The conditions and results of these tests are summarized in Table No. 13.

TABLE NO. 13 :
Effect of Regrind on Bulk Lead-Zinc Flotation

Test No.	Regrind Time min/1000 g	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
34	0	Bulk Rougher Conc	15.25	1.91	4.30	41.0	56.6
		Bulk Ro+Scav Conc	26.69	1.59	3.13	59.7	72.1
		Bulk Scavenger Tail	73.31	0.39	0.44	40.3	27.9
		Feed (Calc)	100.00	0.71	1.16	100.0	100.0
23	3	Bulk Rougher Conc	11.32	2.88	5.50	46.0	54.0
		Bulk Ro+Scav Conc	17.18	2.44	4.59	59.1	68.4
		Bulk Scavenger Tail	82.82	0.35	0.44	40.9	31.6
		Feed (Calc)	100.00	0.71	1.15	100.0	100.0
24	6	Bulk Rougher Conc	9.26	3.56	6.97	47.1	57.2
		Bulk Ro+Scav Conc	14.76	2.84	5.56	59.8	72.8
		Bulk Scavenger Tail	85.24	0.33	0.36	40.2	27.2
		Feed (Calc)	100.00	0.70	1.13	100.0	100.0

The effect of regrind was not as pronounced as with composite DV pH <7 (see Table 11). The beneficial effect of tailing regrinding was improved selectivity towards iron sulphides.

4.2. Effect of Depressant SW2 on Bulk Flotation

A series of three tests was performed on DV composite pH >7 in which depressant SW2 was varied from 0-300 g/t. The conditions and results of these tests are summarized in Table No. 14. From the results obtained, it appeared that the presence of SW2 had a positive effect on lead and zinc recoveries in the bulk concentrate.

TABLE NO. 14 :
Effect of Depressant SW2 on Bulk Rougher Flotation

Test No.	SW2 Addition g/t	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
27	300	Bulk Rougher Conc	6.62	2.79	6.87	25.5	39.6
		Bulk Ro+Scav Conc	16.49	2.53	4.89	57.4	70.2
		Bulk Scavenger Tail	83.51	0.37	0.41	42.6	29.8
		Feed (Calc)	100.00	0.73	1.15	100.0	100.0
31	0	Bulk Rougher Conc	6.28	2.92	7.82	27.7	41.0
		Bulk Ro+Scav Conc	12.72	2.67	5.57	51.3	59.2
		Bulk Scavenger Tail	87.28	0.37	0.56	48.7	40.8
		Feed (Calc)	100.00	0.66	1.20	100.0	100.0
32	150	Bulk Rougher Conc	9.83	2.04	4.51	28.2	38.4
		Bulk Ro+Scav Conc	16.14	2.12	4.19	48.1	58.6
		Bulk Scavenger Tail	83.86	0.44	0.57	51.9	41.4
		Feed (Calc)	100.00	0.71	1.15	100.0	100.0

4.3. Evaluation of High Intensity Conditioning

4.3.1. Effect of Collector Conditioning Time

In a series of tests (25 to 28), the collector HIC conditioning time was varied from 5 minutes to 20 minutes. The conditions and results of these tests are summarized in Table No. 15.

In these tests, conventional conditioning with lime and $CuSO_4$ was maintained constant in all tests.

The results obtained showed that with an increase in the collector HIC time, lead and zinc recoveries in the bulk concentrate increased for conditioning time up to 15 minutes. Further increase from 15 to 20 minutes resulted in a reduction in the overall lead and zinc recoveries in the bulk concentrate (Test 28).

TABLE NO. 15 :
Effect of Collector HIC on Pb-Zn Bulk Flotation

Test No.	HIC Time Speed rpm	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
25	5 1150	Bulk Rougher Conc Bulk Ro+Scav Conc Bulk Scavenger Tail	6.92 12.91 87.09	2.39 2.26 0.49	6.1 4.85 0.61	23.0 40.6 59.4	36.5 54.1 45.9
		Feed (Calc)	100.00	0.72	1.16	100.0	100.0
26	10 1150	Bulk Rougher Conc Bulk Ro+Scav Conc Bulk Scavenger Tail	11.37 18.16 81.84	2.67 2.27 0.38	5.88 4.46 0.42	42.2 57.0 43.0	58.0 70.2 29.8
		Feed (Calc)	100.00	0.72	1.15	100.0	100.0
27	15 1150	Bulk Rougher Conc Bulk Ro+Scav Conc Bulk Scavenger Tail	6.62 16.49 83.51	2.79 2.53 0.37	6.87 4.89 0.41	25.5 57.4 42.6	39.6 70.2 29.8
		Feed (Calc)	100.00	0.73	1.15	100.0	100.0
28	20 1150	Bulk Rougher Conc Bulk Ro+Scav Conc Bulk Scavenger Tail	5.27 11.24 88.76	2.86 2.96 0.47	7.28 6.48 0.47	20.1 44.4 55.6	33.5 63.6 36.4
		Feed (Calc)	100.00	0.75	1.15	100.0	100.0

4.3.2. Effect of High Intensity Conditioning Speed

In this series of tests, the collector conditioning time was fixed at 10 minutes and the conditioning speed was varied from 600 rpm to 1150 rpm. The conditions and results of these tests are summarized in Table No. 16. Note that the lime and $CuSO_4$ conditioning were conventional and were fixed at 5 minutes per stage.

The results obtained demonstrated that with an increase in conditioning speed, the lead and zinc recoveries in the bulk concentrate increased significantly. In fact, the increases in the lead and zinc recoveries in the bulk concentrate were proportional to the increase in the conditioning speed. Note that a conditioning speed of 600 rpm is near conventional conditioning power input.

TABLE NO. 16 :
Effect of HIC Speed on Pb-Zn Bulk Flotation at Fixed Conditioning Time of 10 minutes

Test No.	Conditioning Speed, rpm	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
29	600	Bulk Rougher Conc	7.04	2.66	6.11	25.6	37.1
		Bulk Ro+Scav Conc	14.47	2.33	4.58	46.2	57.3
		Bulk Scavenger Tail	85.53	0.46	0.58	53.8	42.8
		Feed (Calc)	100.00	0.73	1.16	100.0	100.0
30	900	Bulk Rougher Conc	6.96	3.04	7.57	29.2	45.3
		Bulk Ro+Scav Conc	16.05	2.42	4.84	53.6	66.8
		Bulk Scavenger Tail	83.95	0.40	0.46	46.4	33.2
		Feed (Calc)	100.00	0.72	1.16	100.0	100.0
26	1150	Bulk Rougher Conc	11.37	2.67	5.88	42.2	58.0
		Bulk Ro+Scav Conc	18.16	2.27	4.46	57.0	70.2
		Bulk Scavenger Tail	81.84	0.38	0.42	43.0	29.8
		Feed (Calc)	100.00	0.72	1.15	100.0	100.0

4.3.3. Effect of Collector High Intensity Conditioning Time Using Fixed HIC with Lime and $CuSO_4$

Comparative tests were performed in which constant high intensity conditioning times of 5 minutes per stage with lime and $CuSO_4$ were used and the collector conditioning time was varied from 5 to 15 minutes. The conditions and results of these tests are summarized in Table No. 17.

TABLE NO. 17 :
Effect of High Intensity Collector Conditioning Time Using Fixed HIC Times with Depressant and Activator

Test No.	HIC Time rpm	Product	Weight %	Assays %		% Distribution	
				Pb	Zn	Pb	Zn
33	5+5+5	Bulk Rougher Conc	12.82	1.98	4.84	35.8	52.8
		Bulk Ro+Scav Conc	22.37	1.75	3.69	55.2	70.3
		Bulk Scavenger Tail	77.63	0.41	0.45	44.8	29.7
		Feed (Calc)	100.00	0.71	1.18	100.0	100.0
34	5+5+10	Bulk Rougher Conc	15.25	1.91	4.3	41.0	56.6
		Bulk Ro+Scav Conc	26.69	1.59	3.13	59.7	72.1
		Bulk Scavenger Tail	73.31	0.39	0.44	40.3	27.9
		Feed (Calc)	100.00	0.71	1.16	100.0	100.0
35	5+5+15	Bulk Rougher Conc	16.09	1.92	4.28	42.6	59.9
		Bulk Ro+Scav Conc	28.55	1.59	3.12	62.6	77.6
		Bulk Scavenger Tail	71.45	0.38	0.36	37.4	22.9
		Feed (Calc)	100.00	0.73	1.15	100.0	100.0

From these results and from the results obtained in the series of tests with conventional lime and $CuSO_4$ conditioning, the following conclusions are made:

- The positioning of high intensity conditioning is an important parameter in the Faro tailing retreatment flowsheet design.

- The use of conventional conditioning with lime and $CuSO_4$ and HIC with collector gave poorer recoveries (Table 15), than when using split high intensity conditioning with lime-$CuSO_4$ and collector (Table 17).

- The average power requirement remained the same whether split high intensity conditioning or the combination of conventional and high intensity conditioning were used.

4.4. Preliminary Bulk Concentrate Upgrading Tests

During the preliminary testwork, two cleaning tests were carried out using the flowsheet shown in Figure No. 7. The results obtained in these tests are shown in Table No. 18.

TABLE NO. 18 :
Preliminary Bulk Concentrate Upgrading Tests

Test No.	Product	Weight %	Assays %, g/t			% Distribution	
			Pb	Zn	Ag	Pb	Zn
6	Bulk 4th Cl Conc	1.74	10.2	37.4	92.2	25.4	58.2
	Bulk 1st Cl Conc	4.71	6.7	17.6	68.6	45.6	74.1
	Bulk Rougher Conc	14.43	2.88	6.1	22.4	59.5	78.6
	Bulk Rougher Tail	85.57	0.33	0.28	-	40.5	21.4
	Feed (Calc)	100.00	0.70	1.12	-	100.0	100.0
7	Bulk 4th Cl Conc	1.67	12.7	35.1	115	30.4	52.6
	Bulk 1st Cl Conc	5.15	6.37	15.0	64.8	47.0	69.4
	Bulk Rougher Conc	15.53	2.64	5.28	21.5	58.8	73.5
	Bulk Rougher Tail	84.47	0.34	0.35	-	41.2	26.5
	Feed (Calc)	100.00	0.70	1.12	-	100.0	100.0

The results showed that production of marketable bulk concentrates is possible.

APPENDIX NO. 1

Details of Tests

TEST NO. 1

Purpose: Preliminary test on Faro tailing lower zone composite to examine Zn-Pb bulk flotation.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		RQ	$Ca(OH)_2$	CuSO4	A317	MIBC	Grind	Cond.	Froth	
Conditioning	1	100	500	-	-	-	-	5	-	-
	2	-	-	300	-	-	-	5	-	10.0
BulkRo	1	-	-	-	15	5	-	1	3	-
	2	-	-	-	10	5	-	1	3	-
	3	-	-	-	5	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	169.8	18.28	1.52	2.77	38.2	42.2
2	Bulk Rougher Tail	759.3	81.72	0.55	0.85	61.8	57.8
	Head (calc)	929.1	100.0	0.73	1.20	100.0	100.0

TEST NO. 2

Purpose: Preliminary test to examine the effect of H.I.C. using a lime-BPW depressant system.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	BPW	$CuSO_4$	A317	M2030	Grind	Cond.	Froth	
H.I. Cond	1	1000	150	-	-	-	-	5	-	-
	2	-	-	380	-	-	-	5	-	-
	3	-	-	-	15	10	-	5	-	-
Bulk Rougher		-	-	-	-	-	-	-	4	-
Bulk Scav		-	-	-	10	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	65.1	7.36	4.23	10.7	43.4	66.0
2	Bulk Rougher Conc 2	95.6	10.81	1.19	1.48	17.9	13.4
3	Bulk Rougher Tail	723.5	81.83	0.34	0.3	38.7	20.6
	Head (calc)	884.2	100.0	0.72	1.19	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	18.17	2.4	5.2	61.3	79.4

TEST NO. 3

Purpose: As in Test No. 2, but with upper zone tailings composite.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing DV Composite pH <7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	BPW	$CuSO_4$	A317	M2030	Grind	Cond.	Froth	
H.I. Cond	1	1500	300	-	-	-	-	5	-	-
	2	-	-	350	-	-	-	5	-	-
	3	-	-	-	15	10	-	10	-	-
Bulk Ro	1	-	-	-	-	-	-	1	5	10.2
Bulk Ro	2	-	-	-	5	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	63.3	6.75	4.12	10	38.7	55.5
2	Bulk Rougher Conc 2	89.0	9.48	1.46	2.62	19.3	20.4
3	Bulk Rougher Tail	786.1	83.77	0.36	0.35	42.0	24.1
	Head (calc)	938.4	100.0	0.72	1.22	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	16.23	2.6	5.7	58.0	75.9

TEST NO. 4

Purpose: An initial scoping test, but with increased collector and $CuSO_4$.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne				Time, minutes			pH
	Lime	$CuSO_4$	343	M2030	Grind	Cond.	Froth	
H.I. Condition 1	5000	-	-	-	-	5	-	10.6
2	-	700	-	-	-	5	-	-
3	-	-	50	10	-	5	-	-
Bulk Rougher 1	-	-	-	-	-	-	5	-
2	-	-	10	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	50.5	5.40	2.98	8.94	24.4	42.3
2	Bulk Rougher Conc 2	22.8	2.44	1.2	2.1	4.4	4.5
3	Bulk Rougher Tail	861.4	92.16	0.51	0.66	71.2	53.2
	Head (calc)	934.7	100.0	0.66	1.14	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	7.84	2.4	6.8	28.8	46.8

TEST NO. 5

Purpose: To repeat Test 4, but with the decreased collector, decreased $CuSO_4$ and the addition of depressant BPW.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		Lime	$CuSO_4$	343	M2030	BPW	Grind	Cond.	Froth	
H.I. Cond	1	5000	-	-	-	200	-	5	-	-
	2	-	350	-	-	-	-	5	-	-
	3	-	-	30	10	-	-	5	-	-
Bulk Ro	1	-	-	-	-	-	-	-	5	-
	2	-	-	10	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	77.8	8.39	2.26	5.61	28.8	41.2
2	Bulk Rougher Conc 2	38.4	4.14	0.97	1.41	6.1	5.1
3	Bulk Rougher Tail	810.8	87.46	0.49	0.7	65.1	53.6
	Head (calc)	927.0	100.0	0.66	1.14	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	12.54	1.8	4.2	34.9	46.4

TEST NO. 6

Purpose: A preliminary bulk flotation and upgrading test on DV Faro Tailing pH >7.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	BPW	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	1000	150	-	-	-	-	-	5	-	9.8
2	-	-	380	-	-	-	-	5	-	-
3	-	-	-	5	10	-	-	10	-	-
Bulk Rougher	-	-	-	-	-	-	-	1	4	-
Bulk Scavenger	-	-	-	10	5	-	-	1	3	-
Regrind (PM)	700	100	-	-	-	-	15	-	-	-
H.I. Condition	-	-	-	15	5	-	-	10	-	11.5
Bulk 1st Cleaner	-	-	-	-	-	-	-	1	3	-
	-	-	-	-	2	-	-	1	2	-
Bulk 1st Cl Scav	-	-	-	5	2	-	-	1	3	-
Bulk 2nd Cleaner	150	20	-	-	-	-	-	3	3	11.5
Bulk 3rd Cleaner	150	20	-	-	-	-	-	3	3	11.5
Bulk 4th Cleaner	150	20	-	-	-	-	-	3	3	11.5

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	65.6	1.74	10.2	37.4	92.2	25.4	58.2	14.7
2	Bulk 4th Cleaner Tail	13.8	0.37	9.91	18.3	124	5.2	6.0	4.2
3	Bulk 3rd Cleaner Tail	11.8	0.31	4.88	5.46	64.5	2.2	1.5	1.8
4	Bulk 2nd Cleaner Tail	48.5	1.29	3.38	3.5	35.2	6.2	4.0	4.1
5	Bulk 1st Cl Scav Conc	38.0	1.01	4.52	4.86	51.5	6.5	4.4	4.7
6	Bulk 1st Cl Scav Tail	366.9	9.72	1	0.51	15.8	13.9	4.4	14.1
7	Bulk Rougher Tail	3228.8	85.57	0.33	0.28	7.2	40.5	21.4	56.4
	Head (calc)	3773.4	100.00	0.70	1.12	10.9	100.0	100.0	100.0

Combined Products

1-2	Bulk 3rd Cleaner Conc	2.10	10.1	34.1	97.7	30.6	64.2	18.8
1-3	Bulk 2nd Cleaner Conc	2.42	9.47	30.4	93.4	32.8	65.7	20.7
1-4	Bulk 1st Cleaner Conc	3.70	7.4	21.0	73.2	39.0	69.7	24.8
1-5	Bulk 1st Cl+Cl Scav Concs	4.71	6.7	17.6	68.6	45.6	74.1	29.6
1-6	Bulk Rougher Conc	14.43	2.88	6.1	33.0	59.5	78.6	43.6
6-7	Bulk Ro+1st Cl Scav Tails	95.29	0.40	0.30	8.08	54.4	25.9	70.4

TEST NO. 7

Purpose: To repeat the conditions of Test No. 6, but reduce lime additions to the bulk cleaners.

Procedure: Similar to Test 6.

Feed: ~4000 grams of Faro Tailing Composite DV pH>7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	BPW	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	1000	150	-	-	-	-	-	5	-	-
2	-	-	380	-	-	-	-	5	-	-
3	-	-	-	15	10	-	-	10	-	9.5
Bulk Rougher	-	-	-	-	-	-	-	1	4	-
Bulk Scavenger	-	-	-	10	5	-	-	1	3	-
Regrind (PM)	500	100	-	-	-	-	15	-	-	-
H.I. Condition	-	-	-	15	5	-	-	10	-	-
Bulk 1st Cleaner	-	-	-	-	-	-	-	1	3	-
	-	-	-	-	2	-	-	1	2	-
Bulk 1st Cl Scav	-	-	-	5	2	-	-	1	3	-
Bulk 2nd Cleaner	50	20	-	-	-	-	-	3	3	9.8
Bulk 3rd Cleaner	50	20	-	-	-	-	-	3	3	9.8
Bulk 4th Cleaner	50	20	-	-	-	-	-	3	3	9.8

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	62.4	1.67	12.7	35.1	115	30.4	52.6	17.0
2	Bulk 4th Cleaner Tail	17.1	0.46	8.03	17.1	58.6	5.3	7.0	2.4
3	Bulk 3rd Cleaner Tail	30.8	0.83	4.28	7.21	69.5	5.1	5.3	5.1
4	Bulk 2nd Cleaner Tail	49.0	1.31	1.79	1.84	21.6	3.4	2.2	2.5
5	Bulk 1st Cl Scav Conc	33.0	0.88	2.28	2.87	32.6	2.9	2.3	2.5
6	Bulk 1st Cl Scav Tail	387.5	10.38	0.79	0.44	12.7	11.8	4.1	11.6
7	Bulk Rougher Tail	3153.0	84.47	0.34	0.35	7.9	41.2	26.5	58.9
	Head (calc)	3732.8	100.00	0.70	1.12	11.3	100.0	100.0	100.0

Combined Products

1-2	Bulk 3rd Cleaner Conc	2.13	11.7	31.2	103	35.7	59.6	19.3
1-3	Bulk 2nd Cleaner Conc	2.95	9.62	24.5	93.6	40.8	65.0	24.4
1-4	Bulk 1st Cleaner Conc	4.27	7.21	17.5	71.4	44.2	67.1	26.9
1-5	Bulk 1st Cl+Cl Scav Concs	5.15	6.37	15.0	64.8	47.0	69.4	29.5
1-6	Bulk Rougher Conc	15.53	2.64	5.28	30.0	58.8	73.5	41.1
6-7	Bulk Ro+1st Cl Scav Tails	94.85	0.39	0.36	8.43	53.0	30.6	70.5

TEST NO. 8

Purpose: The first in a series of tests to investigate various collector types on Faro Tailing pH <7.

Procedure: Similar to Test 3, but replace M2030 with M748.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	BPW	$CuSO_4$	A317	M748	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	5000	300	-	-	-	-	-	5	-	10.2
2	-	-	350	-	-	-	-	5	-	9.7
3	-	-	-	15	10	-	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	10	-	1	5	9.4
2	-	-	-	5	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	77.9	8.38	1.85	3.58	24.3	27.0
2	Bulk Rougher Conc 2	18.5	1.99	1.31	2.57	4.1	4.6
3	Bulk Rougher Tail	832.8	89.63	0.51	0.85	71.6	68.4
	Head (calc)	929.2	100.0	0.64	1.11	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	10.37	1.7	3.4	28.4	31.6

TEST NO. 9

Purpose: To repeat the conditions of Test 3, but replace M2030 with LST0.

Procedure: As for Test 3.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

	Reagents Added, grams per tonne					Time, minutes			pH
	$Ca(OH)_2$	BPW	$CuSO_4$	A317	LST0	Grind	Cond.	Froth	
H.I. Cond 1	5000	300	-	-	-	-	5	-	-
2	-	-	350	-	-	-	5	-	9.7
3	-	-	-	15	10	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	1	5	9.4
2	-	-	-	5	5	-	1	3	-

METALLURGICAL RESULTS

Product	Weight		Assays,%		% Distribution	
	g	%	Pb	Zn	Pb	Zn
1 Bulk Rougher Conc 1	45.0	4.79	3.02	6.41	22.7	28.1
2 Bulk Rougher Conc 2	26.3	2.80	1.44	3.35	6.3	8.6
3 Bulk Rougher Tail	867.7	92.41	0.49	0.75	71.0	63.3
Head (calc)	939.0	100.0	0.64	1.09	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	7.59	2.4	5.3	29.0	36.7

TEST NO. 10

Purpose: To repeat the conditions of Test 3, but add 20 g/t A317 to the H.I. Conditioner.

Procedure: As for Test 3.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	BPW	$CuSO_4$	A317	M2030	Grind	Cond.	Froth	
H.I. Cond	1	5000	300	-	-	-	-	5	-	10.2
	2	-	-	350	-	-	-	5	-	9.7
	3	-	-	-	20	10	-	10	-	-
Bulk Rougher	1	-	-	-	-	-	-	1	5	9.4
	2	-	-	-	5	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	59.4	6.33	2.74	6.78	27.1	37.3
2	Bulk Rougher Conc 2	35.4	3.77	1.14	2.42	6.7	7.9
3	Bulk Rougher Tail	844.1	89.90	0.47	0.7	66.1	54.7
	Head (calc)	938.9	100.0	0.64	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	10.10	2.1	5.2	33.9	45.3

TEST NO. 11

Purpose: The first in a series of tests to examine the effect of pH on DV Faro Tailing Composite DV pH <7.

Procedure: As shown below.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	Grind	Cond.	Froth	
H.I. Cond	1	3000	-	400	-	-	-	5	-	7.2
	2	-	350	-	-	-	-	5	-	-
	3	-	-	-	16	30	-	10	-	-
Bulk Rougher	1	-	-	-	-	-	-	1	4	-
	2	-	-	-	4	5	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	252.1	27.15	0.74	1.92	30.8	48.3
2	Bulk Rougher Conc 2	107.7	11.60	0.73	1.54	13.0	16.5
3	Bulk Rougher Tail	568.6	61.25	0.6	0.62	56.3	35.2
	Head (calc)	928.4	100.0	0.65	1.08	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	38.75	0.7	1.8	43.7	64.8

TEST NO. 12

Purpose: To repeat the conditions of Test 11, but at higher pH.

Procedure: As for Test 11 with 5000 g/t lime.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	5000	-	400	-	-	-	-	5	-	-
2	-	350	-	-	-	-	-	5	-	-
3	-	-	-	15	25	8	-	10	-	9.8
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	-	8	10	-	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	146.2	17.89	1.42	3.4	39.7	52.6
2	Bulk Rougher Conc 2	182.9	22.38	0.39	0.74	13.6	14.3
3	Bulk Rougher Tail	488.3	59.74	0.5	0.64	46.7	33.1
	Head (calc)	817.4	100.0	0.64	1.16	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	40.26	0.8	1.9	53.3	66.9

TEST NO. 13

Purpose: To repeat the conditions of Test 11 and 12, at higher pH.

Procedure: Similar to Tests 11 and 12.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	8000	-	400	-	-	-	-	5	-	-
2	-	350	-	-	-	-	-	5	-	-
3	-	-	-	15	25	8	-	10	-	11.3
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	-	10	10	-	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	92.5	9.74	2.79	6.76	43.4	60.4
2	Bulk Rougher Conc 2	37.5	3.95	1.32	1.77	8.3	6.4
3	Bulk Rougher Tail	819.7	86.31	0.35	0.42	48.3	33.2
	Head (calc)	949.7	100.0	0.63	1.09	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	13.69	2.4	5.3	51.7	66.8

TEST NO. 14

Purpose: To repeat the conditions of Tests 11 to 13 at higher pH.

Procedure: Similar to Tests 11 to 13.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	10000	-	400	-	-	-	-	5	-	-
2	-	350	-	-	-	-	-	5	-	-
3	-	-	-	15	25	8	-	10	-	11.5
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	-	8	10	-	-	1	2	-

METALLURGICAL RESULTS

	Product	Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	77.2	8.14	2.88	7.87	38.3	58.3
2	Bulk Rougher Conc 2	55.8	5.88	1.31	1.94	12.6	10.4
3	Bulk Rougher Tail	815.8	85.98	0.35	0.4	49.1	31.3
	Head (calc)	948.8	100.0	0.61	1.10	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	14.02	2.2	5.4	50.9	68.7

TEST NO. 15

Purpose: To repeat the conditions of Test 14, but reduce the depressant BPW addition to 200 g/t.

Procedure: As indicated below.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	10000	-	200	-	-	-	-	5	-	-
2	-	350	-	-	-	-	-	5	-	-
3	-	-	-	15	25	8	-	10	-	11.5
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	-	8	10	-	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	80.6	8.11	3.11	8.24	40.5	59.8
2	Bulk Rougher Conc 2	47.3	4.76	1.36	2.13	10.4	9.1
3	Bulk Rougher Tail	866.5	87.14	0.35	0.4	49.1	31.2
	Head (calc)	994.4	100.0	0.62	1.12	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	12.86	2.5	6.0	50.9	68.8

TEST NO. 16

Purpose: To repeat the conditions of Test 14 but eliminate the BPW.

Procedure: Similar to Test 15, but without BPW addition.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	BPW	Mod M2030	A317	MIBC	Grind	Cond.	Froth	
H.I. Condition 1	10000	-	-	-	-	-	-	5	-	-
2	-	350	-	-	-	-	-	5	-	-
3	-	-	-	15	25	8	-	10	-	11.5
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	-	8	10	-	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	60.5	6.03	3.92	10.6	38.0	57.4
2	Bulk Rougher Conc 2	43.2	4.31	1.48	2.7	10.2	10.4
3	Bulk Rougher Tail	899.4	89.66	0.36	0.4	51.8	32.2
	Head (calc)	1003.1	100.0	0.62	1.11	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	10.34	2.9	7.3	48.2	67.8

Product: **Bulk Ro. Tail** **Test No:** 16

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
589	28	4.8	2.0	2.0	98.0
417	35	2.7	1.1	3.2	96.8
295	48	5.5	2.3	5.5	94.5
208	65	6.8	2.9	8.4	91.6
147	100	14.8	6.3	14.6	85.4
104	150	18.9	8.0	22.6	77.4
74	200	23.5	9.9	32.5	67.5
53	270	27.2	11.5	44.0	56.0
38	400	24.0	10.1	54.1	45.9
-38	-400	108.6	45.9	100.0	-
	Total	236.8	100.0	-	-

K80 **117 µm**

TEST NO. 17

Purpose: To repeat the conditions of Test 16, but regrind the tailing and omit lime from the HIC stage.

Procedure: As shown below.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Grind: 6 minutes at 65% solids in a laboratory rod mill.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	Grind	Cond.	Froth	
Grind		10000	-	-	-	-	6	-	-	-
H.I. Cond	1	-	-	-	-	-	-	0	-	-
	2	-	350	-	-	-	-	5	-	-
	3	-	-	15	25	-	-	10	-	-
Bulk Ro	1	-	-	-	-	-	-	1	3	-
	2	-	-	5	8	-	-	1	2	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	100.9	9.88	3.69	8.79	57.3	78.6
2	Bulk Rougher Conc 2	45.5	4.45	1.29	1.26	9.0	5.1
3	Bulk Rougher Tail	875.3	85.67	0.25	0.21	33.7	16.3
	Head (calc)	1021.7	100.0	0.64	1.10	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	14.33	2.94	6.45	66.3	83.7

TEST NO. 18

Purpose: A preliminary cleaning test on Faro Tailing Composite DV pH <7 using the rougher conditions of Test 17.

Procedure: As shown below.

Feed: ~2000 grams of Faro Tailing Composite DV pH <7.

Grind: 12 minutes at 65% solids in a laboratory rod mill.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			
		$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	Grind	Cond.	Froth	pH
Grind		10000	-	-	-	-	12	-	-	-
H.I. Cond	1	-	-	-	-	-	-	0	-	11.4
	2	-	350	-	-	-	-	5	-	-
	3	-	-	15	25	-	-	10	-	-
Bulk Ro	1	-	-	-	-	-	-	1	4	-
	2	-	-	5	8		-	1	3	-
Regrind (PM)		1000	80	-	-	-	25	-	-	-
H.I. Cond		-	-	5	10	-	-	15	-	-
Bulk 1st Cl		-	-	-	-	-	-	1	4	11.8
Bulk 1st Cl Scav		-	-	-	-	-	-	1	3	-
Bulk 2nd Cl		50	-	-	-	-	-	1	3	11.5
Bulk 3rd Cl		20	-	-	-	-	-	1	2	11.5
Bulk 4th Cl		20	-	-	-	-	-	1	2	11.5

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	62.8	3.21	7.72	23.2	110	40.4	70.6	27.5
2	Bulk 4th Cleaner Tail	7.1	0.36	6.37	8.29	108	3.8	2.9	3.1
3	Bulk 3rd Cleaner Tail	8.5	0.43	4.82	6.03	130	3.4	2.5	4.4
4	Bulk 2nd Cleaner Tail	17.0	0.87	2.18	2.29	38.8	3.1	1.9	2.6
5	Bulk 1st Cl Scav Conc	15.0	0.77	1.37	1.78	24.8	1.7	1.3	1.5
6	Bulk 1st Cl Scav Tail	245.2	12.53	0.63	0.45	12.9	12.9	5.3	12.6
7	Bulk Rougher Tail	1600.8	81.82	0.26	0.2	7.6	34.7	15.5	48.4
	Head (calc)	1956.4	100.00	0.61	1.05	12.9	100.0	100.0	100.0

Combined Products

1-2	Bulk 3rd Cleaner Conc	3.57	7.58	21.7	110	44.2	73.5	30.5
1-3	Bulk 2nd Cleaner Conc	4.01	7.28	20.0	112	47.6	76.0	34.9
1-4	Bulk 1st Cleaner Conc	4.88	6.37	16.8	98.9	50.7	77.8	37.5
1-5	Bulk 1st Cl+Cl Scav Concs	5.64	5.69	14.8	88.9	52.4	79.1	39.0
1-6	Bulk Rougher Conc	18.18	2.20	4.90	36.5	65.3	84.5	51.6
6-7	Bulk Ro+1st Cl Scav Tails	94.36	0.31	0.23	8.30	47.6	20.9	61.0

TEST NO. 19

Purpose: To repeat the conditions of Test 18, but use SD200 in the bulk cleaners.

Procedure: Similar to Test 18.

Feed: ~2000 grams of Faro Tailing Composite DV pH <7.

Grind: 12 minutes at 65% solids in a laboratory rod mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	SD200	Grind	Cond.	Froth	
Grind	10000	-	-	-	-	-	12	-	-	-
H.I. Cond 1	-	-	-	-	-	-	-	0	-	-
2	-	350	-	-	-	-	-	5	-	11.5
3	-	-	15	25	-	-	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	5	10	-	-	-	1	3	-
Bulk Regrind	1000	-	-	-	-	50	25	-	-	-
H.I. Condition	-	-	5	10	-	-	-	15	-	-
Bulk 1st Cleaner	-	-	-	-	-	-	-	1	4	11.8
Bulk 1st Cl Scav	-	-	2	4	-	-	-	1	2	-
Bulk 2nd Cleaner	100	-	-	-	-	20	-	1	3	11.5
Bulk 3rd Cleaner	50	-	-	-	-	20	-	1	2	11.5
Bulk 4th Cleaner	50	-	-	-	-	20	-	1	2	11.5

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	35.3	1.75	6.88	28.6	89.3	19.2	46.9	12.9
2	Bulk 4th Cleaner Tail	19.9	0.99	6.69	13.7	83.5	10.5	12.7	6.8
3	Bulk 3rd Cleaner Tail	26.6	1.32	4.65	7.56	66.3	9.8	9.3	7.2
4	Bulk 2nd Cleaner Tail	43.1	2.13	2.74	3.54	43.5	9.3	7.1	7.7
5	Bulk 1st Cl Scav Conc	26.4	1.31	1.61	1.58	27.7	3.4	1.9	3.0
6	Bulk 1st Cl Scav Tail	210.9	10.44	0.76	0.6	15.1	12.6	5.9	13.0
7	Bulk Rougher Tail	1657.9	82.07	0.27	0.21	7.3	35.3	16.2	49.5
	Head (calc)	2020.1	100.00	0.63	1.07	12.1	100.0	100.0	100.0

Combined Products

1-2	Bulk3rd Cleaner Conc	2.73	6.81	23.2	87.2	29.6	59.6	19.7
1-3	Bulk 2nd Cleaner Conc	4.05	6.11	18.1	80.4	39.4	68.9	26.9
1-4	Bulk 1st Cleaner Conc	6.18	4.95	13.1	67.7	48.7	76.0	34.5
1-5	Bulk 1st Cl+Cl Scav Concs	7.49	4.36	11.1	60.7	52.1	77.9	37.5
1-6	Bulk Rougher Conc	17.93	2.27	4.98	34.1	64.7	83.8	50.5
6-7	Bulk Ro+1st Cl Scav Tails	92.51	0.33	0.25	8.18	47.9	22.1	62.5

TEST NO. 20

Purpose: To examine the effect of depressant SW2 in bulk concentrate upgrading.

Procedure: As indicated below.

Feed: 2 x 2000 grams of Faro Tailing Composite DV pH <7.

Grind: 12 minutes at 65% solids in a lab rod mill.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	SW2	Grind	Cond.	Froth	
Grind	10000	-	-	-	-	-	12	-	-	-
H.I. Cond 1	-	-	-	-	-	-	-	0	-	10.8
2	-	350		-	-	-	-	5	-	-
3	-	-	15	25	-	-	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	4	5	-	-	-	1	4	-
Bulk Regrind	1000	-	-	-	-	150	35	-	-	-
H.I. Condition	-	-	-	5	6	-	-	15	-	-
Bulk 1st Cleaner	-	-	-	-	-	-	-	1	4	11.7
Bulk 1st Cl Scav	-	-	2	2	-	-	-	1	3	-
Bulk 2nd Cleaner	100	-	-	-	-	20	-	1	4	11.7
Bulk 3rd Cleaner	100	-	-	-	-	20	-	1	3	11.7
Bulk 4th Cleaner	100	-	-	-	-	20	-	1	2	11.9

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	47.4	1.26	3.58	33.9	67.9	7.8	41.6	6.9
2	Bulk 4th Cleaner Tail	29.6	0.79	5.66	17	84.8	7.7	13.0	5.4
3	Bulk 3rd Cleaner Tail	42.3	1.13	3.93	5.38	58.9	7.6	5.9	5.4
4	Bulk 2nd Cleaner Tail	104.1	2.77	2.24	2.2	33.5	10.7	5.9	7.5
5	Bulk 1st Cl Scav Conc	54.3	1.45	5.02	5.8	84.3	12.5	8.2	7.5
6	Bulk 1st Cl Scav Tail	550.2	14.65	0.8	0.56	15.1	20.2	8.0	17.9
7	Bulk Rougher Tail	2927.8	77.96	0.25	0.23	7.8	33.6	17.4	49.3
	Head (calc)	3755.7	100.00	0.58	1.03	12.3	100.0	100.0	100.0

Combined Products

1-2	Bulk 3rd Cleaner Conc	2.05	4.38	27.4	74.4	15.5	54.6	12.4
1-3	Bulk 2nd Cleaner Conc	3.18	4.22	19.6	68.9	23.1	60.5	17.7
1-4	Bulk 1st Cleaner Conc	5.95	3.30	11.5	52.4	33.8	66.4	25.3
1-5	Bulk 1st Cl+Cl Scav Concs	7.39	3.63	10.4	54.7	46.3	74.6	32.8
1-6	Bulk Rougher Conc	22.04	1.75	3.85	28.4	66.4	82.6	50.7
6-7	Bulk Ro+1st Cl Scav Tails	92.61	0.34	0.28	8.95	53.7	25.4	67.2

TEST NO. 21

Purpose: To repeat the conditions of Test 20, but add depressant SW2 to the bulk grind.

Procedure: As indicated below.

Feed: 2 x 2000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	SW2	Grind	Cond.	Froth	
Grind	10000	-	-	-	-	100	12	-	-	-
H.I. Cond 1	-	-	-	-	-	-	-	0	-	10.6
2	-	350		-	-	-	-	5	-	-
3	-	-	15	25	-	-	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	1	4	-
2	-	-	5	10	-	-	-	1	4	-
Bulk Regrind	1000	100	-	-	-	100	35	-	-	-
H.I. Condition	-	-	-	5	4	-	-	15	-	-
Bulk 1st Cleaner	-	-	-	-	-	-	-	1	4	11.0
Bulk 1st Cl Scav	-	-	-	5	2	-	-	1	3	-
Bulk 2nd Cleaner	100	-	-	-	-	20	-	1	4	11.7
	-	-	-	-	2	-	-	1	1	-
Bulk 3rd Cleaner	100	-	-	-	-	20	-	1	4	11.8
	-	-	-	-	2	-	-	1	1	-
Bulk 4th Cleaner	100	-	-	-	-	20	-	1	3	11.9

METALLURGICAL RESULTS

Product		Weight		Assays,%,g/t			% Distribution		
		g	%	Pb	Zn	Ag	Pb	Zn	Ag
1	Bulk 4th Cleaner Conc	72.1	1.92	5.13	31.2	83	15.8	57.9	12.6
2	Bulk 4th Cleaner Tail	33.7	0.90	5.42	7.81	73.9	7.8	6.8	5.2
3	Bulk 3rd Cleaner Tail	64.5	1.72	2.91	2.42	41.1	8.0	4.0	5.6
4	Bulk 2nd Cleaner Tail	154.9	4.12	1.59	1.08	24.2	10.5	4.3	7.9
5	Bulk 1st Cl Scav Conc	47.5	1.26	2.56	2.41	40.9	5.2	2.9	4.1
6	Bulk 1st Cl Scav Tail	455.0	12.11	0.71	0.45	13.5	13.8	5.3	12.9
7	Bulk Rougher Tail	2929.1	77.97	0.31	0.25	8.4	38.8	18.8	51.7
	Head (calc)	3756.8	100.00	0.62	1.03	12.7	100.0	100.0	100.0

Combined Products

1-2	Bulk 3rd Cleaner Conc	2.82	5.22	23.7	80.1	23.6	64.6	17.8
1-3	Bulk 2nd Cleaner Conc	4.53	4.35	15.7	65.3	31.6	68.6	23.4
1-4	Bulk 1st Cleaner Conc	8.66	3.03	8.7	45.7	42.2	73.0	31.3
1-5	Bulk 1st Cl+Cl Scav Concs	9.92	2.97	7.9	45.1	47.4	75.9	35.4
1-6	Bulk Rougher Conc	22.03	1.73	3.81	27.7	61.2	81.2	48.3
6-7	Bulk Ro+1st Cl Scav Talls	90.08	0.36	0.28	9.09	52.6	24.1	64.6

TEST NO. 22

Purpose: As for Test 17, but with a 3 minute grind.

Procedure: As shown below.

Feed: ~1000 grams of Faro Tailing Composite DV pH <7.

Grind: 3 minutes at 65% solids in a laboratory rod mill.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	Grind	Cond.	Froth	
Grind		10000	-	-	-	-	3	-	-	-
H.I. Cond	1	-	-	-	-	-	-	0	-	-
	2	-	350	-	-	-	-	5	-	-
	3	-	-	15	25	-	-	10	-	-
Bulk Rougher	1	-	-	-	-	-	-	-	3.5	11.9
	2	-	-	5	8	5	-	-	2.5	11.0

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	83.8	8.80	3.32	8.8	46.3	69.7
2	Bulk Rougher Conc 2	32.1	3.37	1.45	1.64	7.7	5.0
3	Bulk Rougher Tail	836.5	87.83	0.33	0.32	45.9	25.3
	Head (calc)	952.4	100.0	0.63	1.11	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	12.17	2.80	6.82	54.1	74.7

TEST NO. 23

Purpose: To evaluate the effect of grind time on pH >7 tailings.

Procedure: Similar to Test 22 with lower lime.

Feed: ~1000 grams of Faro Tailing Composite DV pH >7.

Grind: 3 minutes at 65% solids in a laboratory rod mill.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	Grind	Cond.	Froth	
Grind		1000	-	-	-	-	3	-	-	-
H.I. Cond	1	-	-	-	-	-	-	0	-	-
	2	-	380	-	-	-	-	5	-	-
	3	-	-	15	25	-	-	10	-	-
Bulk Rougher	1	-	-	-	-	25	-	1	3.5	8.9
	2	-	-	5	8	10	-	1	2.5	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	104.5	11.32	2.88	5.5	46.0	54.0
2	Bulk Rougher Conc 2	54.1	5.86	1.59	2.84	13.1	14.4
3	Bulk Rougher Tail	764.5	82.82	0.35	0.44	40.9	31.6
	Head (calc)	923.1	100.0	0.71	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	17.18	2.44	4.59	59.1	68.4

TEST NO. 24

Purpose: As for Test 23, but with a 6 minute grind.

Procedure: As shown below.

Feed: ~1000 grams of Faro Tailing Composite DV pH >7.

Grind: 6 minutes at 65% solids in a laboratory rod mill.

Conditions:

		Reagents Added, grams per tonne					Time, minutes			pH
		$Ca(OH)_2$	$CuSO_4$	M2030	A317	MIBC	Grind	Cond.	Froth	
Grind		1000	-	-	-	-	6	-	-	-
H.I. Cond	1	-	-	-	-	-	-	0	-	-
	2	-	380	-	-	-	-	5	-	-
	3	-	-	15	25	-	-	10	-	-
Bulk Rougher	1	-	-	-	-	25	-	1	3.5	8.8
	2	-	-	5	8	-	-	1	2.5	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	82.2	9.26	3.56	6.97	47.1	57.2
2	Bulk Rougher Conc 2	48.8	5.50	1.62	3.19	12.7	15.6
3	Bulk Rougher Tail	756.4	85.24	0.33	0.36	40.2	27.2
	Head (calc)	887.4	100.0	0.70	1.13	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	14.76	2.84	5.56	59.8	72.8

TEST NO. 25

Purpose: The first in a series of tests to evaluate collector high intensity conditioning time.

Procedure: Condition the pulp in a 2 L Denver ceil at 1200 rpm for 2 stages then place the pulp in the high intensity conditioning ceil and dilute the pulp until the blades are covered. Condition for 5 minutes then transfer the pulp to a 4L cell and float 2 bulk roughers.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	300	-	-	-	-	-	5	-	11.9
Condition	-	-	350	-	-	-	-	5	-	11.6
H.I. Condition	-	-	-	25	10	-	-	5	-	-
Bulk Rougher 1	-	-	-	-	-	5	-	1	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	65.5	6.92	2.39	6.1	23.0	36.5
2	Bulk Rougher Conc 2	56.6	5.98	2.12	3.4	17.6	17.6
3	Bulk Rougher Tail	824.0	87.09	0.49	0.61	59.4	45.9
	Head (calc)	946.1	100.0	0.72	1.16	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	12.91	2.26	4.85	40.6	54.1

TEST NO. 26

Purpose: As for Test 25 but increase HIC time to 10 minutes.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH <7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	300	-	-	-	-	-	5	-	11.9
Condition	-	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	-	25	10	15	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	105.5	11.37	2.68	5.88	42.2	58.0
2	Bulk Rougher Conc 2	62.9	6.78	1.58	2.08	14.8	12.2
3	Bulk Rougher Tail	759.1	81.84	0.38	0.42	43.0	29.8
	Head (calc)	927.5	100.0	0.72	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	18.16	2.27	4.46	57.0	70.2

TEST NO. 27

Purpose: As for Test 25, but increase HIC time to 15 minutes.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	300	-	-	-	-	-	5	-	11.8
Condition	-	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	-	25	10	15	-	15	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	61.2	6.62	2.79	6.87	25.5	39.6
2	Bulk Rougher Conc 2	91.1	9.86	2.35	3.56	31.9	30.6
3	Bulk Rougher Tail	771.5	83.51	0.37	0.41	42.6	29.8
	Head (calc)	923.8	100.0	0.73	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	16.49	2.53	4.89	57.4	70.2

TEST NO. 28

Purpose: As for Test 25 but increase HIC time to 20 minutes.

Procedure: As for Test 27, but increase HiC time from 15 to 20 minutes

Feed: 1000 grams of Faro Tailing at pH 7.5.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Conditlon	1500	300	-	-	-	-	-	5	-	11.9
Conditlon	-	-	350	-	-	-	-	5	-	-
H.I. Conditlon	-	-	-	25	10	15	-	20	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	49.6	5.27	2.86	7.28	20.1	33.5
2	Bulk Rougher Conc 2	56.3	5.98	3.05	5.77	24.3	30.1
3	Bulk Rougher Tail	836.1	88.76	0.47	0.47	55.6	36.4
	Head (calc)	942.0	100.0	0.75	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	11.24	2.96	6.48	44.4	63.6

TEST NO. 29

Purpose: The first in a series of tests to investigate the effect of various speeds of HIC.

Procedure: As for Test 25, but with an HIC speed of 600 rpm for 10 minutes.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	300	-	-	-	-	-	5	-	11.9
Condition	-	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	-	25	10	15	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	64.8	7.04	2.66	6.11	25.6	37.1
2	Bulk Rougher Conc 2	68.4	7.43	2.02	3.14	20.5	20.1
3	Bulk Rougher Tail	787.1	85.53	0.46	0.58	53.8	42.8
	Head (calc)	920.3	100.0	0.73	1.16	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	14.47	2.33	4.58	46.2	57.2

TEST NO. 30

Purpose: As for Test 29, but with an HIC speed of 900 rpm.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	300	-	-	-	-	-	5	-	11.9
Condition	-	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	-	25	10	15	-	10	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	3	10.5
2	-	-	-	15	5	-	-	1	5	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	64.6	6.96	3.04	7.57	29.2	45.3
2	Bulk Rougher Conc 2	64.5	9.10	1.94	2.75	24.4	21.5
3	Bulk Rougher Tail	779.7	83.95	0.4	0.46	46.4	33.2
	Head (calc)	928.8	100.0	0.72	1.16	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	16.05	2.42	4.84	53.6	66.8

TEST NO. 31

Purpose: To repeat the conditions of Test 27, but omit depressant SW2.

Procedure: Similar to Test 27, but without SW2 depressant.

Feed: ~1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

	Reagents Added, grams per tonne					Time, minutes			
	$Ca(OH)_2$	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	pH
Condition	1500	-	-	-	-	-	5	-	11.7
Condition	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	25	10	15	-	15	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	5	10.5
2	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	54.0	6.28	2.92	7.82	27.7	41.0
2	Bulk Rougher Conc 2	55.4	6.44	2.43	3.38	23.6	18.2
3	Bulk Rougher Tail	750.7	87.28	0.37	0.56	48.7	40.8
	Head (calc)	860.1	100.0	0.66	1.20	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	12.72	2.67	5.57	51.3	59.2

TEST NO. 32

Purpose: To repeat the conditions of Test 27, but use 150 g/t of SW2 depressant.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage	Reagents Added, grams per tonne						Time, minutes			pH
	$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
Condition	1500	150	-	-	-	-	-	5	-	11.8
Condition	-	-	350	-	-	-	-	5	-	-
H.I. Condition	-	-	-	25	10	15	-	15	-	-
Bulk Rougher 1	-	-	-	-	-	-	-	-	5	10.5
2	-	-	-	15	5	-	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	91.0	9.83	2.04	4.51	28.2	38.4
2	Bulk Rougher Conc 2	58.4	6.31	2.24	3.7	19.9	20.2
3	Bulk Rougher Tail	776.4	83.86	0.44	0.57	51.9	41.4
	Head (calc)	925.8	100.0	0.71	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	16.14	2.12	4.19	48.1	58.6

TEST NO. 33

Purpose: To repeat the conditions of Test 25, but use high intensity conditioning in all 3 stages of conditioning.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage		Reagents Added, grams per tonne						Time, minutes			pH
		$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
H.I. Cond	1	1500	300	-	-	-	-	-	5	-	10.7
	2	-	-	350	-	-	-	-	5	-	-
	3	-	-	-	25	10	15	-	5	-	-
Bulk Rougher	1	-	-	-	-	-	10	-	1	5	10.6
	2	-	-	-	15	5	5	-	1	5	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	118.5	12.82	1.98	4.84	35.8	52.8
2	Bulk Rougher Conc 2	88.3	9.55	1.44	2.15	19.4	17.5
3	Bulk Rougher Tail	717.5	77.63	0.41	0.45	44.8	29.7
	Head (calc)	924.3	100.0	0.71	1.18	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	22.37	1.75	3.69	55.2	70.3

TEST NO. 34

Purpose: To repeat the conditions of Test 33, but increase the length of high intensity conditioning time with collector to 10 minutes.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage		Reagents Added, grams per tonne						Time, minutes			pH
		$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
H.I. Cond	1	1500	300	-	-	-	-	-	5	-	-
	2	-	-	350	-	-	-	-	5	-	-
	3	-	-	-	25	10	15	-	10	-	-
Bulk Rougher	1	-	-	-	-	-	10	-	1	5	10.5
	2	-	-	-	15	5	5	-	1	3	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	142.3	15.25	1.91	4.3	41.0	56.6
2	Bulk Rougher Conc 2	106.7	11.44	1.16	1.57	18.7	15.5
3	Bulk Rougher Tail	684.0	73.31	0.39	0.44	40.3	27.9
	Head (calc)	933.0	100.0	0.71	1.16	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	26.69	1.59	3.13	59.7	72.1

TEST NO. 35

Purpose: To repeat the conditions of Test 34, but increase the high intensity conditioning stage with collector to 15 minutes.

Procedure: As indicated below.

Feed: 1000 grams of Faro Tailing Composite DV pH >7.

Conditions:

Stage		Reagents Added, grams per tonne						Time, minutes			pH
		$Ca(OH)_2$	SW2	$CuSO_4$	A317	M2030	MIBC	Grind	Cond.	Froth	
H.I. Cond	1	1500	300	-	-	-	-	-	5	-	-
	2	-	-	350	-	-	-	-	5	-	-
	3	-	-	-	25	10	15	-	15	-	-
Bulk Rougher	1	-	-	-	-	-	10	-	1	5	10.5
	2	-	-	-	15	5	5	-	1	5	-

METALLURGICAL RESULTS

Product		Weight		Assays,%		% Distribution	
		g	%	Pb	Zn	Pb	Zn
1	Bulk Rougher Conc 1	149.2	16.09	1.92	4.28	42.6	59.9
2	Bulk Rougher Conc 2	115.5	12.46	1.16	1.63	19.9	17.7
3	Bulk Rougher Tail	662.4	71.45	0.38	0.36	37.4	22.4
	Head (calc)	927.1	100.0	0.73	1.15	100.0	100.0

Combined Products

Bulk Rougher Conc. 1+2	28.55	1.59	3.12	62.6	77.6