

An Investigation of
THE RECOVERY OF LEAD AND ZINC

from Grum Deposit samples

submitted by

KERR ADDISON MINES LIMITED

Progress Report No. 8

014935

Project No. L.R. 1991

NOTE:

This report refers to the samples as received.

The practice of this Company in issuing reports of this nature is to require the recipient not to publish the report or any part thereof without the written consent of Lakefield Research of Canada Limited.

LAKEFIELD RESEARCH OF CANADA LIMITED
Lakefield, Ontario
September 9, 1977

I N D E X

	<u>Page No.</u>
INTRODUCTION	1
SUMMARY	2 - 16
1. Head Analyses	2
2. Overall Composite Preparation	2
3. General Evaluation	3 - 4
4. Flowsheet	4 - 7
5. Reagent Balance	8
6. Flotation Results	9 - 11
6.1. Batch Test Results - Overall Composites	9
6.2. Cycle Test Results	10 - 11
7. Effect of Fineness of Primary Grind and Pb Concentrate Regrind on Pb Flotation and Cleaning ...	11 - 12
8. Effect of Zinc Concentrate Regrind	12 - 13
9. Effect of Recycle Water	13 - 14
10. Settling and Filtration Tests	15 - 16
10.1. Settling Test Results	15
10.2. Filtration Test Results	16
DISCUSSION	17 - 35
1. Testwork - Composite No. 1	17 - 25
1.1. Effect of Fineness of Primary Grind on Lead Flotation	17 - 18
1.2. Effect of Fineness of Lead Concentrate Regrind	18 - 20
1.3. Zinc Circuit - Effect of Fineness of Rougher Concentrate Regrind	21 - 23
1.4. Effect of Level of Different Zinc and Pyrite Depressants	24
1.5. Zinc Circuit - Effect of Type of Collector Additions	25
2. Flotation Results - Composite No. 2.....	26 - 28
2.1. Lead Circuit - Effect of Concentrate Regrind .	26 - 27
2.2. Effect of Aeration on Pb Flotation	28
2.3. Zinc Flotation	28
3. Flotation Results - Composite No. 3	29
4. Flotation Results - Composite No. 4 and 5	30 - 31
5. Effect of Recycle Water on Lead and Zinc Flotation Results	31 - 35
5.1. Preparation of Tailing Water Effluent	31
5.2. Water Analyses	32 - 33
5.3. Flotation Test Results	34 - 35

Index - Continued

			<u>Page No.</u>
SAMPLE PREPARATION			36 - 38
DETAILS OF TESTS			39 - 174
Test No. 188 - 206	Composite No. 1	Batch Test	39 - 74
Test No. 207	Composite No. 1	Cycle Test	75 - 70
Test No. 208 - 216	Composite No. 1	Batch Test	81 - 108
Test No. 217	Composite No. 1	Cycle Test	109 - 113
Test No. 218 - 224	Composite No. 1	Batch Test	114 - 128
Test No. 225	Composite No. 3	Batch Test	129 - 131
Test No. 226	Composite No. 2	Batch Test	132 - 133
Test No. 227	Composite No. 4	Batch Test	134 - 135
Test No. 228	Composite No. 5	Batch Test	136 - 137
Test No. 229	Composite No. 1	Batch Test	138 - 139
Test No. 230	Composite No. 3	Cycle Test	140 - 144
Test No. 231 - 233	Composite No. 2	Batch Test	145 - 150
Test No. 234	Composite No. 2	Cycle Test	151 - 152
Test No. 235	Composite No. 4	Batch Test	153 - 155
Test No. 236	Composite No. 5	Batch Test	156 - 158
Test No. 237	Composite No. 2	Batch Test	159 - 163
Test No. 238	Composite No. 2	Batch Test	164 - 165
Test No. 239	Composite No. 2	Batch Test	166 - 167
Test No. 240	Composite No. 2	Cycle Test	168 - 172
Test No. 241	Composite No. 1	Batch Test	173 - 174
Settling and Thickener Area Requirements (Tests 1 - 4)			175 - 182
Filtration Tests (F1 to F2)			183 - 184
Appendix No. 1			185 - 186

I N T R O D U C T I O N

On June 14, 1977, a meeting was held in the offices of Kerr Addison Mines Limited with Messrs. M.D. Rowswell, J.K. Carrington and P.S. Cross of Kerr Addison Mines Limited, and Messrs. R.L. Coleman, B.P. Wallace and K.V. Konigsmann of Noranda Mines Limited.

During the meeting the results from testwork obtained on individual samples was discussed. From the available test results it was decided that further testwork should be performed on various composite samples prepared from the individual samples.

The testwork had the following objectives:

- 1) To optimize power requirements and attempt to reduce power input in the primary grind and regrind stages.
- 2) To evaluate the effect of recirculation of tailing effluent on lead and zinc metallurgical results.
- 3) To evaluate possible reagent changes that might improve flotation results.
- 4) To carry out testwork on overall composite that contained at least 20 percent of sample A-77.

LAKEFIELD RESEARCH OF CANADA LIMITED



A.G. Scobie, P. Eng.,
Manager



S. Bulatovic, P. Eng.,
Project Metallurgist

Investigation by: C.W. Payne

S U M M A R Y

1. Head Analyses

The head analyses of the overall composite samples are listed in the table below:

Head Analyses

Element	Composite No.				
	1	2	3	4	5
Lead (Pb) %	4.0	6.12	4.69	5.63	6.19
* (Pb) %	(4.16)	(5.91)	(4.60)	(5.68)	(5.95)
Zinc (Zn) %	6.50	9.44	9.05	10.40	10.60
* (Zn) %	(6.60)	(9.25)	(9.12)	(10.65)	(10.61)
Arsenic (As) %	-	0.34	0.37	0.40	0.37
Silver (Ag) oz/t	-	2.39	2.05	2.45	2.54

* Calculated from testwork

2. Overall Composite Preparation

Five composite samples were prepared for this testwork from the eight individual samples. Composite No. 2 contained 20 % ore sample A-77. The distributions of the individual samples in the various composites are shown below:

Sample No.	Assays, %		Composite, Weight %				
	Pb	Zn	1	2	3	4	5
F-3V	6.86	15.8	2.5	10.0	10.0	14.0	12.5
F-3H	6.87	11.1	4.3	15.0	15.0	14.0	12.5
C-77	4.72	11.1	-	10.0	10.0	14.0	12.5
C-3	3.82	6.52	30.1	-	10.0	-	-
H-3	3.11	6.20	10.4	15.0	10.0	14.0	12.5
G-3	1.37	2.83	31.2	20.0	20.0	14.0	12.5
D-3	3.84	7.82	10.4	10.0	20.0	10.0	12.5
A-77	13.00	7.81	8.6	20.0	5.0	10.0	12.5
B-2	7.81	15.20	2.5	-	-	10.0	12.5
Total	-	-	100.0	100.0	100.0	100.0	100.0

Summary - Continued

3. General Evaluation

The test program was designed to evaluate the metallurgical processing characteristics of the various overall composite samples prepared from the individual samples, which had been tested and described in Progress Report No. 7.

During the course of the testwork an attempt was made to reduce power input to the primary grind and the lead and zinc concentrate regrind stages. It was found that a decrease in power input in the primary grind was possible, with no changes in lead and zinc rougher recoveries. However, using a coarser primary grind, more power had to be applied in the lead and zinc regrinding stages in order to obtain satisfactory metallurgical results. The optimum power distribution in the primary grind and lead and zinc concentrate regrind was established as follows. About 55 % of the total grinding power was applied in the primary grind (9.3 kWh/ton), 38 % was applied in the lead concentrate regrind (6.4 kWh/t) and only 7 % in the zinc concentrate regrind (1.1 kWh/ton).

In most of the testwork the modified standard procedure was used. The following variables in the modified procedure were studied:

- 1) Effect of middling recirculation-cycle tests.
- 2) Evaluation of the effect of fineness of primary grind and regrind of the lead and zinc concentrates on the respective grades and recoveries.
- 3) Level and type of zinc depressants.
- 4) Type of lead and zinc collectors.
- 5) Effect of tailing effluent on lead and zinc metallurgical results.

Summary - Continued

3. General Evaluation

The overall metallurgical results obtained with all composites were satisfactory; all composites had similar flotation characteristics. In composites in which sample B-2 was present (> 10 %), the zinc flotation deteriorated slightly as compared to those in which sample B-2 was absent.

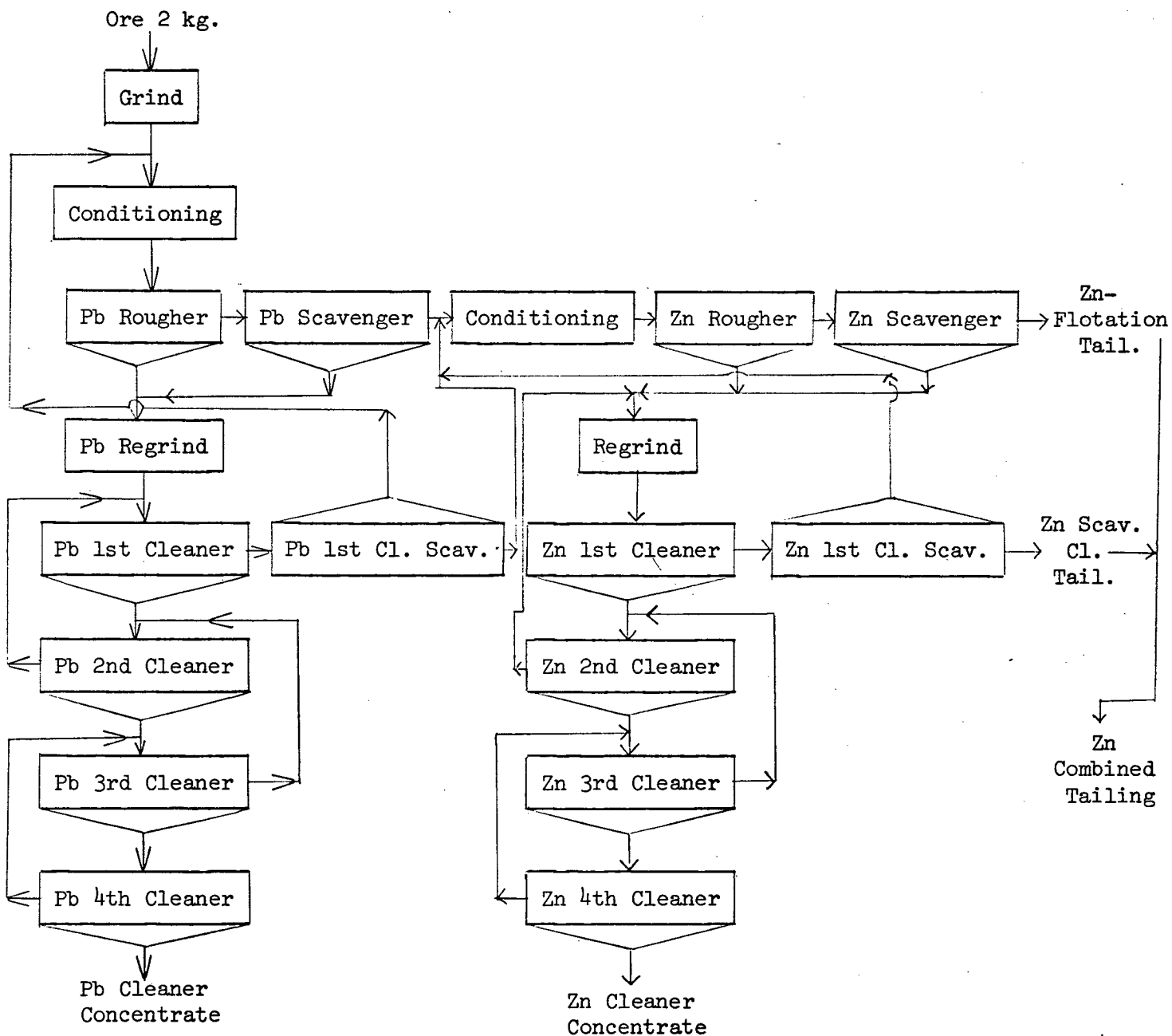
It should be pointed out that the cleaning of lead concentrate in all composites was sensitive to the fineness of regrind of the rougher concentrate. For the zinc circuit only little regrinding was required to obtain a high zinc concentrate grade and recovery. Finer regrinding than necessary of the zinc concentrate lowered the final zinc recovery. The recycle water, tested under laboratory conditions did not effect lead and zinc metallurgical results. Recirculation of middling products in the cycle tests affected zinc circuit flotation. Scavenging the zinc first cleaner tailing in open-circuit improved zinc flotation. Unfortunately, the effect of the middlings produced by fine batch grinding in the laboratory could not be readily established. This was due to differences in the characteristics of middlings produced in a laboratory or in a pilot plant or plant, even when ground to the same degree of fineness.

4. Flowsheet

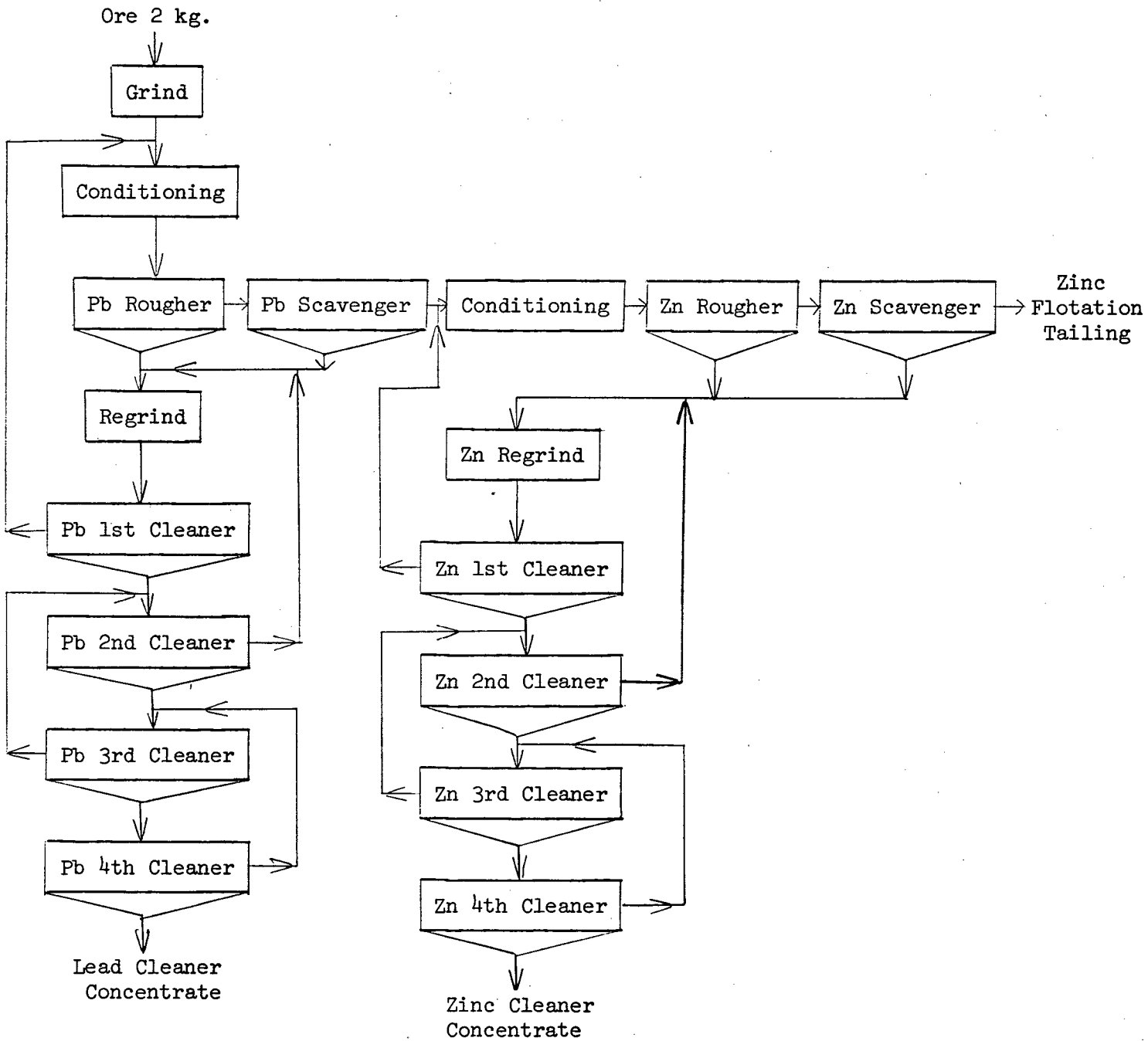
The standard flowsheet used for treatment of individual ore samples (Progress Report No. 7, page 3) was not changed. Only modifications in the type of collector in both lead and zinc circuits were made. In the series of cycle-tests, three modified standard flowsheets were tested, mainly to evaluate the effect of middling recirculation (Flowsheets No. 1, 2 and 3). Flowsheet No. 3 produced the most stable flotation conditions.

For the initial pilot plant operation, flowsheet No. 2 is suggested, and the final flowsheet would be developed during the pilot plant operation.

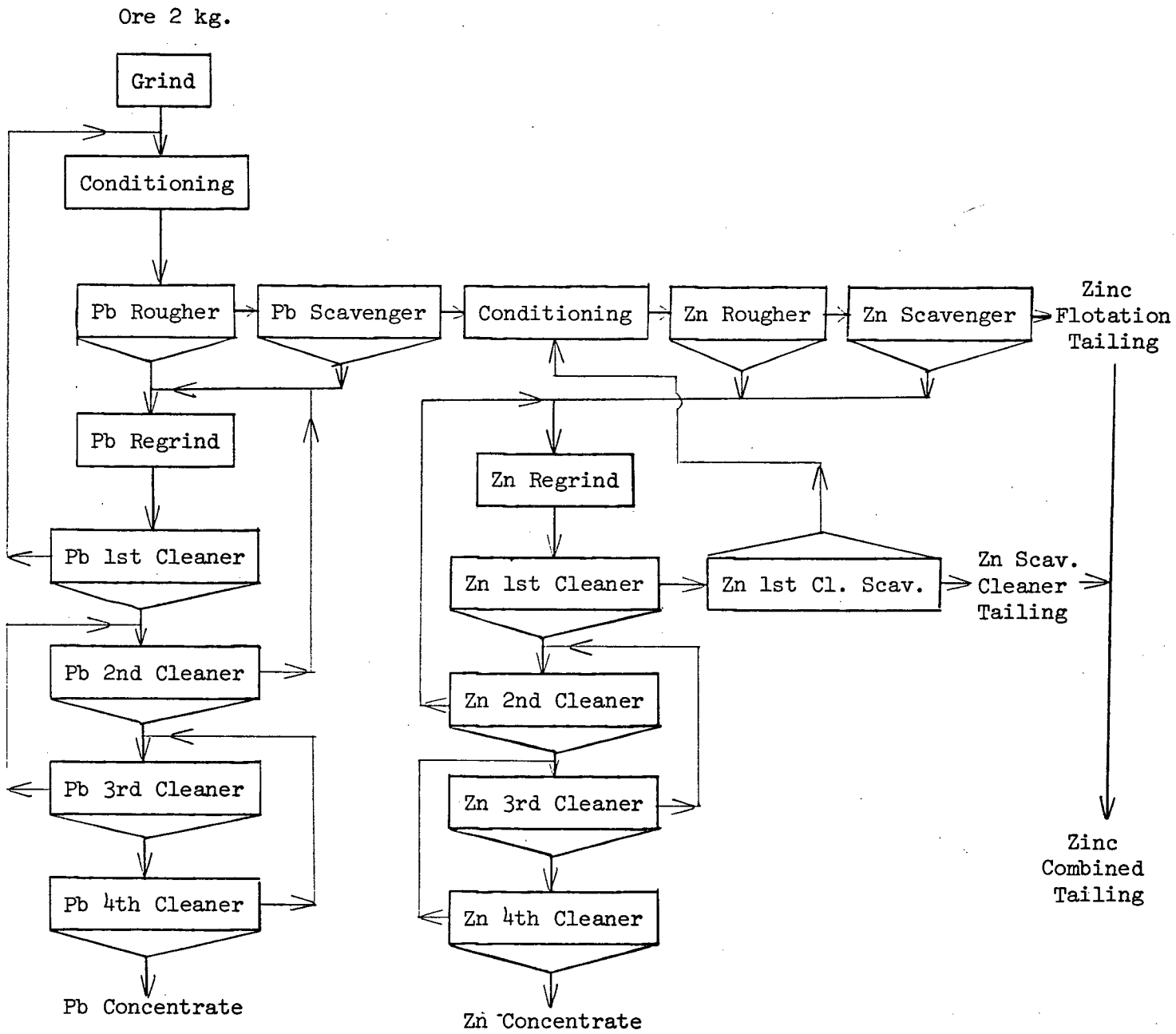
Flowsheet No. 1



Flowsheet No. 2



Flowsheet No. 3



Summary - Continued

5. Reagent Balance

Table No. 1 shows the reagent balance for the lead and zinc circuits, respectively. This reagent balance is recommended for the initial pilot plant operation.

Table No. 1 - Reagent Balance

Stage	Reagent Added, pounds per ton										pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z - 11	MIBC/CA*	Ca(OH) ₂	M-748	CuSO ₄	Na ₂ SiO ₃	
Grind	2.0	1.0	0.3	-	0.07	-	-	-	-	-	9.0
Pb Rougher	-	-	-	-	0.05	0.1	-	-	-	-	9.0
Pb Re grind	0.5	0.5	0.2	0.03	-	-	-	-	-	-	9.0
Pb Cleaning	0.4	0.3	0.2	0.025	0.015	0.015	-	-	-	-	9.0-
Zn Condit.	-	-	-	-	-	-	2.0	-	1.0	-	9.3
Zn Rougher	-	-	-	-	0.05	0.08	-	0.1	0.2	-	10.8
Zn Re grind	-	-	-	-	-	-	1.0	0.02	0.2	0.2	-
Zn Cleaner	-	-	-	-	0.025	0.025	0.5	-	-	0.2	10.9
											11.0-
											11.3

* MIBC : Cresylic Acid = 3:1 ratio

The changes made in the reagent balance used in the standard procedure were designed to improve lead frothing characteristics, and the selectivity between zinc and pyrite. The lead collectors R-242 and Z-4 used in the previous testwork were replaced with collector Z-11, and R-242 was added only in the lead cleaning.

In the zinc circuit collectors Z-200 and Z-4 were replaced with collectors Minerec 748 and Z-11. A marked improvement in the lead and zinc metallurgical results was achieved when using the above collector combinations.

The effect of ZnSO₄ additions was not established. In the absence of ZnSO₄, selectivity between lead and zinc did not change significantly. The omission of cyanide from the circuit resulted in a poor froth condition and lead floated slowly.

Summary - Continued

6. Flotation Results

6.1. Batch Test Results - Overall Composites

The flotation test results, in which the standard laboratory flowsheet (Progress Report No. 7) and reagent balance described above were used, are summarized in Table No. 2.

These results indicated that the flotation characteristics of the overall composites were similar. The variations in flotation characteristics, observed on the individual samples from which the composites were made (Progress Report No. 7), were not present when using the samples in various combinations.

Table No. 2 - Flotation Results - Composite Samples

Test No.	Composite No.	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
222	1	Pb Cleaner Conc.	5.80	60.8	5.59	85.8	4.7
		Pb 1st Cl. Conc.	9.46	39.5	7.76	91.1	10.7
		Zn Cleaner Conc.	9.69	0.45	55.70	1.0	78.5
		Zn Rougher Conc.	17.44	0.53	32.40	2.1	82.3
		Zn Flot. Tailing	73.10	0.38	0.66	6.8	7.0
226	2	Pb Cleaner Conc.	8.44	61.3	7.18	88.0	6.3
		Pb 1st Cl. Conc.	13.49	40.9	10.00	93.8	14.1
		Zn Cleaner Conc.	13.29	0.46	57.00	1.0	78.7
		Zn Rougher Conc.	21.90	0.59	36.30	2.2	82.5
		Zn Flot. Tailing	64.61	0.36	0.50	4.0	3.4
225	3	Pb Cleaner Conc.	5.92	63.5	6.83	83.7	4.2
		Pb 1st Cl. Conc.	10.49	39.7	10.20	92.7	11.1
		Zn Cleaner Conc.	14.17	0.45	55.20	1.4	81.8
		Zn Rougher Conc.	26.61	0.48	30.50	2.8	85.1
		Zn Flot. Tailing	62.90	0.32	0.57	4.5	3.8
235	4	Pb Cleaner Conc.	8.16	61.5	8.17	87.2	5.9
		Pb 1st Cl. Conc.	12.95	41.2	11.80	92.9	13.5
		Zn Cleaner Conc.	16.06	0.67	56.3	1.9	80.5
		Zn Rougher Conc.	23.56	0.77	39.4	3.1	82.7
		Zn Flot. Tailing	63.49	0.36	0.67	4.0	3.8
236	5	Pb Cleaner Conc.	8.72	60.2	8.79	87.2	7.0
		Pb 1st Cl. Conc.	13.93	40.3	11.90	93.2	15.2
		Zn Cleaner Conc.	14.45	0.54	57.70	1.3	75.7
		Zn Rougher Conc.	24.07	0.72	37.20	2.8	81.2
		Zn Flot. Tailing	62.00	0.39	0.66	4.0	3.6

Summary - Continued

6.2. Cycle Test Results

Using modified flowsheets (Flowsheets 1, 2 and 3), several cycle tests were performed to study the effect of middling recirculation on Pb and Zn metallurgical results. Composites No. 1, 2 and 3 were included in this series. These results are summarized in Table No. 3 below.

Table No. 3

Effect of Type of Flowsheet on Pb-Zn Metallurgical Results - Cycle Tests

Test No.	Flowsheet No.	Composite No.	Product	Weight %	Assays, %		Distribution	
					Pb	Zn	Pb	Zn
207	1	1	Pb Cleaner Conc.	4.77	66.7	4.56	78.4	3.2
			Zn Cleaner Conc.	9.18	0.58	57.40	1.3	78.5
			Zn Flot. Tailing	86.05	0.95	1.43	20.3	18.3
			Head (Calc.)	100.00	4.06	6.71	100.0	100.0
217	2	1	Pb Cleaner Conc.	6.12	62.2	5.67	91.0	5.0
			Zn Cleaner Conc.	8.91	0.40	59.70	0.9	76.7
			Zn Flot. Tailing	84.97	0.40	1.49	8.1	18.3
			Head (Calc.)	100.00	4.18	6.93	100.0	100.0
230	3	3*	Pb Cleaner Conc.	5.82	62.5	6.16	80.6	3.9
			Zn Cleaner Conc.	13.75	0.39	57.80	1.2	85.4
			Zn Flot. Tailing	80.43	1.02	1.25	18.2	10.7
			Head (Calc.)	100.00	4.51	9.31	100.0	100.0
237	3	2	Pb Cleaner Conc.	9.12	59.7	7.47	93.3	7.4
			Zn Cleaner Conc.	14.31	0.56	55.7	1.4	86.2
			Zn Flot. Tailing	76.57	0.41	0.78	5.3	6.4
			Head (Calc.)	100.00	5.84	9.25	100.0	100.0
	3	2	Pb Cleaner Conc.	9.06	59.1	7.24	91.4	6.9
			Zn Cleaner Conc.	14.49	0.46	56.6	1.2	86.0
			Zn Flot. Tailing	75.87	0.44	0.57	5.7	4.5
			Head (Calc.)	100.00	5.86	9.53	100.0	100.0

lated by Noranda procedure

Summary - Continued

6.2. Cycle Test Results

The results obtained were satisfactory. It should be noted that the zinc recovery in the above tests was a function of zinc head grade. However, the results suggested that the zinc recovery could be improved in the pilot plant operation.

7. Effect of Fineness of Primary Grind and Pb Concentrate Regrind on Pb Flotation and Cleaning

A series of lead rougher and cleaning tests were performed, in which the fineness of primary grind of 73.5 % and 87.4 % passing minus 200 mesh was used. and in which the Pb concentrate regrind times were varied from 10 to 30 minutes. These results are summarized in Table No. 4.

Table No. 4

Effect of Fineness of Primary Grind and Pb Concentrate Regrind on Grade and Recovery

Test No.	Primary Grind		Concentrate Regrind		Product	Weight %	Assays, %		% Distr.	
	Grind Time min/2000g	% Passing 200 mesh	Regrind minutes	% Passing 25 Microns			Pb	Zn	Pb	Zn
200	30	87.4	10	N.D.	Pb Cl. Conc. Pb Ro. Conc.	6.39 -	<u>44.8</u> -	7.47 -	<u>74.2</u> -	7.1 -
214	20	<u>73.5</u>	<u>20</u> ✓	84.0	Pb Cl. Conc. Pb Ro. Conc.	5.97 26.24	52.7 14.0	7.50 8.11	<u>79.5</u> 93.0	6.8 32.4
213	20	73.5	30	94.0	Pb Cl. Conc. Pb Ro. Conc.	4.88 25.70	63.0 14.7	5.70 8.08	<u>75.6</u> 93.2	4.2 31.4
212	30	87.4	30	96.2	Pb Cl. Conc. Pb Ro. Conc.	5.64 22.96	60.5 16.7	5.88 8.26	<u>83.4</u> 93.6	5.0 28.6
199	30	<u>87.4</u>	20 ✓	N.D.	Pb Cl. Conc. Pb Ro. Conc.	5.36 -	<u>59.1</u> -	6.36 -	<u>80.5</u> -	5.1 -

Summary - Continued

7. Effect of Fineness of Primary Grind and Pb Concentrate Re grind on Pb Flotation and Cleaning

The above results indicated that the fineness of primary grind in the range tested, had no effect on the rougher recovery. However, after an equal regrind time (Tests 213 and 212) lead recovery decreased with decreasing primary grind time. It appeared that a decrease in power input in the primary grind must be compensated for by an increase in power input to the Pb regrind stage to obtain satisfactory results.

8. Effect of Zinc Concentrate Re grind

Six identical tests were conducted in which the zinc regrind times were varied from zero to 20 minutes. These results are presented in Table No. 5 below:

Table No. 5

Effect of Zinc Concentrate Re grind on Grade and Recovery - Composite No. 1

Test No.	Primary Grind		Concentrate Re grind		Product	Weight %	Assays, %		% Distr.	
	Grind Time min/2000g	% Passing 200 mesh	Regrind Time minutes	% Passing 35 microns			Pb	Zn	Pb	Zn
218	20	73.5	0	61.0	Zn Cl. Conc.	8.58	0.48	55.2	1.0	68.9
					Zn Ro. Conc.	17.69	0.72	31.5	3.0	81.0
219	30	87.4	0	70.0	Zn Cl. Conc.	8.85	0.38	55.7	0.8	71.2
					Zn Ro. Conc.	18.89	0.57	29.6	2.6	80.4
220	20	73.5	10	79.0	Zn Cl. Conc.	6.50	0.35	60.6	0.6	57.3
					Zn Ro. Conc.	16.56	0.60	33.4	2.5	80.4
221	20	73.5	15	85.0	Zn Cl. Conc.	8.00	0.40	57.0	0.8	68.5
					Zn Ro. Conc.	19.99	0.58	26.7	2.9	80.3
223	20	73.5	20	91.0	Zn Cl. Conc.	7.41	0.37	52.8	0.7	65.9
					Zn Ro. Conc.	19.94	0.57	27.8	2.8	82.4
224	30	87.4	20	92.0	Zn Cl. Conc.	7.65	0.36	58.3	0.7	68.3
					Zn Ro. Conc.	19.33	0.53	27.6	2.6	81.7

Summary - Continued

8. Effect of Zinc Concentrate Regrind

The above results indicated that at a finer regrind the zinc grade increased, but the zinc recovery was poor. In these tests the zinc was distributed throughout the cleaner tailings. Therefore, a slight regrind of the zinc concentrate would be necessary to achieve satisfactory zinc grade and recovery.

9. Effect of Recycle Water

A series of tests was conducted in which the effect of recycle water in Pb-Zn flotation was studied. The tailing water was produced from a large batch test, and was stored in a covered tank outside the building. In Test No. 216, tailing water that had been taken immediately after the test was done. In tests 222 and 229 the tailing water was in contact with tailing for 2 and 5 weeks respectively before use. The results from these tests are summarized in Table No. 6 below.

Summary - Continued

9. Effect of Recycle Water

Table No. 6

Effect of Recycle Water on Pb and Zn Flotation Results - Composite No. 1

Test No.	Water Used	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
208	Tap	Pb Concentrate	5.44	60.6	6.34	82.5	5.0
		Zn Concentrate	9.64	0.50	54.10	1.2	76.0
		Zn Flot. Tail.	73.69	0.39	0.73	7.3	7.8
216	Decant Immediately after test	Pb Concentrate	6.17	54.5	6.13	86.9	5.7
		Zn Concentrate	9.10	0.44	55.30	1.1	75.1
		Zn Flot. Tail.	74.09	0.33	0.93	6.4	10.3
222	Decant after two weeks standing	Pb Concentrate	5.80	60.8	5.59	85.8	4.7
		Zn Concentrate	9.69	0.45	55.7	1.0	78.5
		Zn Flot. Tail.	73.10	0.38	0.66	6.8	7.0
229	Decant after 5 weeks standing	Pb Concentrate	5.05	63.6	5.01	77.4	3.7
		Zn Concentrate	9.97	0.57	54.0	1.4	78.2
		Zn Flot. Tail.	71.29	0.30	0.69	5.2	7.2
241	Decant after 8 weeks standing	Pb Concentrate	5.88	60.5	5.75	86.7	4.9
		Zn Concentrate	9.68	0.44	56.1	1.1	78.9
		Zn Flot. Tail.	75.20	0.33	0.67	6.1	7.4

The immediate use of recycle water affected Pb concentrate grade. The use of recycle water after 2, 5 and 8 weeks standing had no effect on Pb and Zn flotation results.

Summary - Continued

10. Settling and Filtration Tests

10.1. Settling Test Results

Preliminary settling tests were carried out on final lead and zinc concentrates from Tests No. 215a and b. The results obtained are summarized in Tables No. 7 and 8.

Table No. 7

Lead Concentrate Thickening Tests

Test No.	pH	Flocculant		Final Density		Setting Rate [☒]		Thickener Area ft ² /T/D*	
		Type	lb/ton Conc.	gpl	% Solids	Feed Zone	Compr. Zone	Feed Zone	Compr. Zone
S-1	8.3	-	-	2880	80.6	4.64	0.70	0.47	0.59
S-2	8.5	SF-127	0.015	2821	77.7	6.66	1.02	0.33	0.47

☒ Feet per hour

* No safety factor applied

Table No. 8

Zinc Concentrate Thickening Tests

Test No.	pH	Flocculant		Final Density		Settling Rate [☒]		Thickener Area ft ² /T/D*	
		Type	lb/ton Conc.	gpl	% Solids	Feed Zone	Compr. Zone	Feed Zone	Compr. Zone
S-3	9.5	-	-	2309	75.4	3.07	1.21	0.82	0.95
S-4	9.5	SF-127	0.015	2126	70.5	5.19	1.45	0.45	0.59

☒ Feet per hour

* No safety factor applied

Thickener area requirements were reduced with the additions of a polymer.

Summary - Continued

10.2. Filtration Test Results

Only two filtration tests were conducted on lead and zinc concentrates.

The results are summarized in Table No. 9 below.

Table No. 9

Lead and Zinc Filtration Tests

Test No.	Filter Feed	Slurry		Filter Cloth	Flocc. Added lb/t	Filter Time Sec.			Filter Cake			Filt. Rate *
		% Solids	pH			Form	Dry	Cycle Total	Thick In.	% Moist	Rate **	
F-1	Lead Conc.	60.7	8.6	Co-6	SF-127 ☒	30	90	180	0.4	7.64	132.07	9.51
F-2	Zinc Conc.	56.8	7.7	Co-6	SF-127 ☒	30	90	180	0.3	9.35	82.8	10.6

- ** Dry pounds per hour per square foot
- * U.S. gallons per hour per square foot
- ☒ 0.015 lb/ton

DISCUSSION

1. Testwork - Composite No. 1

Composite No. 1 was prepared from 7 individual samples, excluding sample C-77. In this Composite the metal content was limited to 4.0 % Pb and 6.5 % Zn, and kept within the distribution of the three ore types. Several test series were performed in which the following parameters were evaluated:

- 1) Fineness of primary grind and regrind of lead concentrate
- 2) Fineness of primary grind and regrind of zinc concentrate
- 3) Level of zinc depressant additions
- 4) Effect of middling recirculation

1.1. Effect of Fineness of Primary Grind on Lead Flotation

A series of rougher tests was conducted to investigate the effect of fineness of primary grind on the grade and recovery of lead. In these tests the grinding times were varied from 20 to 40 minutes, using either a rod or a ball mill for grinding. The results of these tests are summarized in Table

Discussion - Continued

1.1. Effect of Fineness of Primary Grind on Lead Flotation

Table No. 1

Effect of Primary Grind on Pb Flotation

Test	Grind	% Passing 200 mesh	Product	Weight	Assays, %		% Distribution	
					Pb	Zn	Pb	Zn
211	20**	73.5	Pb Rougher Conc.	25.04	15.8	8.42	92.3	31.6
			Pb Flot. Tailing	74.96	0.44	6.10	7.7	68.4
195	30*	79.2	Pb Rougher Conc.	26.13	14.2	8.72	93.0	35.3
			Pb Flot. Tail.	73.87	0.38	5.67	7.0	64.7
210	30**	87.4	Pb Rougher Conc.	24.88	16.4	8.47	93.8	31.3
			Pb Flot. Tail.	75.12	0.36	6.17	6.2	68.7
191	40*	93.3	Pb Rougher Conc.	32.10	11.9	8.44	94.9	40.8
			Pb Flot. Tail.	67.90	0.31	5.76	5.1	59.2

* Rod Mill
** Ball Mill

The above results illustrate that fineness of grind in the range tested, had no significant effect on lead rougher grade and recovery.

1.2. Effect of Fineness of Lead Concentrate Regrind

Several different fineness of regrind of lead concentrate were tested in which the primary grind fineness was either 73.5 or 87.4 % minus 200 mesh. The results of these tests are summarized in Table No. 2 below, and graphically presented in Figure No. 1.

A decrease in the fineness of lead concentrate regrind, or omission of regrinding (Test 200) resulted in a decrease in the lead concentrate grade and recovery.

Discussion - Continued

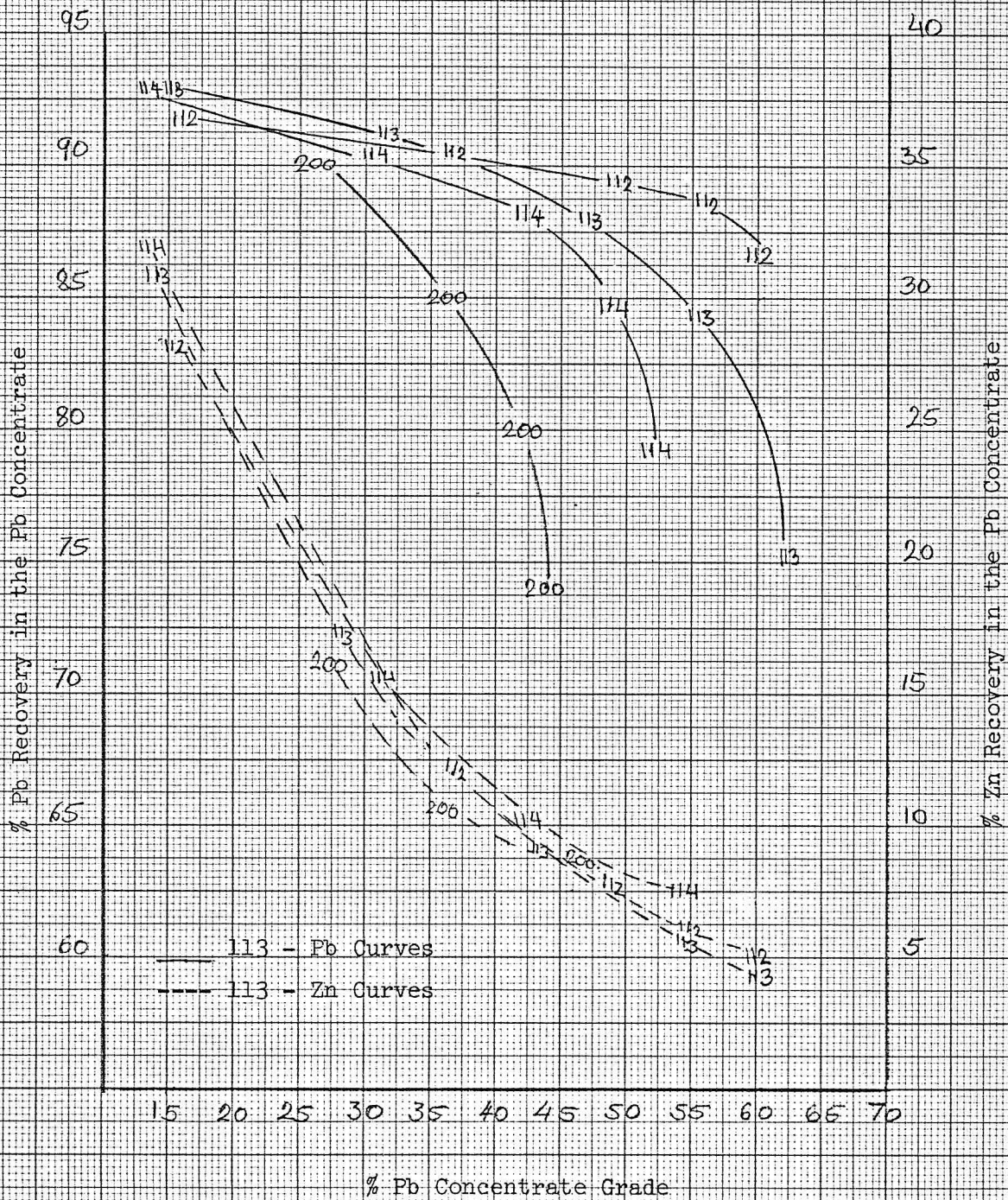
Table No. 2

Effect of Primary Grind and Lead Re grind on Lead Grade and Recovery

Test No.	Primary Grind		Conc. Re grind		Product	Weight %	Assays, %		% Distr.	
	Grind Time min/2000g	% Pass. 200 mesh	Re grind Time min.	% Pass. 25 µm			Pb	Zn	Pb	Zn
210	30	87.4	-	44.5	Pb Ro. Conc. Pb Ro. Tail.	24.88 75.12	16.4 0.36	8.47 6.17	93.8 6.2	31.3 68.7
211	20	73.5	-	40.1	Pb Ro. Conc. Pb Ro. Tail.	25.04 74.96	15.8 0.44	8.42 6.10	92.3 7.7	31.6 68.4
212	30	87.4	30	96.2	Pb Cl. Conc. Pb 1st Cl. Conc. Pb Ro. Conc. Pb Comb. Tail.	5.64 10.21 22.96 89.79	60.5 36.6 16.7 0.40	5.88 8.07 8.26 6.46	83.4 91.3 93.6 8.7	5.0 12.4 28.6 87.6
213	20	73.5	30	94.0	Pb Cl. Conc. Pb 1st Cl. Conc. Pb Ro. Conc. Pb Comb. Tail.	4.88 11.09 25.70 88.91	63.0 33.4 14.7 0.41	5.70 8.27 8.08 6.41	75.6 91.1 93.2 8.9	4.2 13.9 31.4 86.1
214	20	73.5	20	84.0	Pb Cl. Conc. Pb 1st Cl. Conc. Pb Ro. Conc. Pb Comb. Tail.	5.97 11.78 26.24 88.22	52.7 30.4 14.0 0.42	7.50 8.61 8.11 6.29	79.5 90.7 93.0 9.3	6.8 15.4 32.4 84.6
200	30	87.4	10	-	Pb Cl. Conc. Pb 1st Cl. Conc. Pb Ro. Conc. Pb Comb. Tail.	6.39 12.95 - 87.02	44.8 26.8 - 0.45	7.47 8.46 - 6.51	74.2 89.8 - 10.2	7.1 16.2 - 83.8

Also, the zinc recovered with the lead concentrate decreased with the increase in the fineness of concentrate re grind.

Figure No. 1 - Effect of Fineness of Lead Concentrate Re grind on Cleaning



3 6 11 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 32 33 34 35 36 37 38 39 40 41 42 43 44 45 46 47 48 49 50 51 52 53 54 55 56 57 58 59 60 61 62 63 64 65 66 67 68 69 70 71 72 73 74 75 76 77 78 79 80 81 82 83 84 85 86 87 88 89 90 91 92 93 94 95 96 97 98 99 100
D. CAN. MADE IN CANADA
E. G. H.
G. S. L. O. N. (TRADING OR LEASING) P. A. R. E. N.
E. I. O. 3. T. H. I.

Discussion - Continued

1.3. Zinc Circuit - Effect of Fineness of Rougher Concentrate Re grind

Several tests were conducted in which the zinc re grind times were varied from 0 to 20 minutes. In these tests the primary grind fineness was varied from 73.5 to 87.4 % passing minus 200 mesh. These results are summarized in Table No. 3 and graphically presented in Figure No. 2.

Table No. 3

Effect of Primary Grinding and Zn Concentrate Re grinding on Zinc Grade and Recovery

Test No.	Primary Grind		Conc. Re grind		Product	Weight %	Assays, %		% Distr.	
	Grind Time min./ 2000g	% Pass. -200 mesh	Grind Time min.	% Pass. 35 μ m			Pb	Zn	Pb	Zn
218	20	73.5	0	61.0	Zn Cl. Conc.	8.58	0.48	55.2	1.0	68.9
					Zn Ro. Conc.	17.69	0.72	31.5	3.0	81.0
					Zn Flot. Tail.	73.10	0.45	0.74	7.9	7.9
219	30	87.4	0	70.0	Zn Cl. Conc.	8.88	0.38	55.7	0.8	71.2
					Zn Ro. Conc.	18.89	0.57	29.6	2.6	80.4
					Zn Flot. Tail.	71.01	0.38	0.74	6.5	7.5
220	20	73.5	10	79.0	Zn Cl. Conc.	6.50	0.35	60.6	0.6	57.3
					Zn Ro. Conc.	16.56	0.60	33.40	2.5	80.4
					Zn Flot. Tail.	73.86	0.39	0.76	7.1	8.1
221	20	73.5	15	85.0	Zn Cl. Conc.	8.00	0.40	57.0	0.8	68.5
					Zn Ro. Conc.	19.99	0.58	26.7	2.9	80.3
					Zn Flot. Tail.	69.47	0.33	0.60	5.4	6.2
223	20	73.5	20	91.0	Zn Cl. Conc.	7.41	0.37	59.80	0.7	65.9
					Zn Ro. Conc.	19.94	0.57	27.80	2.8	82.4
					Zn Flot. Tail.	70.64	0.32	0.62	5.6	6.6
224	30	87.4	20	92.0	Zn Cl. Conc.	7.65	0.36	58.3	0.7	68.3
					Zn Ro. Conc.	19.33	0.53	27.6	2.6	81.7
					Zn Flot. Tail.	70.27	0.31	0.57	5.4	6.1

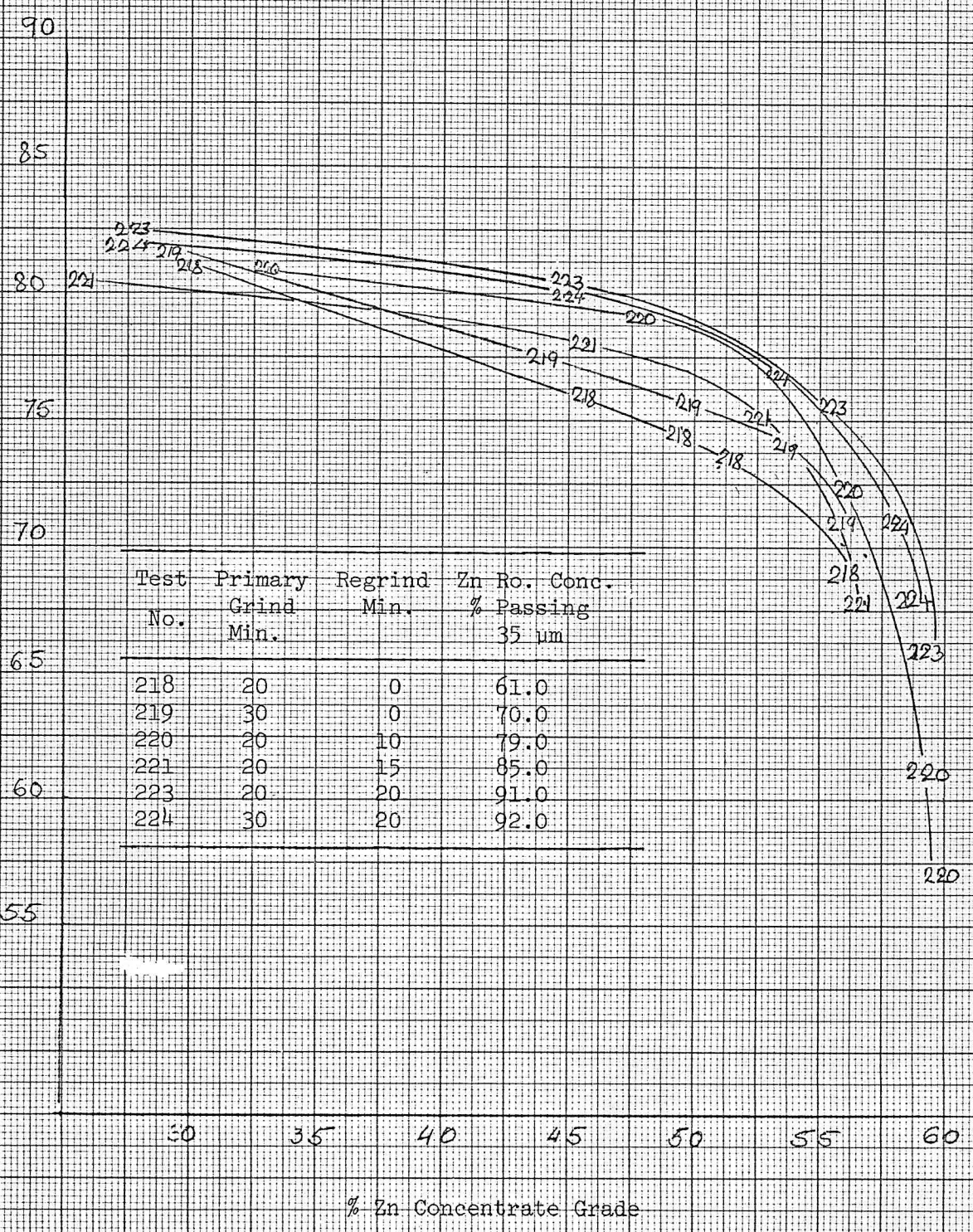
Discussion - Continued

1.3. Zinc Circuit - Effect of Fineness of Rougher Concentrate Re grind

In Tests 218 and 219 in which regrinding was omitted, the zinc concentrate grade was slightly lower as compared to those tests in which zinc rougher concentrate was reground. With finer regrinding (Tests No. 221 to 224) the zinc concentrate grade increased, but the losses of zinc in the cleaning were higher than in tests in which the concentrate was cleaned without regrinding.

Figure No. 2 - Zn Grade-Recovery Curve

Different Fineness of Primary Grind and Zn Conc. Re grind



Test No.	Primary Grind Min.	Regrind Min.	Zn Ro. Conc. % Passing 35 um
218	20	0	61.0
219	30	0	70.0
220	20	10	79.0
221	20	15	85.0
223	20	20	91.0
224	30	20	92.0

G. 10Y THE ...
 TRA ... DR D. ... 3 PA. ...
 MADE IN CANADA
 CONI CAN/

Discussion - Continued

1.4. Effect of Level of Different Zinc and Pyrite Depressants

Tests were conducted to investigate the effect of different Na₂CO₃, ZnSO₄ and NaCN additions. In Test No. 205 the soda ash was replaced with lime. The results and conditions of these tests are presented in Table No. 4 below.

Table No. 4

Effect of Different Zinc and Pyrite Depressants

Test No.	Reagents Added, pounds per ton				pH
	Na ₂ CO ₃	NaCN	ZnSO ₄	Ca(OH) ₂	
191	2.0	0.3	1.0	-	9.3
192	2.0	0.3	0.5	-	9.4
193	2.0	0.3	-	-	9.6
194	2.0	-	1.0	-	9.2
205	3.0	0.3	1.0	-	9.7
206	-	0.3	1.0	2.0	11.0

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
191	Pb Ro. Conc.	32.11	11.90	8.44	94.9	40.8
	Pb Flot. Tail.	67.90	0.31	5.76	5.1	59.2
192	Pb Ro. Conc.	29.61	12.90	8.43	94.5	37.6
	Pb Flot. Tail.	70.39	0.32	5.87	5.5	62.4
193	Pb Ro. Conc.	27.30	13.90	8.46	93.3	35.0
	Pb Flot. Tail.	72.70	0.37	5.91	6.7	65.0
194	Pb Ro. Conc.	35.52	10.6	8.13	92.7	42.3
	Pb Flot. Tail.	64.48	0.46	6.09	7.3	57.7
205	Pb Ro. Conc.	22.43	16.6	8.68	92.1	29.9
	Pb Flot. Tail.	77.57	0.41	5.90	7.9	70.1
206	Pb Ro. Conc.	17.53	20.2	9.67	86.9	25.7
	Pb Flot. Tail.	82.47	0.65	5.96	13.1	74.3

Low additions or omission of ZnSO₄ did not increase Zn flotation in the lead rougher concentrate. In the absence of NaCN in Test 194, lead floated slowly and selectivity was low. Lime additions in Test 206 resulted in poor lead frothing conditions.

Discussion - Continued

1.5. Zinc Circuit - Effect of Type of Collector Additions

A series of tests were conducted to investigate the effect of Collectors Z-200, Z-4, Z-11 and Minerec 748 on zinc grade and recovery. Collectors Z-200 and Z-4, and Collectors M-748 and Z-11 were added in combinations. The results and conditions of these tests are summarized in Table No. 5 below and graphically presented in Figure No. 3.

Table No. 5

Effect of Different Zinc Collectors

Test No.	Reagents Added, pounds per ton				pH
	Z-200	Z - 4	Z - 11	M-748	
189	0.06	0.04	-	-	11.0
190	-	-	0.07	-	11.1
200	0.06	0.04	-	-	11.1
208	-	-	0.03	0.07	11.1

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
189	Zn Cl. Conc.	7.98	0.48	55.0	1.0	66.0
	Zn Ro. Conc.	18.75	0.84	28.0	4.0	78.9
	Zn Flot. Tail.	71.42	0.43	0.84	7.9	9.0
190	Zn Cl. Conc.	8.22	0.42	55.7	0.9	65.5
	Zn Ro. Conc.	18.60	0.60	28.7	2.8	76.5
	Zn Flot. Tail.	69.42	0.34	0.88	6.0	8.7
200	Zn Cl. Conc.	8.54	0.73	54.6	1.6	68.9
	Zn Ro. Conc.	22.96	0.85	23.2	5.0	78.7
	Zn Flot. Tail.	64.09	0.31	0.53	5.2	5.1
208	Zn Cl. Conc.	9.64	0.50	54.10	1.2	76.0
	Zn Ro. Conc.	17.05	0.64	32.60	2.8	80.9
	Zn Flot. Tail.	73.69	0.39	0.73	7.3	7.8

The combination of collectors Z-11 and Minerec 748 were the most selective of collectors tested. The zinc final concentrate recovery was 9 % higher than that obtained with collectors Z-200 and Z-4 or with Z-11 alone. The selectivity between pyrite and zinc also increased.

Discussion - Continued

2. Flotation Results - Composite No. 2

In this composite the content of sample A-77 was increased to 20 % and hence the metal content increased to 6.12 % Pb and 9.44 % Zn. The flotation characteristics of this composite were similar to those of composite No. 1, with the exception that the zinc content of the lead concentrate increased slightly.

2.1. Lead Circuit - Effect of Concentrate Re grind

Keeping the primary grind times constant, the effect of the regrind time on the grade and recovery of lead was studied in Tests 226, 231 and 233. These results are summarized in Table No. 6.

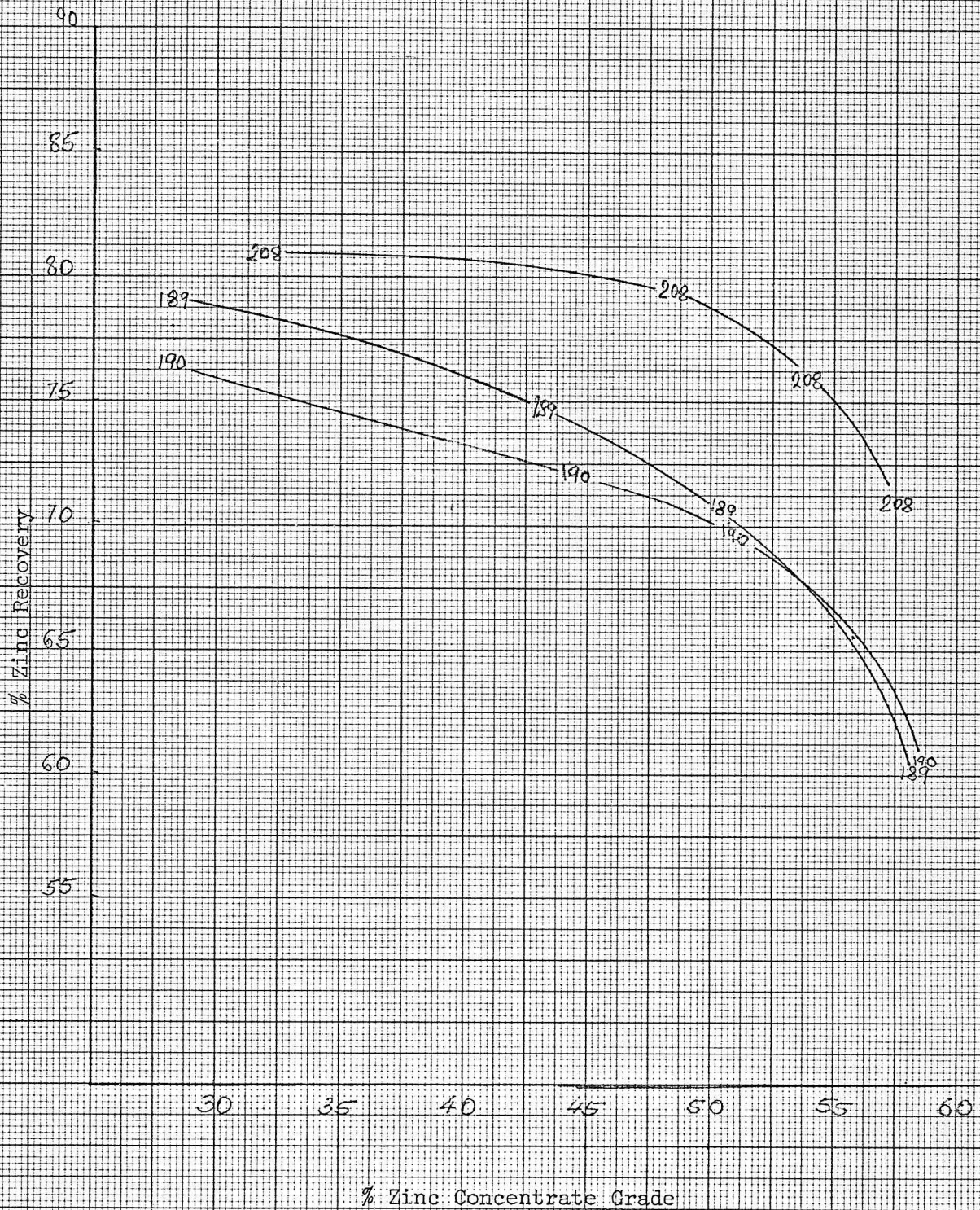
Table No. 6

Effect of Fineness of Pb Concentrate Re grind on Pb Metallurgical Results

Test No.	Primary Grind min.	Pb Re grind		Product	Weight %	Assays, %		% Distr.	
		Time min.	% Passing 20 µm			Pb	Zn	Pb	Zn
226	30	30	N.D.	Pb Cl. Conc.	8.44	61.3	7.18	88.0	6.3
				Pb 1st Cl. Conc.	13.49	40.9	10.00	93.8	14.1
231	30	40	95.0	Pb Cl. Conc.	7.01	67.96	5.42	81.6	4.2
				Pb 1st Cl. Conc.	11.64	46.83	9.15	93.6	11.7
233	30	50	97.0	Pb Cl. Conc.	6.73	65.7	5.43	77.0	4.1
				Pb 1st Cl. Conc.	12.51	42.5	9.15	92.5	12.7

The optimum fineness of re grind (95 % passing 20 µm) established in Composite 1 was also optimum for Composite No. 2 (Test 231). In Test 233, with slightly finer re grinding (97 % passing 20 µm), the losses of lead in the cleaning increased considerably.

Figure No. 3 - Effect of Type of Collector on Zinc Flotation



Discussion - Continued

2.2. Effect of Aeration on Pb Flotation

In Test 234, the effect of aeration on the lead flotation was studied. The results of the comparative tests are summarized in Table No. 7 below.

Table No. 7

Effect of Aeration on Pb Flotation

Test No.	Aeration Time min.	Product	Weight %	Assays, %		% Distribution	
				Pb	Zn	Pb	Zn
226	0	Pb Cleaner Conc.	8.44	61.3	7.18	88.0	6.3
		Pb 2nd Cl. Conc.	13.49	40.9	10.00	93.8	14.1
234	10	Pb Cleaner Conc.	7.07	63.1	6.36	76.3	4.8
		Pb 2nd Cl. Conc.	12.46	42.8	9.62	91.4	12.8

The above results indicated that aeration did not greatly affect the flotation of lead.

2.3. Zinc Flotation

The zinc flotation was investigated only in Test No. 226. Selected products of this test are shown in Table No. 8 below.

Table No. 8

Zinc Flotation Results

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
226	Zn Cleaner Conc.	13.29	0.46	57.0	1.0	78.7
	Zn Rougher Conc.	21.90	0.59	36.3	2.2	82.5
	Zn Flot. Tailing	64.61	0.36	0.50	4.0	3.4

Discussion - Continued

3. Flotation Results - Composite No. 3

This composite was similar to that used by Mattagami Lake (see Mattagami Lake Mines Report No. 6). This composite contained about 13 % combined Pb and Zn. Only one standard batch test was carried out to verify the results obtained at Mattagami Lake, (Cycle Test Van 178). These results are compared in Table No. 9 below.

Table No. 9

Flotation Results Composite No. 3

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
225	Pb Cleaner Conc.	5.92	63.5	6.83	83.7	4.2
	Pb 1st Cl. Conc.	10.49	39.7	10.20	92.7	11.1
	Zn Cleaner Conc.	14.17	0.45	55.20	1.4	81.8
	Zn Rougher Conc.	26.61	0.48	30.5	2.8	85.1
	Zn Flot. Tailing	62.90	0.32	0.57	4.5	3.8
VAN* 178	Pb Cleaner Conc.	6.0	48.0	11.0	76.8	7.2
	Zn Cleaner Conc.	15.2	1.6	52.0	6.5	86.7
	Zn Flot. Tailing	78.8	0.8	0.7	16.7	6.1

* Cycle Test - Project Results - Mattagami Lake Lab. Composite No. 1.

Discussion - Continued

4. Flotation Results - Composite No. 4 and 5

Both composites included large amounts of samples B-2 and A-77 (over 20 %). These two samples had produced poor metallurgical results in the previous investigation. Several tests were conducted on both Composites in which the standard flowsheet and reagent balance were used. The results of these tests are summarized in Table No. 10 below.

In general, the composite samples responded well to the conditions used, and improvement could be achieved by a slight adjustment of the lead concentrate regrind.

Table No. 10

Flotation Results - Composite No. 4 and 5

Test No.	Composite No.	Pb Conc. Regrind Time min.	Product	Weight %	Assays,		% Distr.	
					Pb	Zn	Pb	Zn
227	4	30	Pb Cleaner Conc.	6.87	61.8	8.42	77.2	5.3
			Pb 1st Cl. Conc.	14.45	35.7	12.70	93.7	16.8
			Zn Cleaner Conc.	14.40	0.46	57.0	1.2	74.8
			Zn Rougher Conc.	24.91	0.58	35.1	2.6	79.7
			Zn Flot. Tail.	60.64	0.33	0.64	3.7	3.5
235	4	40	Pb Cleaner Conc.	8.16	61.5	8.17	87.2	5.9
			Pb 1st Cl. Conc.	12.95	41.2	11.80	92.9	13.5
			Zn Cleaner Conc.	16.06	0.67	56.30	1.9	80.5
			Zn Rougher Conc.	23.56	0.77	39.40	3.1	82.7
			Zn Flot. Tail.	63.49	0.36	0.67	4.0	3.8
236	5	40	Pb Cleaner Conc.	8.72	60.2	8.79	87.2	7.0
			Pb 1st Cl. Conc.	13.93	40.3	11.90	93.2	15.2
			Zn Cleaner Conc.	16.13	0.64	53.2	1.7	77.9
			Zn Rougher Conc.	24.07	0.72	37.2	2.8	81.2
			Zn Flot. Tail.	62.00	0.39	0.66	4.0	3.6
228	5	30	Pb Cleaner Conc.	6.64	62.2	8.32	70.2	5.0
			Pb 1st Cl. Conc.	14.04	38.8	12.20	92.6	15.4
			Zn Cleaner Conc.	15.14	0.76	56.6	1.9	77.5
			Zn Rougher Conc.	26.03	0.85	34.5	3.7	31.3
			Zn Flot. Tail.	59.93	0.36	0.60	3.7	3.3

Discussion - Continued

4. Flotation Results - Composite No. 4 and 5

In Test 235 (Composite 4) and Test 236 (Composite 5) 87.2 % of the lead could be recovered at grade of 60 % Pb. The zinc losses in the lead concentrate were 5 to 7 % of the total zinc.

5. Effect of Recycle Water on Lead and Zinc Flotation Results

The effect of decant water on Pb and Zn metallurgical results was studied in a series of tests using overall composite No. 1.

5.1. Preparation of Tailing Effluent

Two 10 kilogram tests were performed to produce typical tailing sample, and at the same time to produce water that had been in contact with solids, to be used in batch tests. (Flowsheet Figure No. 4). The final lead and zinc concentrates were thickened for 24 hours and 60 % of the water was removed and combined with the tailing. This tailing was stored in a rubber-lined 200 litre tank.

Discussion - Continued

5.2. Water Analyses

Four tailing water samples were prepared at the same time as the water was used for the test. The partial chemical analyses of these samples are presented in Table No. 11 below.

Table No. 11

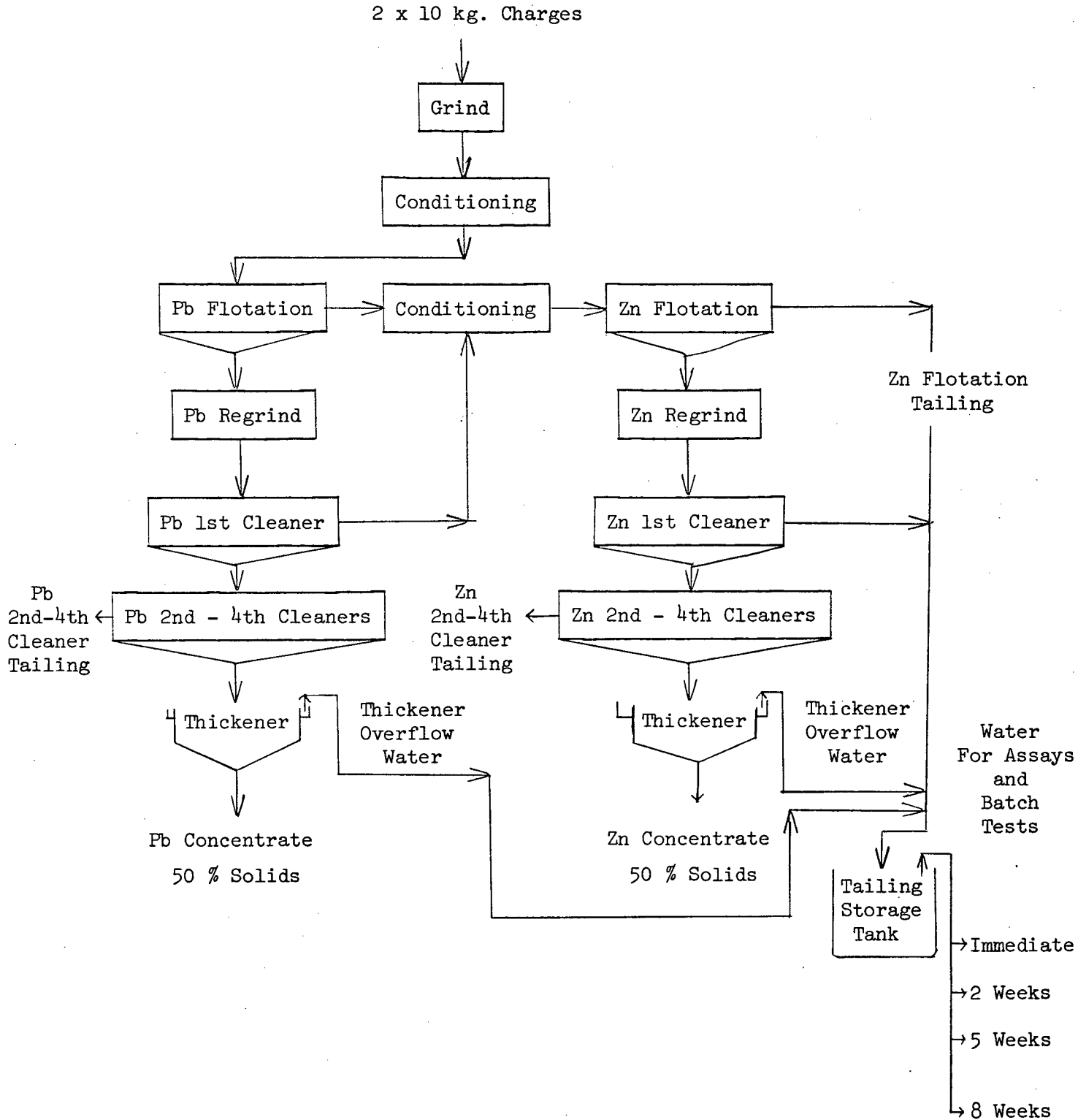
Partial Water Sample Analyses

Element grams per litre	Samples Contact Time			
	Immediate	2 weeks	5 weeks	8 weeks
Iron (Fe)	0.00012	0.00015	0.00006	< 0.0002
Copper (Cu)	0.004	0.003	0.005	0.00022
Arsenic (As)	0.00005	0.00012	0.0003	-
Lime (CaO)	0.015	0.019	0.022	0.0027
Sulphate (SO ⁴)	0.45	0.53	0.32	0.135
Cyanide	0.02	N.D.	N.D.	N.D.
pH	9.30	7.9	7.7	7.5

N.D. - Not Detected

Flowsheet No. 3

Tailing Preparation for Recycle Water Reuse



Discussion - Continued

5.3. Flotation Test Results

A series of individual batch tests were carried out in which the tailing water was used after different contact periods. The results from these tests are summarized in Table No. 12 below.

Table No. 12

Effect of Decant Water on Pb-Zn Metallurgical Results - Composite No. 1

Test No.	Water Used	Product	Weight %	Assays, %		% Distr.	
				Pb	Zn	Pb	Zn
208	Tap	Pb Cleaner Conc.	5.44	60.6	6.34	82.5	5.0
		Pb 1st Cl. Conc.	9.26	38.8	8.36	89.9	11.3
		Zn Cleaner Conc.	9.64	0.50	54.10	1.2	76.0
		Zn Rougher Conc.	17.05	0.64	32.60	2.8	80.9
		Zn Flot. Tail.	73.69	0.39	0.73	7.3	7.8
216	Decant Immediate Use	Pb Cleaner Conc.	6.17	54.5	6.13	86.9	5.7
		Pb 1st Cl. Conc.	10.41	34.2	7.80	91.8	12.2
		Zn Cleaner Conc.	9.10	0.44	55.3	1.1	75.1
		Zn Rougher Conc.	15.50	0.44	33.5	1.8	77.5
		Zn Flot. Tail.	74.09	0.33	0.93	6.4	10.3
222	Decant after 2 weeks standing	Pb Cleaner Conc.	5.80	60.8	5.59	85.8	4.7
		Pb 1st Cl. Conc.	9.46	39.5	7.76	91.1	10.7
		Zn Cleaner Conc.	9.69	0.45	55.7	1.0	78.5
		Zn Rougher Conc.	17.44	0.53	32.4	2.1	82.3
		Zn Flot. Tail.	73.10	0.38	0.66	6.8	7.0
229	Decant after 5 weeks standing	Pb Cleaner Conc.	5.05	63.6	5.01	77.4	3.7
		Pb 1st Cl. Conc.	9.65	39.4	7.73	91.7	10.8
		Zn Cleaner Conc.	9.97	0.57	54.0	1.4	78.2
		Zn Rougher Conc.	19.06	0.68	29.6	3.1	82.0
		Zn Flot. Tail.	71.29	0.30	0.69	5.2	7.2
241	Decant after 8 weeks standing	Pb Cleaner Conc.	5.88	60.5	5.75	86.7	4.9
		Pb 1st Cl. Conc.	9.46	39.9	7.78	92.0	10.6
		Zn Cleaner Conc.	9.68	0.44	56.1	1.1	78.9
		Zn Rougher Conc.	15.34	0.51	36.8	1.9	82.0
		Zn Flot. Tail.	75.20	0.33	0.67	6.1	7.4

Discussion - Continued

5.3. Flotation Test Results

In Test No. 216, decant water that had been taken immediately from the tailing was used. In Tests No. 222, 229 and 241 the tailing water was in contact with the solids for 2, 5 and 8 weeks before use.

The results obtained indicated that immediate use of decant water affected the Pb concentrate grade. The use of recycle water after 2, 5 or 8 weeks of standing had no effect on Pb and Zn flotation.

SAMPLE PREPARATION

The composite samples were prepared from the rejects of individual samples (See Progress Report No. 7).

Each reject sample was roll-crushed to 10 mesh and samples for preparation of the overall composites were removed. The 10 mesh composite was divided into 2 kg. test charges and stored in the freezer. One charge was removed from each composite for head analysis. The distribution of individual samples in the composite and head analyses are given in section summary of this report.

Screen Analysis

Minus 10 Mesh Head - Composite No. 2

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 14	9.9	9.9	90.1
20	16.5	26.4	73.6
28	15.0	41.4	58.6
35	11.0	52.4	47.6
48	9.4	61.8	38.2
65	6.8	68.6	31.4
100	5.2	73.8	26.2
150	4.6	78.4	21.6
200	4.6	83.0	17.0
270	2.8	85.8	14.2
400	3.3	89.1	10.9
- 400	10.9	100.0	-
Total	100.0	-	-

Sample Preparation - Continued

Screen Analysis

Composite No. 3

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 14	11.3	11.3	88.7
20	17.8	29.1	70.9
28	15.2	44.3	55.7
35	10.9	55.2	44.8
48	9.2	64.4	35.6
65	6.2	70.6	29.4
100	5.0	75.6	24.4
150	4.4	80.0	20.0
200	4.3	84.3	15.7
270	2.5	86.8	13.2
400	2.5	89.3	10.7
- 400	10.7	100.0	-
Total	100.0	-	-

Composite No. 4

+ 14	9.1	9.1	90.9
20	15.7	24.8	75.2
28	14.3	39.1	60.9
35	10.8	49.9	50.1
48	9.7	59.6	40.4
65	6.8	66.4	33.6
100	5.9	72.3	27.7
150	5.2	77.5	22.5
200	5.1	82.6	17.4
270	3.1	85.7	14.3
400	3.3	89.0	11.0
- 400	11.0	100.0	-
Total	100.0	-	-

Sample Preparation - Continued

Screen Analysis

Composite No. 5

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 14	9.5	9.5	90.5
20	17.0	26.5	73.5
28	14.8	41.3	58.7
35	10.9	52.2	47.8
48	9.5	61.7	38.3
65	7.0	68.7	31.3
100	5.5	74.2	25.8
150	4.7	78.9	21.1
200	4.7	83.6	16.4
270	2.8	86.4	13.6
400	3.5	89.9	10.1
- 400	10.1	100.0	-
Total	100.0	-	-

DETAILS OF TESTS

Test No. 188

Purpose: To perform the standard test procedure on Overall Composite No. 1.

Procedure: Grind and float a lead concentrat and a zinc concentrate. Regrind the lead concentrate and clean four times. Clean the zinc concentrate five times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.015	-	1	3	9.7
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.7
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.3	0.2	0.10	-	-	0.005	-	1	3	9.8
	-	-	-	0.005	-	-	-	1	1	-
Pb 3rd Cl.	0.2	0.1	0.05	-	-	-	-	1	3	9.9
Pb 4th Cl.	0.2	-	0.05	0.005	-	-	-	1	2	9.9

Stage	Pb Rougher	Pb Reagrind	Pb 1st & 2nd Cl.	Pb 3rd & 4th Cl.
Equipment	1000 g D - 1	lab Rod Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 188 - Continued

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-200	Z-4	MIBC	DF-250	Na ₂ SiO ₃	Grind	Cond.	Froth	
<u>Zn Circuit</u>											
Condition	1.5	1.0	-	-	-	-	-	-	2	-	10.9
Zn Rougher	-	-	0.04	0.02	0.02	-	-	-	1	3	-
	-	-	0.02	0.02	0.01	0.02	-	-	1	3	-
Zn 1st Cl.	0.3	-	-	-	-	0.005	-	-	1	2	11.1
	-	-	0.01	-	-	-	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	0.005	-	-	-	1	2	11.2
	-	-	0.005	-	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	-	-	-	1	2½	11.4
Zn 4th Cl.	0.2	-	-	-	-	-	-	-	1	2	11.5
Zn 5th Cl.	0.5	-	-	-	-	-	0.2	-	2	2	12.0

Stage	Zn Rougher	Zn 1st to 4th Cl.	Zn 5th Cleaner
Flotation Cell	1000 g D - 1	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	1300	1000

Test No. 188 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	3.89	64.9	4.80	64.3	2.9
2. Pb 4th Cl. Tail.	1.21	35.4	8.61	10.9	1.6
3. Pb 3rd Cl. Tail.	1.69	17.1	10.5	7.4	2.7
4. Pb 2nd Cl. Tail.	4.37	5.97	9.81	6.6	6.6
5. Pb 1st Cl. Tail.	12.64	0.94	8.06	3.0	15.6
6. Zn Cleaner Conc.	6.95	0.37	54.1	0.7	57.6
7. Zn 5th Cl. Tail.	0.72	0.70	26.1	0.1	2.9
8. Zn 4th Cl. Tail.	0.70	0.88	13.2	0.2	1.4
9. Zn 3rd Cl. Tail.	0.81	0.95	8.38	0.2	1.0
10. Zn 2nd Cl. Tail.	1.22	0.87	4.41	0.3	0.8
11. Zn 1st Cl. Tail.	7.44	0.62	1.74	1.2	2.0
12. Zn Rougher Tail.	58.36	0.35	0.54	5.1	4.9
Head (Calculated)	100.00	3.93	6.52	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	5.10	57.9	5.70	75.2	4.5
Products 1 to 3	6.79	47.8	6.90	82.6	7.2
Products 1 to 4	11.16	31.4	8.04	89.2	13.8
Products 1 to 5	23.80	15.2	8.05	92.2	29.4
Products 6 plus 7	7.67	0.40	51.5	0.8	60.5
Products 6 to 8	8.37	0.44	48.3	1.0	61.9
Products 6 to 9	9.18	0.49	44.7	1.2	62.9
Products 6 to 10	10.40	0.53	40.0	1.5	63.7
Products 6 to 11	17.84	0.57	24.1	2.7	65.7

Test No. 188 - Continued

Screen Analysis

Flotation Feed

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ . 65	0.1	0.1	99.9
100	0.5	0.6	99.4
150	2.5	3.1	96.9
200	9.5	12.6	87.4
270	12.0	24.6	75.4
400	18.7	43.3	56.7
- 400	56.7	100.0	-
Total	100.00	-	-

Test No. 189

Purpose: To repeat test No. 188, but with reduced Na₂CO₃, and improve zinc recovery by including Pb 1st cleaner tailing in Zn circuit.

Procedure: Grind and float a lead concentrate. Regrind the lead concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Clean the zinc concentrate four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.3
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.2
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	0.005	-	1	3	9.4
	-	-	-	0.01	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0	-	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	1	2	9.6
Combine Pb rougher and 1st cleaner tailing for Zn flotation.										

Test No. 189 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₃	Na ₂ SiO ₃	Z-200	Z-4	MIBC	Grind	Cond.	Froth	
<u>Zn Circuit</u>										
Condition	2.0	1.0	0.5	-	-	-	-	2	-	11.0
Zn Rougher	-	-	-	0.04	0.02	-	-	1	3	-
	-	-	-	0.02	0.02	-	-	1	5	-
Zn 1st Cl.	0.3	-	0.2	-	-	-	-	1	3	11.2
	-	-	-	0.01	-	-	-	1	2	-
Zn 2nd Cl.	0.2	-	0.1	-	-	0.005	-	1	3	11.2
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	0.1	-	-	0.005	-	1	3	11.4
Zn 4th Cl.	0.2	-	0.1	-	-	0.005	-	1	2	11.5

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	3.59	64.2	4.87	59.3	2.6
2. Pb 4th Cl. Tail.	1.17	43.1	7.79	13.0	1.4
3. Pb 3rd Cl. Tail.	1.55	22.0	10.7	8.8	2.5
4. Pb 2nd Cl. Tail.	3.52	7.72	10.6	7.0	5.6
5. Zn Cleaner Conc.	7.01	0.42	57.4	0.8	60.4
6. Zn 4th Cl. Tail.	0.97	0.93	38.1	0.2	5.6
7. Zn 3rd Cl. Tail.	1.16	1.14	26.6	0.3	4.6
8. Zn 2nd Cl. Tail.	2.38	1.45	11.0	0.9	3.9
9. Zn 1st Cl. Tail.	7.23	0.98	4.03	1.8	4.4
10. Zn Rougher Tail.	71.42	0.43	0.84	7.9	9.0
Head (Calculated)	100.00	3.89	6.66	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	4.76	59.0	5.59	72.3	4.0
Products 1 to 3	6.31	49.9	6.84	81.1	6.5
Products 1 to 4	9.83	34.8	8.19	88.1	12.1
Products 5 plus 6	7.98	0.48	55.0	1.0	66.0
Products 5 to 7	9.14	0.56	51.4	1.3	70.6
Products 5 to 8	11.52	0.75	43.1	2.2	74.5
Products 5 to 9	18.75	0.84	28.0	4.0	78.9

Test No. 190

Purpose: To investigate the effect of using Z-11 as the only collector in the lead and zinc circuits.

Procedure: As for test No. 189.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.*	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.04	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	1	3	9.3
	-	-	-	0.02	0.02	-	1	3	-
	-	-	-	0.02	0.02	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.02	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	0.01	-	1	3	9.3
	-	-	-	0.01	0.005	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	1	3	9.5
	-	-	-	0.005	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.6

Combine Pb rougher and 1st cleaner tailings for Zn flotation.

* MIBC : Cresylic Acid, 3 : 1

Test No. 190 - Continued

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	MIBC	Na ₂ SiO ₃	Grind	Cond.	Froth	
<u>Zn Circuit</u>									
Condition	2.0	1.0	-	-	-	-	2	-	11.1
Zn Rougher	-	-	0.05	0.02	-	-	1	3	-
	-	-	0.02	0.01	-	-	1	3	-
Zn 1st Cl.	0.3	-	-	-	0.20	-	1	2	11.3
	-	-	0.005	0.005	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	0.10	-	1	2	11.3
	-	-	0.002	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.05	-	1	2½	11.4
Zn 4th Cl.	0.2	-	-	-	0.05	-	1	2	11.5

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.79	62.2	5.65	75.2	3.9
2. Pb 4th Cl. Tail.	1.40	27.4	10.5	9.7	2.1
3. Pb 3rd Cl. Tail.	1.63	9.90	11.5	4.1	2.7
4. Pb 2nd Cl. Tail.	4.16	2.14	10.2	2.2	6.1
5. Zn Cleaner Conc.	7.25	0.37	58.2	0.7	60.4
6. Zn 4th Cl. Tail.	0.97	0.78	36.7	0.2	5.1
7. Zn 3rd Cl. Tail.	1.35	0.97	21.8	0.3	4.2
8. Zn 2nd Cl. Tail.	1.86	0.95	8.91	0.4	2.4
9. Zn 1st Cl. Tail.	7.17	0.65	4.28	1.2	4.4
10. Zn Rougher Tail.	69.42	0.34	0.88	6.0	8.7
Head (Calculated)	100.00	3.96	6.98	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.19	54.3	6.75	84.9	6.0
Products 1 to 3	7.82	45.1	7.74	89.0	8.7
Products 1 to 4	11.98	30.2	8.59	91.2	14.8
Products 5 plus 6	8.22	0.42	55.7	0.9	65.5
Products 5 to 7	9.57	0.50	50.9	1.2	69.7
Products 5 to 8	11.43	0.57	44.1	1.6	72.1
Products 5 to 9	18.60	0.60	28.7	2.8	76.5

Test No. 191

Purpose: To perform a rougher test to investigate the affect of reduced Z-11 to the lead rougher circuit.

Procedure: Grind and float four lead rougher concentrates.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 60 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	1.0	0.30	0.03	-	20	-	-	-
Pb Conc. No. 1	-	-	-	-	0.05	-	1	3	9.3
Pb Conc. No. 2	-	-	-	0.01	0.01	-	1	3	-
Pb Conc. No. 3	-	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	-	0.01	0.02	-	1	3	-

Stage	Flotation
Flotation Cell	500 g D - 1
Speed: r.p.m.	1300
% Solids	33

Test No. 191 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	13.50	24.4	8.50	80.1	17.3
2. Pb Conc. No. 2	8.96	5.32	9.27	11.6	12.5
3. Pb Conc. No. 3	5.18	1.75	7.86	2.2	6.1
4. Pb Conc. No. 4	4.46	0.96	7.29	1.0	4.9
5. Pb Rougher Tail.	67.90	0.31	5.76	5.1	59.2
Head (Calc.)	100.00	4.11	6.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	22.46	16.8	8.81	91.7	29.8
Products 1 to 3	27.64	14.0	8.63	93.9	35.9
Products 1 to 4	32.10	11.9	8.44	94.9	40.8

Screen Analysis

Flotation Feed

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.1	0.1	99.9
150	0.6	0.7	99.3
200	6.0	6.7	93.3
270	16.0	22.7	77.3
400	23.4	46.1	53.9
- 400	53.9	100.0	-
Total	100.0	-	-

Test No. 192

Purpose: To repeat test No. 191, but reduce ZnSO₄ addition to 0.5 lb/ton.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 60 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	0.5	0.30	0.03	-	20	-	-	-
Pb Conc. No. 1	-	-	-	-	0.05	-	1	3	9.4
Pb Conc. No. 2	-	-	-	0.01	0.01	-	1	3	-
Pb Conc. No. 3	-	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	12.17	26.2	8.41	79.0	15.4
2. Pb Conc. No. 2	8.78	5.57	9.13	12.1	12.1
3. Pb Conc. No. 3	4.95	1.88	7.96	2.3	5.9
4. Pb Conc. No. 4	3.71	1.15	7.49	1.1	4.2
5. Pb Rougher Tail.	70.39	0.32	5.87	5.5	62.4
Head (Calculated)	100.00	4.04	6.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	20.95	17.6	8.71	91.1	27.5
Products 1 to 3	25.90	14.6	8.57	93.4	33.4
Products 1 to 4	29.61	12.9	8.43	94.5	37.6

Test No. 193

Purpose: To repeat test No. 191, but omit ZnSO₄ addition.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 60 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	NaCN	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	0.30	0.03	-	20	-	-	-
Pb Conc. No. 1	-	-	-	0.05	-	1	3	9.6
Pb Conc. No. 2	-	-	0.01	0.01	-	1	3	-
Pb Conc. No. 3	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	10.69	28.0	7.88	73.7	12.8
2. Pb Conc. No. 2	8.68	7.46	9.54	15.9	12.5
3. Pb Conc. No. 3	4.05	2.54	8.67	2.5	5.3
4. Pb Conc. No. 4	3.88	1.28	7.45	1.2	4.4
5. Pb Rougher Tail.	72.70	0.37	5.91	6.7	65.0
Head (Calculated)	100.00	4.06	6.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	19.37	18.8	8.62	89.6	25.3
Products 1 to 3	23.42	16.0	8.63	92.1	30.6
Products 1 to 4	27.30	13.9	8.46	93.3	35.0

Test No. 194

Purpose: To repeat test No. 191, but omit the NaCN addition.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	1.0	0.03	-	20	-	-	-
Pb Conc. No. 1	-	-	-	0.06	-	1	3	9.2
Pb Conc. No. 2	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 3	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	8.22	7.79	6.91	15.8	8.3
2. Pb Conc. No. 2	9.05	20.2	8.46	45.1	11.2
3. Pb Conc. No. 3	10.72	10.5	9.32	27.8	14.7
4. Pb Conc. No. 4	7.53	2.13	7.36	4.0	8.1
5. Pb Rougher Tail.	64.48	0.46	6.09	7.3	57.7
Head (Calculated)	100.00	4.05	6.81	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	17.27	14.3	7.72	60.9	19.5
Products 1 to 3	27.99	12.8	8.33	88.7	34.2
Products 1 to 4	35.52	10.6	8.13	92.7	42.3

Test No. 195

Purpose: To repeat test No. 191, but with a coarser grind.
 Procedure: As for test No. 191.
 Feed: 1000 grams minus 10 mesh Overall Composite No. 1.
 Grind: 15 minutes at 60 percent solids in the laboratory ball mill.
 Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	1.0	0.30	0.03	-	15	-	-	-
Pb Conc. No. 1	-	-	-	-	0.05	-	1	3	9.5
Pb Conc. No. 2	-	-	-	0.01	0.01	-	1	3	-
Pb Conc. No. 3	-	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	11.79	27.0	8.84	79.9	16.1
2. Pb Conc. No. 2	7.33	5.14	9.23	9.5	10.5
3. Pb Conc. No. 3	4.08	2.39	8.19	2.4	5.2
4. Pb Conc. No. 4	2.93	1.64	7.74	1.2	3.5
5. Pb Rougher Tail.	73.87	0.38	5.67	7.0	64.7
Head (Calculated)	100.00	3.99	6.47	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	19.12	18.6	8.99	89.4	26.6
Products 1 to 3	23.20	15.8	8.85	91.8	31.8
Products 1 to 4	26.13	14.2	8.72	93.0	35.3

Test No. 195 - Continued

Screen Analysis

Flotation Feed

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100	0.3	0.3	99.7
150	3.1	3.4	96.6
200	17.4	20.8	79.2
270	17.0	37.8	62.2
400	19.5	57.3	42.7
- 400	42.7	100.0	-
Total	100.0	-	-

Test No. 196

Purpose: To repeat test No. 195 (coarser grind) but omit the ZnSO₄ addition.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 15 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	NaCN	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	0.30	0.03	-	15	-	-	-
Pb Conc. No. 1	-	-	-	0.05	-	1	3	9.8
Pb Conc. No. 2	-	-	0.01	0.01	-	1	3	-
Pb Conc. No. 3	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	9.64	29.6	8.47	69.7	12.3
2. Pb Conc. No. 2	8.11	8.82	10.4	17.5	12.7
3. Pb Conc. No. 3	4.62	3.30	8.92	3.7	6.2
4. Pb Conc. No. 4	2.85	2.10	8.25	1.5	3.5
5. Pb Rougher Tail.	74.78	0.42	5.80	7.6	65.3
Head (Calculated)	100.00	4.09	6.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	17.75	20.1	9.35	87.2	25.0
Products 1 to 3	22.37	16.6	9.26	90.9	31.2
Products 1 to 4	25.22	15.0	9.15	92.4	34.7

Test No. 197

Purpose: To repeat test No. 195 (coarser grind) but with half the ZnSO₄ addition and omit the NaCN addition.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 15 minutes at 60 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton				Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	Z-11	MIBC	Grind	Cond.	Froth	
Grind	2.0	0.5	0.03	-	15	-	-	-
Pb Conc. No. 1	-	-	-	0.06	-	1	3	9.3
Pb Conc. No. 2	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 3	-	-	0.01	0.02	-	1	3	-
Pb Conc. No. 4	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	10.58	12.7	8.71	32.5	14.2
2. Pb Conc. No. 2	10.58	16.9	9.70	43.3	15.8
3. Pb Conc. No. 3	8.66	6.50	9.04	13.6	12.0
4. Pb Conc. No. 4	5.62	1.92	7.06	2.6	6.1
5. Pb Rougher Tail.	64.56	0.51	5.23	8.0	51.9
Head (Calculated)	100.00	4.13	6.50	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	21.16	14.8	9.21	75.8	30.0
Products 1 to 3	29.82	12.4	9.16	89.4	42.0
Products 1 to 4	35.44	10.7	8.83	92.0	48.1

Test No. 198

Purpose: To repeat the previous tests, but use the standard reagent balance for comparison.

Procedure: As for test No. 191.

Feed: 1000 grams minus 10 mesh Overall Composite No. 1.

Grind: 15 minutes at 60 percent solids in the laboratory rod mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Grind	2.0	1.0	0.30	0.07	-	-	15	-	-	-
Pb Conc. No. 1	-	-	-	0.01	0.02	0.01	-	1	3	9.5
Pb Conc. No. 2	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. No. 3	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. No. 4	-	-	-	0.01	0.01	-	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Conc. No. 1	14.40	23.7	8.48	83.7	18.7
2. Pb Conc. No. 2	9.32	3.23	8.62	7.4	12.3
3. Pb Conc. No. 3	3.55	1.81	7.93	1.6	4.3
4. Pb Conc. No. 4	2.50	1.22	7.73	0.8	3.0
5. Pb Rougher Tail.	70.23	0.38	5.72	6.5	61.7
Head (Calculated)	100.00	4.08	6.52	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	23.72	15.7	8.54	91.1	31.0
Products 1 to 3	27.27	13.9	8.46	92.7	35.3
Products 1 to 4	29.77	12.8	8.40	93.5	38.3

Test No. 199

Purpose: To repeat test No. 189, but reduce lead regrind time and introduce a short regrind in the Zn circuit.

Procedure: Grind and float a lead concentrate. Regrind the lead concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Regrind the zinc concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.4
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.03	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.3
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	0.005	-	1	3	9.4
	-	-	-	0.01	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	-	-	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailing for Zn flotation.										

Test No. 199 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Na ₂ SiO ₃	Z-200	Z-4	MIBC	Grind	Cond.	Froth	
<u>Zn Circuit</u>										
Condition	2.0	1.0	0.5	-	-	-	-	2	-	11.1
Zn Rougher	-	-	-	0.04	0.02	-	-	1	3	-
	-	-	-	0.02	0.02	-	-	1	5	-
Zn Conc. Reagr.	0.5	0.1	0.2	0.01	-	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	0.005	-	1	3	11.1
	-	-	-	0.01	-	-	-	1	3	-
Zn 2nd Cl.	0.2	-	0.1	-	-	-	-	1	3	11.2
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	0.1	-	-	-	-	1	3	11.2
Zn 4th Cl.	0.2	-	0.1	-	-	0.005	-	1	2	11.3

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.36	59.1	6.35	80.5	5.1
2. Pb 4th Cl. Tail.	1.25	15.2	10.6	4.8	2.0
3. Pb 3rd Cl. Tail.	1.19	7.17	11.1	2.2	2.0
4. Pb 2nd Cl. Tail.	3.90	3.05	9.90	3.0	5.8
5. Zn Cleaner Conc.	6.66	0.38	60.0	0.6	60.4
6. Zn 4th Cl. Tail.	0.44	0.97	44.0	0.1	2.9
7. Zn 3rd Cl. Tail.	1.14	1.21	34.0	0.4	5.9
8. Zn 2nd Cl. Tail.	1.79	1.02	24.7	0.5	6.7
9. Zn 1st Cl. Tail.	4.78	0.66	2.62	0.8	1.9
10. Zn Rougher Tail.	73.49	0.38	0.66	7.1	7.3
Head (Calculated)	100.00	3.94	6.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.61	50.8	7.16	85.3	7.1
Products 1 to 3	7.80	44.1	7.76	87.5	9.1
Products 1 to 4	11.70	30.4	8.48	90.5	14.9
Products 5 plus 6	7.10	0.42	59.0	0.7	63.3
Products 5 to 7	8.24	0.53	55.6	1.1	69.2
Products 5 to 8	10.03	0.62	50.0	1.6	75.9
Products 5 to 9	14.81	0.63	34.7	2.4	77.8

Test No. 200

Purpose: To repeat test No. 199, but further reduce lead regrind time and increase zinc regrind time.

Procedure: As for test No. 199.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.4
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.02	-	-	10	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.5
	-	-	-	0.01	0.005	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.6
	-	-	-	0.01	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	-	-	-	1	3	9.6
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	1	2	9.8
Combine Pb rougher and 1st cleaner tailing for Zn flotation.										

Test No. 200 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Na ₂ SiO ₃	Z-200	Z-4	MIBC	Grind	Cond.	Froth	
<u>Zn Circuit</u>										
Condition	2.0	1.0	0.5	-	-	-	-	2	-	11.1
Zn Rougher	-	-	-	0.04	0.02	0.01	-	1	3	-
Zn Conc. Reagr.	0.5	0.2	0.2	0.02	-	-	20	-	-	-
Zn 1st Cl.	-	-	-	-	-	0.005	-	1	3	10.8
Zn 2nd Cl.	0.3	-	0.1	-	-	-	-	1	3	11.0
Zn 3rd Cl.	0.2	-	0.1	-	-	-	-	1	3	11.1
Zn 4th Cl.	0.2	-	0.1	-	-	0.005	-	1	2	11.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.39	44.8	7.47	74.2	7.1
2. Pb 4th Cl. Tail.	0.84	25.5	7.69	5.6	1.0
3. Pb 3rd Cl. Tail.	1.64	11.6	10.1	4.9	2.4
4. Pb 2nd Cl. Tail.	4.08	4.85	9.51	5.1	5.7
5. Zn Cleaner Conc.	8.54	0.73	54.6	1.6	68.9
6. Zn 4th Cl. Tail.	0.67	1.90	22.1	0.3	2.2
7. Zn 3rd Cl. Tail.	0.71	1.98	13.8	0.4	1.4
8. Zn 2nd Cl. Tail.	2.15	1.70	9.99	0.9	3.2
9. Zn 1st Cl. Tail.	10.89	0.63	1.89	1.8	3.0
10. Zn Rougher Tail.	64.09	0.31	0.53	5.2	5.1
Head (Calculated)	100.00	3.86	6.76	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.23	42.6	7.49	79.8	8.1
Products 1 to 3	8.87	36.8	7.97	84.7	10.5
Products 1 to 4	12.95	26.8	8.46	89.8	16.2
Products 5 plus 6	9.21	0.81	52.3	1.9	71.1
Products 5 to 7	9.92	0.90	49.5	2.3	72.5
Products 5 to 8	12.07	1.04	42.5	3.2	75.7
Products 5 to 9	22.96	0.85	23.2	5.0	78.7

Test No. 201

Purpose: To repeat test No. 190, but reduce lead regrind time and reduce CuSO₄ addition to the Zn circuit.

Procedure: As for test No. 189, except only three zinc cleaners.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.04	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	1	3	9.4
	-	-	-	0.02	0.02	-	1	3	-
	-	-	-	0.02	0.02	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.02	-	20	-	-	-
Pb 1st Cl.	-	-	-	0.005	0.01	-	1	3	9.6
	-	-	-	0.005	0.005	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	1	3	9.7
	-	-	-	0.003	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	1	3	9.7
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.8
Combine Pb rougher and 1st cleaner tailing for Zn flotation.									

Stage Pb Concentrate Regrind
 Equipment lab Rod Mill

Test No. 201 - Continued

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	MIBC	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	0.5	-	-	-	-	-	-	11.1
Zn Rougher	-	-	0.05	0.02	-	-	1	3	-
	-	-	0.02	0.01	-	-	1	3	-
Zn 1st Cl.	0.3	-	-	-	0.20	-	1	2	11.3
	-	-	0.005	0.005	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	0.005	0.10	-	1	2	11.4
	-	-	0.002	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	0.005	0.05	-	1	2	11.5

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.83	60.3	6.38	73.7	4.8
2. Pb 4th Cl. Tail.	1.31	30.0	9.49	9.9	1.9
3. Pb 3rd Cl. Tail.	1.25	12.3	10.7	3.9	2.1
4. Pb 2nd Cl. Tail.	4.25	3.52	10.0	3.8	6.6
5. Zn Cleaner Conc.	2.59	0.40	54.3	0.3	21.8
6. Zn 3rd Cl. Tail.	1.03	0.61	46.2	0.2	7.4
7. Zn 2nd Cl. Tail.	1.64	0.61	31.9	0.3	8.1
8. Zn 1st Cl. Tail.	5.72	0.51	15.6	0.7	13.8
9. Zn Rougher Tail.	77.38	0.37	2.81	7.2	33.5
Head (Calculated)	100.00	3.95	6.46	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.14	53.8	7.04	83.6	6.7
Products 1 to 3	7.39	46.8	7.66	87.5	8.8
Products 1 to 4	11.64	31.0	8.52	91.3	15.4
Products 5 plus 6	3.62	0.46	52.0	0.5	29.2
Products 5 to 7	5.26	0.51	45.7	0.8	37.3
Products 5 to 8	10.98	0.51	30.0	1.5	51.1

Test No. 202

Purpose: To repeat test No. 190, but regrind Pb rougher concentrate in ball mill and use Minerec 748 as zinc collector.

Procedure: As for test No. 201.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.04	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	1	3	9.4
	-	-	-	0.02	0.02	-	1	3	-
	-	-	-	0.02	0.02	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.02	-	15	-	-	-
Pb 1st Cl.	-	-	-	0.005	0.005	-	1	3	9.4
	-	-	-	0.005	0.005	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	1	3	9.5
	-	-	-	0.003	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.6
Combine Pb rougher and 1st cleaner tailings for zinc flotation.									

Stage Pb Concentrate Regrind
 Equipment lab Ball mill

Test No. 202 - Continued

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	MIBC	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	2	-	11.1
Zn Rougher	-	-	0.06	0.02	-	-	1	3	-
	-	-	0.02	0.01	-	-	1	3	-
Zn 1st Cl.	0.3	-	-	-	0.20	-	1	2	11.3
	-	-	0.01	0.005	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	0.10	-	1	2	11.3
	-	-	0.005	0.005	-	-	1	1	-
Zn 3rd Cl.	0.2	-	0.005	0.005	0.05	-	1	2	11.4

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.45	52.5	7.67	72.8	6.3
2. Pb 4th Cl. Tail.	1.31	29.6	8.45	9.8	1.7
3. Pb 3rd Cl. Tail.	1.39	13.4	10.6	4.7	2.2
4. Pb 2nd Cl. Tail.	3.70	4.24	10.5	4.0	5.8
5. Zn Cleaner Conc.	4.20	0.32	59.2	0.3	37.2
6. Zn 3rd Cl. Tail.	1.04	0.58	49.8	0.2	7.8
7. Zn 2nd Cl. Tail.	2.55	0.56	38.8	0.4	14.8
8. Zn 1st Cl. Tail.	6.17	0.63	17.5	1.0	16.2
9. Zn Rougher Tail.	74.19	0.36	0.73	6.8	8.0
Head (Calculated)	100.00	3.94	6.68	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.76	48.1	7.82	82.6	8.0
Products 1 to 3	8.15	42.2	8.29	87.3	10.2
Products 1 to 4	11.85	30.4	8.98	91.3	16.0
Products 5 plus 6	5.24	0.37	57.3	0.5	45.0
Products 5 to 7	7.79	0.43	51.3	0.9	59.8
Products 5 to 8	13.96	0.52	36.3	1.9	76.0

Test No. 203

Purpose: To investigate the effect of a coarser primary grind on the flotation of lead and zinc from the Overall Composite.

Procedure: As for test No. 199.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	20	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.4
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.03	-	-	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.3
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	0.005	-	1	3	9.4
	-	-	-	0.01	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	-	-	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailings for Zn flotation.										

Test No. 203 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Na ₂ SiO ₃	Z-200	Z-4	MIBC	Grind	Cond.	Froth	
Condition	2.0	1.0	0.5	-	-	-	-	2	-	-
Zn Rougher	-	-	-	0.04	0.02	-	-	1	3	11.2
	-	-	-	0.02	0.02	-	-	1	5	-
Zn Conc. Repr.	0.5	0.1	0.2	0.01	-	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	0.01	-	1	3	11.0
	-	-	-	0.01	-	-	-	1	3	-
Zn 2nd Cl.	0.2	-	0.1	-	-	-	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	0.1	-	-	0.005	-	1	3	11.2
Zn 4th Cl.	0.2	-	0.1	-	-	-	-	1	2	11.2

Test No. 203 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.74	64.2	5.40	76.7	3.9
2. Pb 4th Cl. Tail.	0.84	25.6	10.5	5.4	1.3
3. Pb 3rd Cl. Tail.	1.15	11.5	12.1	3.3	2.1
4. Pb 2nd Cl. Tail.	3.35	3.76	11.0	3.2	5.6
5. Zn Cleaner Conc.	7.09	0.39	57.0	0.7	61.6
6. Zn 4th Cl. Tail.	0.50	1.26	39.6	0.2	3.0
7. Zn 3rd Cl. Tail.	1.09	1.56	26.2	0.4	4.4
8. Zn 2nd Cl. Tail.	2.06	1.36	8.51	0.7	2.7
9. Zn 1st Cl. Tail.	6.16	0.70	1.96	1.1	1.8
10. Zn Rougher Tail.	73.02	0.45	1.21	8.3	13.6
Head (Calculated)	100.00	3.97	6.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	5.58	58.4	6.17	82.1	5.2
Products 1 to 3	6.73	50.4	7.18	85.4	7.3
Products 1 to 4	10.08	34.9	8.45	88.6	12.9
Products 5 plus 6	7.59	0.45	55.9	0.9	64.6
Products 5 to 7	8.68	0.59	52.1	1.3	69.0
Products 5 to 8	10.74	0.73	43.8	2.0	71.7
Products 5 to 9	16.90	0.72	28.5	3.1	73.5

Test No. 204

Purpose: To investigate the effect of using a 1:1 emulsion of Z-11: fuel oil as collector in the lead circuit, and Minerec 748 and Z-11 as collectors in the zinc circuit.

Procedure: As for test No. 199.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11 Fuel Oil	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.06	-	1	3	9.3
	-	-	-	0.01	0.02	-	1	3	-
	-	-	-	0.01	0.02	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	0.03	-	20	-	-	-
Pb 1st Cl.	-	-	-	0.01	0.01	-	1	3	9.4
	-	-	-	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	1	3	-
	-	-	-	0.005	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	1	3	9.6
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.6
Combine Pb rougher and 1st cleaner tailings for zinc flotation.									

Test No. 204 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.06	-	0.02	-	-	1	3	11.0
Zn Conc. Reagr.	-	-	0.02	0.02	0.01	-	-	1	5	-
Zn 1st Cl.	0.5	0.1	0.02	-	-	0.2	10	-	-	-
	-	-	-	-	0.005	-	-	1	3	11.0
Zn 2nd Cl.	-	-	-	0.01	0.01	-	-	1	3	-
	0.2	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.1
Zn 4th Cl.	0.2	-	-	-	-	0.1	-	1	2	11.2

Test No. 204 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.93	59.4	5.62	72.1	4.1
2. Pb 4th Cl. Tail.	1.62	29.2	9.46	11.6	2.3
3. Pb 3rd Cl. Tail.	1.79	13.3	10.4	5.9	2.8
4. Pb 2nd Cl. Tail.	2.43	3.00	10.2	1.8	3.7
5. Zn Cleaner Conc.	8.54	0.47	56.0	1.0	71.6
6. Zn 4th Cl. Tail.	0.45	0.75	27.8	0.1	1.9
7. Zn 3rd Cl. Tail.	0.76	0.99	22.1	0.2	2.5
8. Zn 2nd Cl. Tail.	1.47	0.96	10.8	0.3	2.4
9. Zn 1st Cl. Tail.	5.60	0.58	1.74	0.8	1.5
10. Zn Rougher Tail.	72.41	0.35	0.67	6.2	7.2
Head (Calculated)	100.00	4.06	6.68	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.55	51.8	6.57	83.7	6.4
Products 1 to 3	8.34	43.6	7.39	89.6	9.2
Products 1 to 4	10.77	34.5	8.03	91.4	12.9
Products 5 plus 6	8.99	0.49	54.6	1.1	73.5
Products 5 to 7	9.75	0.52	52.1	1.3	76.0
Products 5 to 8	11.22	0.58	46.7	1.6	78.4
Products 5 to 9	16.82	0.58	31.7	2.4	79.9

Test No. 205

Purpose: To repeat the lead circuit of test No. 199, but increase the Na₂CO₃ addition to the mill, to the Pb regrind and to the Pb cleaners.

Procedure: As for test No. 199, but omit the zinc circuit.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	3.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	9.7
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	0.005	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.20	0.03	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.3	0.2	0.10	-	-	-	-	1	3	9.9
	-	-	-	0.01	-	-	-	1	1	-
Pb 3rd Cl.	0.2	0.1	0.05	0.005	-	-	-	1	3	9.9
Pb 4th Cl.	0.2	-	0.05	-	-	-	-	1	2	10.0

Test No. 205 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.83	58.9	6.10	70.6	4.5
2. Pb 4th Cl. Tail.	0.90	30.2	7.88	6.7	1.1
3. Pb 3rd Cl. Tail.	1.51	14.5	10.8	5.4	2.5
4. Pb 2nd Cl. Tail.	3.90	5.81	10.2	5.6	6.1
5. Pb 1st Cl. Tail.	11.29	1.34	9.05	3.8	15.7
6. Pb Rougher Tail.	77.57	0.41	5.90	7.9	70.1
Head (Calculated)	100.00	4.03	6.52	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	5.73	54.4	6.38	77.3	5.6
Products 1 to 3	7.24	46.1	7.30	82.7	8.1
Products 1 to 4	11.14	32.0	8.32	88.3	14.2
Products 1 to 5	22.43	16.6	8.68	92.1	29.9

Test No. 206

Purpose: To investigate the effect of substituting Ca(OH)_2 for Na_2CO_3 in the lead circuit.

Procedure: As for test No. 205.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH)_2	ZnSO_4	NaCN	R-242	Z-4	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.01	0.02	0.02	-	1	3	11.0
	-	-	-	0.01	0.01	0.005	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	0.03	-	-	20	-	-	-
Pb 1st Cl.	-	-	-	-	0.01	-	-	1	3	10.3
	-	-	-	0.01	0.01	-	-	1	3	-
Pb 2nd Cl.	0.1	0.2	0.10	-	-	-	-	1	3	10.2
	-	-	-	0.005	0.005	-	-	1	1	-
Pb 3rd Cl.	0.05	0.1	0.05	0.005	-	-	-	1	3	10.1
Pb 4th Cl.	0.05	-	0.05	-	0.002	-	-	1	2	10.2

Test No. 206 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	3.08	65.7	4.76	49.7	2.2
2. Pb 4th Cl. Tail.	0.96	38.8	8.61	9.1	1.3
3. Pb 3rd Cl. Tail.	1.15	26.8	10.2	7.6	1.8
4. Pb 2nd Cl. Tail.	3.57	13.5	11.0	11.8	5.9
5. Pb 1st Cl. Tail.	8.77	4.03	10.9	8.7	14.5
6. Pb Rougher Tail.	82.47	0.65	5.96	13.1	74.3
Head (Calculated)	100.00	4.07	6.61	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	4.04	59.3	5.68	58.8	3.5
Products 1 to 3	5.19	52.1	6.68	66.4	5.3
Products 1 to 4	8.76	36.4	8.44	78.2	11.2
Products 1 to 5	17.53	20.2	9.67	86.9	25.7

Test No. 207

Purpose: To perform a locked-cycle test on the overall composite using Z-11 as collector in the lead circuit and Minerec 748 in the zinc circuit.

Procedure: See flowsheet.

Feed: Six 2000 gram charges minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes per charge at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Grind	1.5	0.5	0.30	0.05	-	-	30	-	-	-
Cond.	0.5	0.5	-	-	-	-	-	5	-	9.3
Pb Ro. 1	-	-	-	0.02	0.05	-	-	1	3	-
Pb Ro. 2	-	-	-	0.01	0.02	-	-	1	3	-
Pb Ro. 3	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.2	-	-	0.03	30	-	-	-
Pb 1st Cl. 1	-	-	-	-	-	-	-	1	2	9.4
Pb 1st Cl. 2	-	-	-	-	-	-	-	1	2	-
Pb 1st Cl. Scav.	0.3	0.3	-	0.01	-	0.01	-	3	3	9.6
Pb 2nd Cl.	0.2	0.2	0.1	-	-	-	-	3	3	9.7
Pb 3rd Cl. 1	0.1	0.1	0.05	-	0.005	-	-	3	2½	9.8
	-	-	-	-	-	-	-	-	-	-
Pb 4th Cl. 1	0.1	-	0.05	-	-	-	-	3	2	9.9
	-	-	-	-	-	-	-	-	-	-

Stage	Pb Rougher	Pb Re grind	Pb 1st Cleaner	Pb 2nd to 4th Cl.
Equipment	1000 g D - 1	Rod Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000

Test No. 207 - Continued

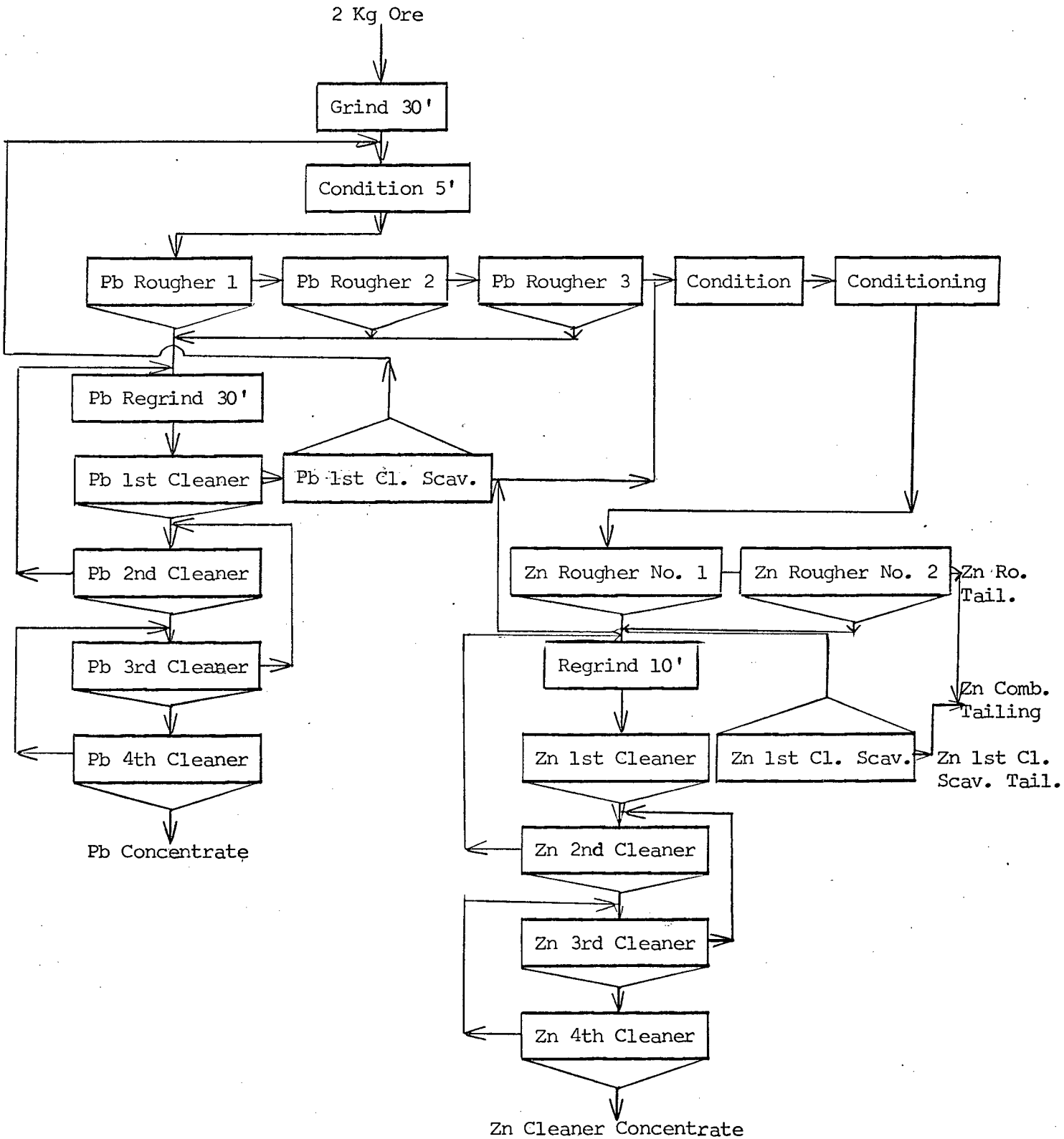
Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ -SiO ₃	Tee Froth A	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	-	5	-	11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	3	3	-
	-	-	0.02	0.02	0.01	-	-	-	1	3	-
Zn Conc. Reagr.	0.5	0.2	0.02	-	-	0.2	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	0.005	-	1	3	11.0
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 1st Cl. Scav.	-	-	-	0.03	-	-	0.005	-	1	4	10.6
Zn 2nd Cl.	0.15	-	-	-	-	0.1	-	-	1	2	11.1
	-	-	-	0.005	0.005	-	-	-	1	2	-
Zn 3rd Cl.	0.17	-	-	-	0.005	0.1	-	-	1	3½	11.1
Zn 4th Cl.	0.18	-	-	-	0.005	0.1	-	-	1	3	11.2

Stage	Zn Rougher	Zn Reagrind	Zn Cleaners
Equipment	1000 g D - 1	Pebble Mill	500 g D - 1
Speed: r.p.m.	1800	-	1200

Test No. 207 - Continued

Flowsheet - Cycle Test



Test No. 207 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution		
		Pb	Zn	Ag*	Pb	Zn	Ag
1. Pb Cleaner Conc. A	0.45	69.2	3.72	24.13	7.7	0.2	6.9
2. Pb Cleaner Conc. B	0.75	68.0	4.38	22.33	12.6	0.5	10.7
3. Pb Cleaner Conc. C	0.82	67.5	4.54	22.38	13.6	0.6	11.7
4. Pb Cleaner Conc. D	0.86	63.5	5.06	21.15	13.5	0.6	11.6
5. Pb Cleaner Conc. E	0.82	64.5	4.71	21.78	13.0	0.6	11.4
6. Pb Cleaner Conc. F	0.77	69.1	4.40	23.28	13.1	0.5	11.4
7. Pb 4th Cl. Tail. F	0.46	50.0	8.31	15.33	5.7	0.6	4.5
8. Pb 3rd Cl. Tail. F	0.76	31.5	11.4	9.80	5.8	1.3	4.7
9. Pb 2nd Cl. Tail. F	1.07	12.3	12.4	4.40	3.2	2.0	3.0
10. Pb 1st Cl. Scav. Conc. F	0.68	4.49	10.9	4.38	0.8	1.1	1.9
11. Pb 1st Cl. Scav. Tail. F	2.24	1.04	9.57	1.13	0.6	3.1	1.6
12. Zn Cleaner Conc. A	1.04	0.35	57.4	0.83	0.1	8.9	0.5
13. Zn Cleaner Conc. B	1.60	0.51	53.3	0.90	0.2	12.7	0.9
14. Zn Cleaner Conc. C	1.62	0.53	55.2	1.25	0.2	13.3	1.3
15. Zn Cleaner Conc. D	1.48	0.48	58.2	1.33	0.2	12.8	1.3
16. Zn Cleaner Conc. E	1.57	0.54	57.2	1.43	0.2	13.4	1.4
17. Zn Cleaner Conc. F	1.49	0.62	57.7	1.68	0.2	12.8	1.6
18. Zn 4th Cl. Tail. F	0.38	2.05	41.0	2.90	0.2	2.3	0.7
19. Zn 3rd Cl. Tail. F	0.69	2.26	25.3	2.43	0.4	2.6	1.1
20. Zn 2nd Cl. Tail. F	0.86	2.16	12.5	1.98	0.5	1.6	1.1
21. Zn 1st Cl. Scav. Conc. F	0.51	1.87	5.75	2.00	0.2	0.5	0.6
22. Zn 1st Cl. Scav. Tail. A	0.67	0.40	1.24	0.25	0.1	0.1	0.1
23. Zn 1st Cl. Scav. Tail. B	0.83	0.57	1.52	0.35	0.1	0.2	0.2
24. Zn 1st Cl. Scav. Tail. C	0.74	0.61	1.40	0.40	0.1	0.2	0.2
25. Zn 1st Cl. Scav. Tail. D	0.85	0.66	1.16	0.40	0.1	0.1	0.2
26. Zn 1st Cl. Scav. Tail. E	0.82	0.73	1.29	0.45	0.2	0.2	0.2
27. Zn 1st Cl. Scav. Tail. F	0.86	0.85	1.40	0.58	0.2	0.2	0.3
28. Zn Rougher Tail. A	10.42	0.34	0.50	0.17	0.9	0.8	1.1
29. Zn Rougher Tail. B	12.22	0.38	0.62	0.15	1.1	1.1	1.2
30. Zn Rougher Tail. C	12.59	0.42	0.68	0.21	1.3	1.3	1.6
31. Zn Rougher Tail. D	12.91	0.41	0.65	0.19	1.3	1.2	1.6
32. Zn Rougher Tail. E	13.14	0.39	0.66	0.20	1.3	1.3	1.7
33. Zn Rougher Tail. F	13.03	0.41	0.67	0.20	1.3	1.3	1.7
Head (Calculated)	100.00	4.06	6.71	1.57	100.0	100.0	100.0

* oz/ton

Test No. 207 - Continued

Calculated Grades and Recoveries

Product	Weight	Assays, %			% Distribution		
	%	Pb	Zn	Ag*	Pb	Zn	Ag
Comb. Pb Cl. Conc.	4.47	66.7	4.53	22.36	73.5	3.0	63.7
Comb. Pb Cl. Tail.	5.21	12.6	10.5	4.74	16.1	8.1	15.7
Comb. Zn Cl. Conc.	8.80	0.51	56.4	1.26	1.1	73.9	7.0
Comb. Zn Cl. Tail.	2.44	2.11	19.1	2.25	1.3	7.0	3.5
Comb. Zn Cl. Scav. Tail.	4.77	0.65	1.34	0.41	0.8	1.0	1.2
Comb. Zn Ro. Tail.	74.31	0.39	0.63	0.19	7.2	7.0	8.9
Comb. Zn Final Tail.	79.08	0.41	0.68	0.20	8.0	8.0	10.2
Zn Final Tail. A	11.09	0.34	0.54	0.17	1.0	0.9	1.2
Zn Final Tail. B	13.05	0.39	0.68	0.16	1.2	1.3	1.4
Zn Final Tail. C	13.33	0.43	0.72	0.22	1.4	1.5	1.8
Zn Final Tail. D	13.76	0.43	0.68	0.20	1.4	1.3	1.8
Zn Final Tail. E	13.96	0.41	0.70	0.21	1.5	1.5	1.9
Zn Final Tail. F	13.89	0.44	0.71	0.22	1.5	1.5	2.0

* oz/ton

Test No. 207 - Continued

Metallurgical Results

Additional Assays

Product	Weight %	Assays, %					% Distribution		
		Pb	Zn	As	Hg	Ag*	Pb	Zn	Ag
1. Zn Cl. Conc. A	-	0.35	57.4	0.073	0.055	0.83	-	-	-
2. Zn Cl. Conc. B	-	0.51	53.3	0.088	0.055	0.90	-	-	-
3. Zn Cl. Conc. C	-	0.53	55.2	0.072	0.055	1.25	-	-	-
4. Zn Cl. Conc. D	-	0.48	58.2	0.034	0.057	1.33	-	-	-
5. Zn Cl. Conc. E	-	0.54	57.2	0.041	0.053	1.43	-	-	-
6. Zn Cl. Conc. F	-	0.62	57.7	0.042	0.058	1.68	-	-	-

* oz/ton

Projected Results - Cycles E and F (Noranda Procedure)

Pb Cl. Conc.	4.77	66.7	4.56	-	-	22.51	78.4	3.2	68.3
Zn Cl. Conc.	9.18	0.58	57.4	0.04	0.055	1.55	1.3	78.5	9.1
Zn Final Tail.	86.05	0.95	1.43	-	-	0.41	20.3	18.3	22.6
Head (Calc.)	100.00	4.06	6.71	-	-	1.57	100.0	100.0	100.0

Projected Results - Cycles E and F (Three-Product Formula)

Pb Cl. Conc.	5.45	66.7	4.56	-	-	22.51	89.6	3.7	78.1
Zn Cl. Conc.	10.22	0.58	57.4	-	-	1.55	1.5	87.4	10.1
Zn Final Tail.	84.33	0.43	0.71	-	-	0.22	8.9	8.9	11.8
Head (Calc.)	100.00	4.06	6.71	-	-	1.57	100.0	100.0	100.0

Test No. 208

Purpose: To repeat the coarse primary grind, but use Z-11 in Pb rougher and Minerec 748 in zinc rougher.

Procedure: As for test No. 199.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.4
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Regrind	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	1	3	9.3
	-	-	-	0.01	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.003	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailings for Zn flotation.										

Test No. 208 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.06	-	0.02	-	-	2	3	11.1
Zn Regrind	-	0.2	0.02	0.03	0.02	-	-	1	5	-
Zn 1st Cl.	0.5	0.1	0.02	-	-	0.2	15	-	-	-
Zn 2nd Cl.	-	-	-	0.01	0.005	-	-	1	3	11.2
Zn 3rd Cl.	-	-	-	0.01	0.01	-	-	1	3	-
Zn 4th Cl.	0.2	-	-	-	-	0.1	-	1	3	11.2
Zn 1st Cl.	-	-	-	0.005	-	-	-	1	1	-
Zn 2nd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.2
Zn 3rd Cl.	-	-	-	-	-	-	-	1	3	11.2
Zn 4th Cl.	0.2	-	-	-	-	0.1	-	1	2	11.3

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.44	60.6	6.34	82.5	5.0
2. Pb 4th Cl. Tail.	0.79	22.5	10.7	4.4	1.2
3. Pb 3rd Cl. Tail.	0.96	8.04	12.6	1.9	1.8
4. Pb 2nd Cl. Tail.	2.07	2.20	10.8	1.1	3.3
5. Zn Cleaner Conc.	8.04	0.39	57.7	0.8	67.5
6. Zn 4th Cl. Tail.	0.60	0.86	43.2	0.1	3.8
7. Zn 3rd Cl. Tail.	1.00	1.15	32.3	0.3	4.7
8. Zn 2nd Cl. Tail.	1.49	1.31	13.2	0.5	2.8
9. Zn 1st Cl. Tail.	5.92	0.71	2.48	1.1	2.1
10. Zn Rougher Tail.	73.69	0.39	0.73	7.3	7.8
Head (Calculated)	100.00	3.99	6.88	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.23	55.8	6.89	86.9	6.2
Products 1 to 3	7.19	49.4	7.66	88.8	8.0
Products 1 to 4	9.26	38.8	8.36	89.9	11.3
Products 5 plus 6	8.64	0.42	56.7	0.9	71.3
Products 5 to 7	9.64	0.50	54.1	1.2	76.0
Products 5 to 8	11.13	0.61	48.7	1.7	78.8
Products 5 to 9	17.05	0.64	32.6	2.8	80.9

Test No. 209

Purpose: To investigate the effect of omitting the ZnSO₄ and increasing NaCN to the lead circuit.

Procedure: As for test No. 199.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Condition:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	0.40	0.05	-	-	30	-	-	-
Pb Rougher	-	-	0.02	0.06	-	-	1	3	9.8
			0.02	0.02	-	-	1	3	-
			0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.25	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	1	3	9.8
			0.01	-	0.01	-	1	3	-
Pb 2nd Cl.	0.1	0.15	-	-	-	-	1	3	9.8
			-	-	0.01	-	1	1	-
Pb 3rd Cl.	-	0.10	-	-	0.003	-	1	3	9.7
Pb 4th Cl.	0.1	0.05	-	-	-	-	1	2	9.8
Combine Pb rougher and 1st cleaner tailings for Zn flotation.									

Test No. 209 - Continued

Conditions:

Stage	ReagentsxAdded, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-200	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	11.2
Zn Rougher	-	-	0.04	0.02	0.02	-	-	1	3	-
	-	-	0.02	0.01	0.02	-	-	1	3	-
Zn Regrind	1.0	0.1	0.02	-	-	0.2	10	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	1	3	11.4
	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.5
	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.5
Zn 4th Cl.	0.1	-	-	-	-	0.1	-	1	2	11.4

Test No. 209 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.07	60.8	6.55	60.7	3.9
2. Pb 4th Cl. Tail.	1.08	39.5	8.48	10.5	1.4
3. Pb 3rd Cl. Tail.	1.30	22.3	9.42	7.1	1.8
4. Pb 2nd Cl. Tail.	3.90	11.1	9.44	10.6	5.4
5. Zn Cleaner Conc.	8.19	0.42	58.6	0.8	70.7
6. Zn 4th Cl. Tail.	0.24	1.29	37.5	0.1	1.3
7. Zn 3rd Cl. Tail.	0.87	1.69	27.1	0.4	3.5
8. Zn 2nd Cl. Tail.	1.09	2.03	12.9	0.5	2.1
9. Zn 1st Cl. Tail.	4.13	0.85	2.40	0.9	1.5
10. Zn Rougher Tail.	75.13	0.46	0.76	8.4	8.4
Head (Calculated)	100.00	4.08	6.78	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	5.15	56.3	6.96	71.2	5.3
Products 1 to 3	6.45	49.5	7.45	78.3	7.1
Products 1 to 4	10.35	35.0	8.20	88.9	12.5
Products 5 plus 6	8.43	0.44	58.0	0.9	72.0
Products 5 to 7	9.30	0.56	55.1	1.3	75.5
Products 5 to 8	10.39	0.72	50.7	1.8	77.6
Products 5 to 9	14.52	0.75	36.9	2.7	79.1

Test No. 209 - Continued

Screen Analysis

Zinc Cleaning Feed

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	0.6	0.6	99.4
270	1.6	2.2	97.8
30.3 μ m	12.7	14.9	85.1
23.5	8.7	23.6	76.4
16.4	14.2	37.8	62.2
11.3	14.6	52.4	47.6
8.7	9.4	61.8	38.2
- 8.7	38.2	100.0	-
Total	100.0	-	-

Specific Gravity 3.73

Test No. 210

Purpose: To determine the size distribution of the lead rougher concentrate and the lead rougher tailing from a 30 minute grind.

Procedure: Grind and float a lead rougher concentrate. Submit concentrate and tailing for cyclosizer analysis.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Grind	2.0	1.0	0.30	0.05	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	1	3	9.3
	-	-	-	0.02	0.02	-	1	3	-
	-	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc.	24.88	16.4	8.46	93.8	31.3
2. Pb Rougher Tail.	75.12	0.36	6.17	6.2	68.7
Head (Calculated)	100.00	4.35	6.74	100.0	100.0

Test No. 210 - Continued

Screen Analyses

Pb Rougher Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	0.1	0.1	99.9
100	0.6	0.7	99.3
150	2.9	3.6	96.4
200	10.6	14.2	85.8
270	12.4	26.6	73.4
400	19.0	45.6	54.4
- 400	54.4	100.0	-
Total	100.0	-	-

Pb Rougher Concentrate

+ 100	0.1	0.1	99.9
150	1.3	1.4	98.6
200	6.2	7.6	92.4
270	8.4	16.0	84.0
400	17.0	33.0	67.0
- 400	67.0	100.0	-
Total	100.0	-	-

Test No. 210 - Continued

Cyclosizer Results

Pb Rougher Concentrate

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	7.4	7.4	92.6
270	10.2	17.6	82.4
27.0 μm	28.2	45.8	54.2
21.0	9.8	55.6	44.4
14.6	11.9	67.5	32.5
10.1	9.2	76.7	23.3
7.8	5.0	81.7	18.3
- 7.8	18.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.37

Pb Flotation Tailing

+ 150 mesh	4.2	4.2	95.8
200	12.1	16.3	83.7
270	12.2	28.5	71.5
34.4 μm	15.6	44.1	55.9
26.6	11.4	55.5	44.5
18.6	13.2	68.7	31.3
12.8	9.4	78.1	21.9
9.9	4.9	83.0	17.0
- 9.9	17.0	100.0	-
Total	100.0	-	-

Specific Gravity 3.12

Test No. 211

Purpose: To determine the size distribution of the lead rougher concentrate and lead rougher tailing from a 20 minute grind.

Procedure: As for test No. 210.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Grind	2.0	1.0	0.30	0.05	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	1	3	9.4
	-	-	-	0.02	0.02	-	1	3	-
	-	-	-	0.01	0.02	-	1	3	-

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Rougher Conc	25.04	15.8	8.42	92.3	31.6
2. Pb Rougher Tail.	74.96	0.44	6.10	7.7	68.4
Head (Calculated)	100.00	4.28	6.68	100.0	100.0

Test No. 211 - Continued

Screen Analyses

Pb Rougher Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	1.0	1.0	99.0
100	3.1	4.1	95.9
150	8.3	12.4	87.6
200	16.7	29.1	70.9
270	12.6	41.7	58.3
400	15.2	56.9	43.1
- 400	43.1	100.0	-
Total	100.0	-	-

Pb Rougher Concentrate

+ 65	0.1	0.1	99.9
100	1.2	1.3	98.7
150	5.0	6.3	93.7
200	12.7	19.0	81.0
270	11.0	30.0	70.0
400	16.5	46.5	53.5
- 400	53.5	100.0	-
Total	100.0	-	-

Test No. 211 - Continued

Cyclosizer Results

Pb Rougher Concentrates

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 150 mesh	7.6	7.6	92.4
200	13.4	21.0	79.0
270	11.9	32.9	67.1
27.2 μ m	25.0	57.9	42.1
21.1	7.9	65.8	34.2
14.7	9.5	75.3	24.7
10.1	7.2	82.5	17.5
7.8	4.0	86.5	13.5
- 7.8	13.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.40

Pb Flotation Tailing

+ 100 mesh	7.5	7.5	92.5
150	9.9	17.4	82.6
200	17.8	35.2	64.8
270	10.8	46.0	54.0
34.9 μ m	11.4	57.4	42.6
27.1	8.2	65.6	34.4
18.9	9.8	75.4	24.6
13.0	7.1	82.5	17.5
10.0	3.9	86.4	13.6
- 10.0	13.6	100.0	-
Total	100.0	-	-

Specific Gravity 3.08

Test No. 212

Purpose: To determine the size distribution of the reground lead concentrate after a 30 minute primary grind.

Procedure: Grind and float a lead rougher concentrate. Regrind the concentrate and clean four times. Perform cycloser on composite of reground products.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.3
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.3
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.003	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4

Stage Pb Reagrind
 Equipment Rod Mill

Test No. 212 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.64	60.5	5.88	83.4	5.0
2. Pb 4th Cl. Tail.	0.70	21.1	9.80	3.6	1.0
3. Pb 3rd Cl. Tail.	1.09	7.86	11.8	2.1	2.0
4. Pb 2nd Cl. Tail.	2.78	3.18	10.6	2.2	4.4
5. Pb 1st Cl. Tail.	12.75	0.73	8.41	2.3	16.2
6. Pb Rougher Tail.	77.04	0.34	6.14	6.4	71.4
Head (Calculated)	100.00	4.09	6.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.34	56.1	6.31	87.0	6.0
Products 1 to 3	7.43	49.1	7.12	89.1	8.0
Products 1 to 4	10.21	36.6	8.07	91.3	12.4
Products 1 to 5	22.96	16.7	8.26	93.6	28.6
Products 5 and 6	89.79	0.40	6.46	8.7	87.6

Test No. 212 - Continued

Cyclosizer Results

Pb Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 27.1 μ m	2.0	2.0	98.0
21.0	6.1	8.1	91.9
14.7	19.5	27.6	72.4
10.1	21.1	48.7	51.3
7.8	12.0	60.7	39.3
- 7.8	39.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.40

Screen Analysis

Pb Combined Tailing

+ 65	2.0	2.0	98.0
100	0.6	0.7	99.3
150	3.1	3.8	96.2
200	9.0	12.8	87.2
270	9.8	22.6	77.4
400	17.3	39.9	60.1
- 400	60.1	100.0	-
Total	100.0	-	-

Test No. 213

Purpose: To determine the size distribution of the reground lead concentrate after a 20 minute primary grind.

Procedure: As for test No. 212.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.3
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.3
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.003	-	1	3	9.4
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4

Stage Pb Regrind
 Equipment Rod Mill

Test No. 213 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	4.88	63.0	5.70	75.6	4.2
2. Pb 4th Cl. Tail.	1.10	32.2	9.38	8.7	1.6
3. Pb 3rd Cl. Tail.	1.44	11.1	11.5	3.9	2.5
4. Pb 2nd Cl. Tail.	3.67	3.16	10.1	2.9	5.6
5. Pb 1st Cl. Tail.	14.61	0.59	7.93	2.1	17.5
6. Pb Rougher Tail.	74.30	0.37	6.11	6.8	68.6
Head (Calculated)	100.00	4.07	6.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	5.98	57.3	6.38	84.3	5.8
Products 1 to 3	7.42	48.4	7.37	88.2	8.3
Products 1 to 4	11.09	33.4	8.27	91.1	13.9
Products 1 to 5	25.70	14.7	8.08	93.2	31.4
Products 5 plus 6	88.91	0.41	6.41	8.9	86.1

Screen Analyses - Pb Combined Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	0.8	0.8	99.2
100	2.8	3.6	96.4
150	7.4	11.0	89.0
200	14.3	25.3	74.7
270	11.0	36.3	63.7
400	12.8	49.1	50.9
- 400	50.9	100.0	-
Total	100.0	-	-

Test No. 213 -- Continued

Cyclosizer Results

Composite Tailings

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100 mesh	4.6	4.6	95.4
150	8.4	13.0	87.0
200	15.0	28.0	72.0
270	10.5	38.5	61.5
33.3 μ m	10.8	49.3	50.7
25.8	8.4	57.7	42.3
18.0	11.2	68.9	31.1
12.4	8.9	77.8	22.2
9.6	4.8	82.6	17.4
- 9.6	17.4	100.0	-
Total	100.0	-	-

Specific Gravity 3.25

Composite Cleaner Products

+ 26.9 μ m	4.6	4.6	95.4
20.9	9.8	14.4	85.6
14.6	21.6	36.0	64.0
10.0	19.4	55.4	44.6
7.7	10.4	65.8	34.2
- 7.7	34.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.46

Test No. 214

Purpose: To determine the size distribution of the reground lead concentrate after a 20 minute primary and a 20 minute regrind.

Procedure: As for test No. 212.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.3
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.02	20	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.3
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.003	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4

Stage Pb Reagrind
Equipment Rod Mill

Test No. 214 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.97	52.7	7.50	79.5	6.8
2. Pb 4th Cl. Tail.	0.92	22.6	9.06	5.3	1.3
3. Pb 3rd Cl. Tail.	1.21	9.65	10.5	3.0	1.9
4. Pb 2nd Cl. Tail.	3.68	3.13	9.69	2.9	5.4
5. Pb 1st Cl. Tail.	14.46	0.64	7.70	2.3	17.0
6. Pb Rougher Tail.	73.76	0.38	6.01	7.0	67.6
Head (Calculated)	100.00	3.96	6.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.89	48.7	7.71	84.8	8.1
Products 1 to 3	8.10	42.9	8.12	87.8	10.0
Products 1 to 4	11.78	30.4	8.61	90.7	15.4
Products 1 to 5	26.24	14.0	8.11	93.0	32.4
Products 5 plus 6	88.22	0.42	6.29	9.3	84.6

Screen Analysis

Pb Combined Tailing

Mesh Size (Tyler)	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 65	0.8	0.8	99.2
100	2.7	3.5	96.5
150	7.5	11.0	89.0
200	14.1	25.1	74.9
270	10.3	35.4	64.6
400	15.2	50.6	49.4
- 400	49.4	100.0	-
Total	100.0	-	-

Test No. 214 - Continued

Cyclosizer Results

Pb Combined Tailing

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100 mesh	4.4	4.4	95.6
150	8.4	12.8	87.2
200	15.4	28.2	71.8
270	9.9	38.1	61.9
33.3 μ m	11.9	50.0	50.0
25.8	8.8	58.8	41.2
18.0	11.5	70.3	29.7
12.4	8.5	78.8	21.2
9.6	4.6	83.4	16.6
- 9.6	16.6	100.0	-
Total	100.0	-	-

Specific Gravity 3.24

Pb Cleaning Feed

+ 27.5 μ m	9.0	9.0	91.0
21.3	13.7	22.7	77.3
14.9	22.6	45.3	54.7
10.2	17.2	62.5	37.5
7.9	8.9	71.4	28.6
- 7.9	28.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.31

Test No. 215 A and B

Purpose: To perform two 10 kg tests to produce lead and zinc concentrates and tailing water.

Procedure: Grind each charge and from each float a lead concentrate. Re grind each lead concentrate and clean four times. Combine the lead 1st cleaner tailing and rougher tailing and float a zinc concentrate. Re grind each zinc concentrate and clean four times. Combine final Pb concentrates, final Zn concentrates and final tailings.

Feed: Two 10 kg charges minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes per charge at 65 percent solids in the 15 x 12 inch ball mill. (140 lbs steel balls).

Conditions: Each charge floated as follows:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.4
	-	-	-	0.02	0.02	-	-	1	3	-
Pb Scav.	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.5
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.1	0.2	0.10	-	-	-	-	1	4	9.5
Pb 3rd Cl.	0.05	0.1	0.05	-	-	-	-	1	3	9.6
Pb 4th Cl.	0.05	-	0.02	-	-	-	-	1	2	9.6

Combine Pb 1st cleaner tailing with Pb rougher tailing for Zn flotation.

Stage	Pb Rougher	Pb Re grind	Pb 1st Cleaner	Pb 2nd to 4th Cleaner
Equipment	Agitair LA-15	15x12" rod mill	2000 g D - 2	1000 g D - 2
Speed: r.p.m. -	-	150 lb rods	1200	1600

Test No. 215 A and B - Continued

Conditions:

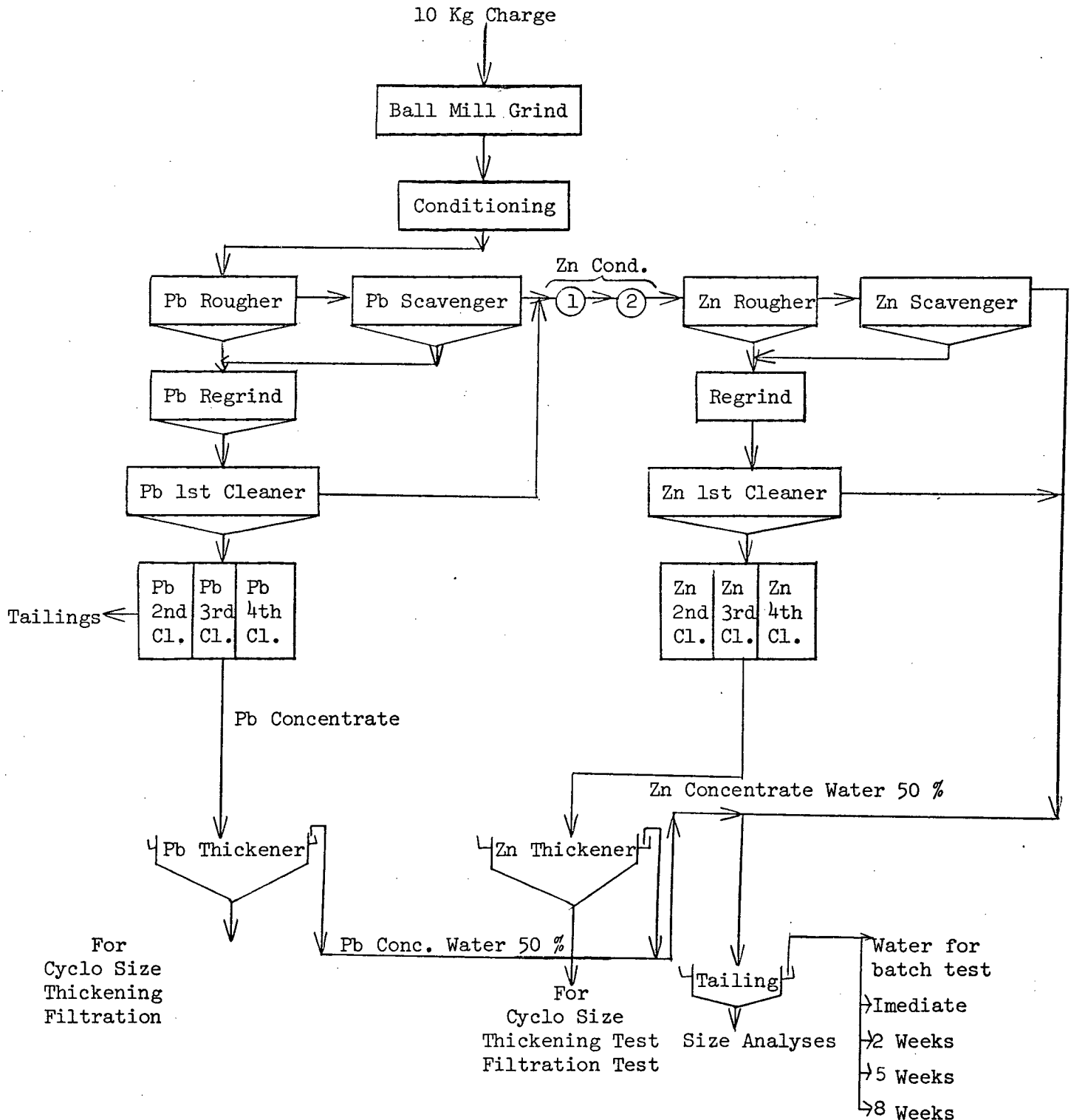
Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	Z-200	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.04	0.02	0.04	-	-	2	3	11.0
Zn Scavenger	-	-	0.02	0.02	0.02	-	-	1	5	-
Zn Conc. Repr.	0.5	0.1	-	0.02	-	0.2	12	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	10.9
	-	-	0.005	0.005	-	-	-	1	3	-
Zn 2nd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.002	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.2
Zn 4th Cl.	0.2	-	-	0.002	-	0.05	-	1	2	11.2

Stage	Zn Rougher	Zn Re grind	Zn 1st Cl.	Zn 2nd to 4th Cl.
Equipment	Agitair LA-15	12x13' pebble mill	2000 g D - 2	1000 g D - 1
Speed: r.p.m.	600	40 lb pebbles	1200	1600

Test No. 215 A and B - Continued

Flowsheet

Water Preparation for Batch Flotation Test



Test No. 215 A and B - Continued

Metallurgical Results

Product	Weight %	Assays, %	
		Pb	Zn
1. Pb Cleaner Conc.	-	53.0	7.84
2. Pb Cleaner Tails.	-	-	-
3. Zn Cleaner Conc.	-	0.35	58.7
4. Zn Cleaner Tails.	-	-	-
5. Zn Rougher Tails.	-	0.33	1.15
Head (Calculated)			

Cyclosizer Result

Zinc Flotation Tailing

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100 mesh	2.3	2.3	97.7
150	5.9	8.2	91.8
200	13.0	21.2	78.8
270	9.9	31.1	68.9
34.7 µm	11.3	42.4	57.6
26.9	9.8	52.2	47.8
18.8	13.0	65.2	34.8
12.9	9.9	75.1	24.9
10.0	5.5	80.6	19.4
- 10.0	19.4	100.0	-
Total	100.0	-	-

Specific Gravity 3.10

Test No. 216

Purpose: To investigate the effect of using the tailing water from test No. 215 as the only dilution water. (Tailing water - pH 9.3)

Procedure: Grind and float a lead concentrate. Re grind the lead concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Re grind the zinc concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	1.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	0.5	-	-	0.02	0.01	-	-	1	3	9.2
	-	-	-	0.02	-	-	-	1	3	-
	-	-	-	0.01	-	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.3
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.4
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.5
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.6
Combine lead rougher and 1st cleaner tailings for zinc flotation.										

Stage	Pb Rougher	Pb Re grind	Pb 1st and 2nd Cl.	Pb 3rd and 4th Cl.
Equipment	1000 g D - 1	Rod Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 216 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	Z-200	Na ₂ SiO ₃	MIBC C.A.	Grind	Cond.	Froth	
Condition	1.5	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.04	0.02	-	0.04	-	1	3	10.6
	-	-	0.02	0.02	-	0.02	-	1	5	-
Zn Conc. Reagr.	0.5	0.1	-	0.02	0.2	-	10	-	-	-
Zn 1st Cl.	0.2	-	-	-	-	0.01	-	1	3	11.0
	-	-	0.005	0.005	-	0.01	-	1	3	-
Zn 2nd Cl.	0.2	-	-	-	0.1	-	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.1	-	-	1	3	11.3
Zn 4th Cl.	0.2	-	-	-	0.1	-	-	1	2	11.4

Comments: Lead flotation frothier than with fresh water, but froth was poor in the zinc circuit.

Test requires 12 liters tailing water.

Stage	Zn Rougher	Zn Reagrind	Zn 1st and 2nd Cl.	Zn 3rd and 4th Cl.
Equipment	1000 g D - 1	Pebble Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000

Test No. 216 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.17	54.5	6.13	86.9	5.7
2. Pb 4th Cl. Tail.	0.64	9.80	10.8	1.6	1.0
3. Pb 3rd Cl. Tail.	0.77	6.25	11.2	1.2	1.3
4. Pb 2nd Cl. Tail.	2.83	2.89	9.86	2.1	4.2
5. Zn Cleaner Conc.	8.57	0.41	57.4	0.9	73.5
6. Zn 4th Cl. Tail.	0.22	1.08	28.6	0.1	0.9
7. Zn 3rd Cl. Tail.	0.31	0.90	14.6	0.1	0.7
8. Zn 2nd Cl. Tail.	1.30	0.69	5.97	0.2	1.2
9. Zn 1st Cl. Tail.	5.10	0.38	1.61	0.5	1.2
10. Zn Rougher Tail.	74.09	0.33	0.93	6.4	10.3
Head (Calculated)	100.00	3.87	6.69	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.81	50.3	6.57	88.5	6.7
Products 1 to 3	7.58	45.8	7.04	89.7	8.0
Products 1 to 4	10.41	34.2	7.80	91.8	12.2
Products 5 plus 6	8.79	0.43	56.7	1.0	74.4
Products 5 to 7	9.10	0.44	55.3	1.1	75.1
Products 5 to 8	10.40	0.47	49.1	1.3	76.3
Products 5 to 9	15.50	0.44	33.5	1.8	77.5

Test No. 217

Purpose: To perform a locked cycle test with a completely-closed circuit.

Procedure: See flowsheet.

Feed: Six 2000 gram charges minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes per charge at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	1.5	0.5	0.30	0.05	-	-	30	-	-	-
Cond.	0.5	0.5	-	-	-	-	-	5	-	9.0
Pb Rougher	-	-	-	0.01	0.02	-	-	1	3	-
	-	-	-	0.01	-	-	-	1	3	-
	-	-	-	0.01	-	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	0.01	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	-	-	1	2	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.3
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	2½	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4

Test No. 217 - Continued

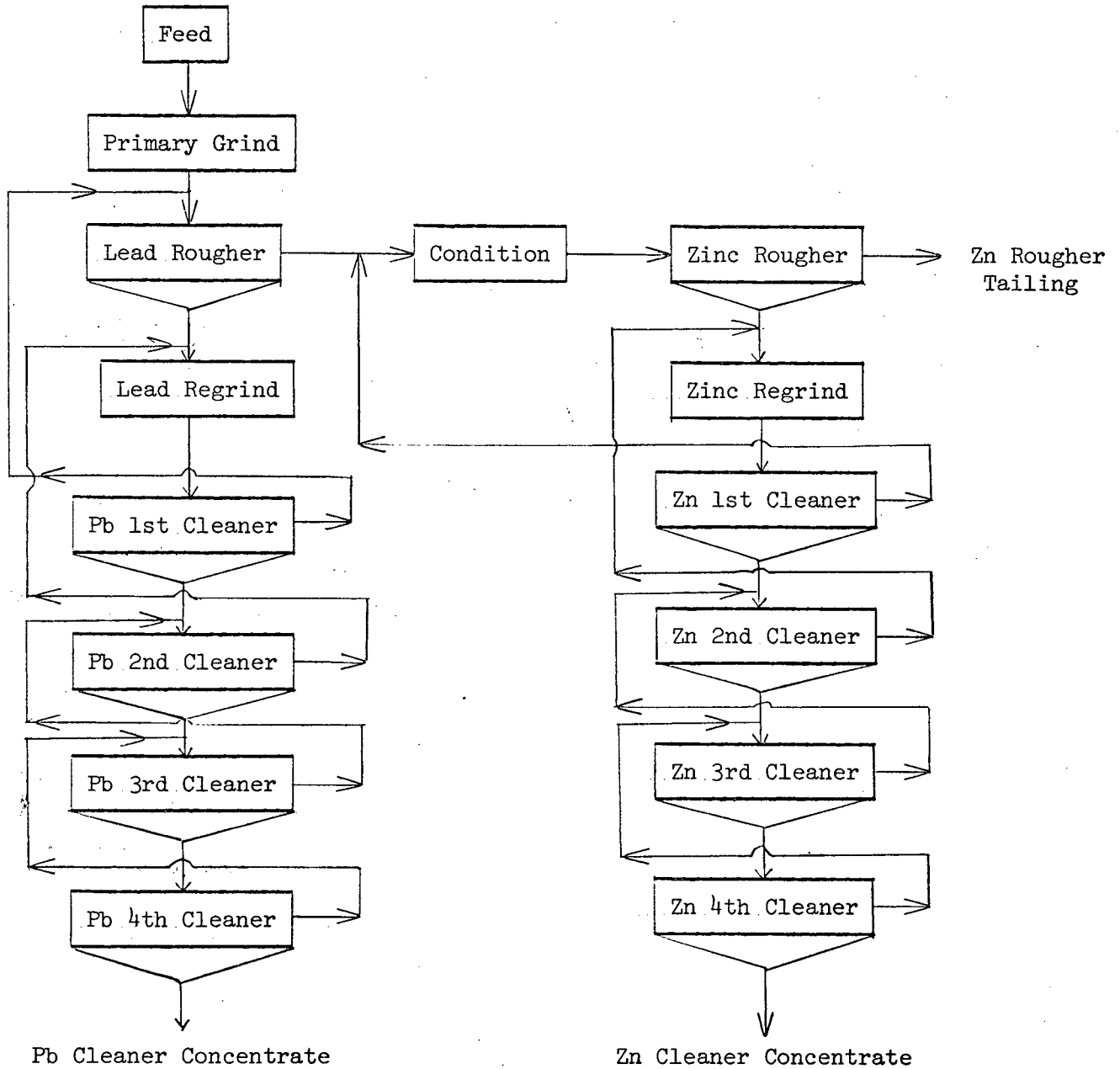
Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ - SiO ₃	Tee Froth A	Grind	Cond.	Froth	
Condition	2.5	1.0	-	-	-	-	-	-	5	-	-
Zn Rougher	-	-	0.04	-	0.01	-	0.005	-	3	3	10.9
Zn Conc. Regr.	-	-	0.02	0.02	0.005	-	-	-	1	3	-
Zn 1st Cl.	0.75	0.2	0.02	-	-	0.2	-	10	-	-	-
Zn 2nd Cl.	-	-	-	-	-	-	-	-	1	3	11.1
Zn 2nd Cl.	0.24	-	-	0.01	-	-	0.005	-	1	3	-
Zn 3rd Cl.	-	-	-	-	-	0.1	-	-	1	2	11.0
Zn 3rd Cl.	0.30	-	-	0.005	0.005	-	-	-	1	2	-
Zn 4th Cl.	0.30	-	-	-	0.005	0.1	-	-	1	3½	11.2
Zn 4th Cl.	0.30	-	-	-	0.005	0.1	-	-	1	3	11.3

Stage	Rougher	Pebble Mill	Cleaners
Equipment	1000 g D - 1	-	500 g D - 1
Speed: r.p.m.	1700	-	1100

Test No. 217 - Continued

Flowsheet



Test No. 217 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution	
		Pb	Zn	As	Pb	Zn
1. Pb Cleaner Conc. A	0.56	66.3	4.49	-	8.9	0.4
2. Pb Cleaner Conc. B	0.81	63.4	4.98	-	12.3	0.6
3. Pb Cleaner Conc. C	0.90	62.0	5.17	-	13.3	0.7
4. Pb Cleaner Conc. D	1.12	61.2	5.75	-	16.4	0.9
5. Pb Cleaner Conc. E	1.03	62.3	5.78	-	15.3	0.9
6. Pb Cleaner Conc. F	1.02	62.2	5.55	-	15.2	0.8
7. Pb 4th Cl. Tail. F	0.45	31.7	11.0	-	3.4	0.7
8. Pb 3rd Cl. Tail. F	0.84	16.6	12.5	-	3.3	1.5
9. Pb 2nd Cl. Tail. F	1.70	6.29	11.5	-	2.6	2.8
10. Pb 1st Cl. Tail. F	3.20	1.30	9.57	-	1.0	4.4
11. Zn Cleaner Conc. A	1.17	0.33	56.7	0.059	0.1	9.6
12. Zn Cleaner Conc. B	1.43	0.38	59.0	0.046	0.1	12.2
13. Zn Cleaner Conc. C	1.43	0.43	58.6	0.054	0.1	12.1
14. Zn Cleaner Conc. D	1.29	0.40	61.1	0.030	0.1	11.4
15. Zn Cleaner Conc. E	1.58	0.41	59.1	0.048	0.2	13.4
16. Zn cleaner Conc. F	1.39	0.39	60.4	0.031	0.1	12.1
17. Zn 4th Cl. Tail. F	0.24	0.80	49.6	-	0.1	1.7
18. Zn 3rd Cl. Tail. F	0.49	1.15	38.6	-	0.1	2.7
19. Zn 2nd Cl. Tail. F	0.81	1.51	22.2	-	0.3	2.6
20. Zn 1st Cl. Tail. F	1.17	1.19	6.89	-	0.3	1.2
21. Zn Rougher Tail. A	10.22	0.27	0.51	-	0.7	0.8
22. Zn Rougher Tail. B	12.48	0.34	0.60	-	1.0	1.1
23. Zn Rougher Tail. C	13.36	0.36	0.64	-	1.1	1.2
24. Zn Rougher Tail. D	13.53	0.35	0.62	-	1.1	1.2
25. Zn Rougher Tail. E	13.87	0.44	0.71	-	1.5	1.4
26. Zn Rougher Tail. F	13.91	0.41	0.82	-	1.4	1.6
Head (Calculated)	100.00	4.18	6.93	-	100.0	100.0

Calculated Grades and Recoveries

Combined Pb Cl. Concs.	5.44	62.6	5.37	-	81.4	4.3
Combined Pb Cl. Tails.	6.19	6.95	10.6	-	10.3	9.4
Combined Zn Cl. Concs.	8.29	0.39	59.2	0.045	0.7	70.8
Combined Zn Cl. Tails.	2.71	1.24	21.0	-	0.8	8.2
Combined Zn Ro. Tails.	77.37	0.37	0.66	-	6.8	7.3

Test No. 217 - Continued

Metallurgical Results - Projected Results of Cycles E and F (Noranda Procedure)

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.12	62.2	5.67	91.0	5.0
2. Zn Cleaner Conc.	8.91	0.40	59.7	0.9	76.7
3. Zn Rougher Tail.	84.97	0.40	1.49	8.1	18.3
Head (Calculated)	100.00	4.18	6.93	100.0	100.0

Projected Results of Cycles E and F (Three-Product Formula)

1. Pb Cleaner Conc.	6.10	62.2	5.67	90.6	5.0
2. Zn Cleaner Conc.	9.95	0.40	59.7	1.0	85.7
3. Zn Rougher Tail.	83.95	0.42	0.77	8.4	9.3
Head (Calculated)	100.00	4.19	6.93	100.0	100.0

Test No. 218

Purpose: To determine the size distribution of the Zn rougher concentrate after a 20 minute primary grind.

Procedure: Grind and float a lead concentrate. Regrind the lead concentrate and clean once. Combine the lead rougher and cleaner tailings and float a zinc concentrate. Clean the Zn concentrate four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ - SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.2
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Regrind	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
	Ca(OH) ₂	CuSO ₄	M-748								
Condition	2.0	1.0	-	-	-	-	-	-	2	-	11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	-	2	5	-
Zn 1st Cl.	0.2	-	-	-	0.005	-	0.2	-	1	3	11.1
	-	-	-	0.01	0.005	-	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.3
	-	-	-	0.005	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	-	0.1	-	1	3	11.4
Zn 4th Cl.	0.2	-	-	-	0.005	-	0.1	-	1	2	11.4

Test No. 218 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	9.21	40.4	8.26	89.1	11.1
2. Zn Cleaner Conc.	8.58	0.48	55.2	1.0	68.9
3. Zn 4th Cl. Tail.	1.12	0.92	27.0	0.2	4.4
4. Zn 3rd Cl. Tail.	0.75	1.27	14.2	0.2	1.5
5. Zn 2nd Cl. Tail.	0.81	1.14	7.50	0.2	0.9
6. Zn 1st Cl. Tail.	6.43	0.89	5.69	1.4	5.3
7. Zn Rougher Tail.	73.10	0.45	0.74	7.9	7.9
Head (Calculated)	100.00	4.18	6.87	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	9.70	0.53	51.9	1.2	73.3
Products 2 to 4	10.45	0.58	49.2	1.4	74.8
Products 2 to 5	11.26	0.62	46.2	1.6	75.7
Products 2 to 6	17.69	0.72	31.5	3.0	81.0

Cyclosizer Result

Zinc Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 100 mesh	2.7	2.7	97.3
150	7.6	10.3	89.7
200	11.8	22.1	77.9
270	8.7	30.8	69.2
30.2µm	14.5	45.3	54.7
23.4	6.3	51.6	48.4
16.3	10.0	61.6	38.4
11.2	9.8	71.4	28.6
8.7	6.0	77.4	22.6
- 8.7	22.6	100.0	-
Total	100.0	-	-

Specific Gravity 3.72

Test No. 219

Purpose: To determine the size distribution of the zinc rougher concentrate after a 30 minute primary grind.

Procedure: As for test No. 218.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ - SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.1
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Reagr.	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and cleaner tailings.											
	Ca(OH) ₂	CuSO ₄	M-748								
Condition	2.0	1.0	-	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	10.9
	-	0.2	0.02	0.03	0.02	-	-	-	2	5	-
Zn 1st Cl.	0.3	-	-	-	-	-	0.2	-	1	3	11.1
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 2nd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.3
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.4
Zn 4th Cl.	0.2	-	-	-	-	-	0.1	-	1	2	11.3

Test No. 219 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	10.10	37.3	8.33	90.9	12.1
2. Zn Cleaner Conc.	8.88	0.38	55.7	0.8	71.2
3. Zn 4th Cl. Tail.	0.65	0.83	24.3	0.1	2.3
4. Zn 3rd Cl. Tail.	0.95	0.93	15.3	0.2	2.1
5. Zn 2nd Cl. Tail.	1.70	0.98	9.07	0.4	2.2
6. Zn 1st Cl. Tail.	6.71	0.65	2.68	1.1	2.6
7. Zn Rougher Tail.	71.01	0.38	0.74	6.5	7.5
Head (Calculated)	100.00	4.15	6.95	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	9.53	0.41	53.5	0.9	73.5
Products 2 to 4	10.48	0.46	50.1	1.1	75.6
Products 2 to 5	12.18	0.53	44.4	1.5	77.8
Products 2 to 6	18.89	0.57	29.6	2.6	80.4

Cyclosizer Result

Zn Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 150 mesh	1.9	1.9	98.1
200	6.0	7.9	92.1
270	7.4	15.3	84.7
30.1 µm	16.4	31.7	68.3
23.4	7.8	39.5	60.5
16.3	12.4	51.9	48.1
11.2	12.1	64.0	36.0
8.7	7.4	71.4	28.6
- 8.7	28.6	100.0	-
Total	100.0	-	-

Specific Gravity 3.70

Test No. 220

Purpose: To determine the size distribution of the Zn cleaner feed after a 20 minute primary grind and a 10 minute Zn concentrate regrind.

Procedure: Grind and float a lead rougher concentrate. Regrind the lead concentrate and clean once. Combine the lead rougher and cleaner tailings and float a zinc concentrate. Regrind the Zn concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ -SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.3
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Regrind	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and cleaner tailings.											
	Ca(OH) ₂	CuSO ₄	M-748								
Condition	2.0	1.0	-	-	-	-	-	-	2	-	11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	-	-	5	-
Zn Conc Regr.	0.5	0.1	0.02	-	-	-	0.2	10	-	-	-
Zn 1st Cl.	-	-	-	-	0.01	-	-	-	1	3	11.0
	-	-	-	0.01	0.01	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.3	-	-	-	-	-	0.1	-	1	3	11.2
Zn 4th Cl.	0.2	-	-	-	-	-	0.1	-	1	2	11.2

Stage	Pb and Zn Ro.	Pb Regrind	Pb Cleaner	Zn Regrind
Equipment	1000 g D - 1	lab rod mill	500 g D - 1	Pebble Mill
Speed: r.p.m.	1800	-	1300	

Stage	Zn 1st to 3rd Cleaner	Zn 4th Cleaner
Equipment	500 G D - 1	250 g D - 1
Speed: r.p.m.	1300	1000

Test No. 220 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	9.58	38.3	8.26	90.4	11.5
2. Zn Cleaner Conc.	6.50	0.35	60.6	0.6	57.3
3. Zn 4th Cl. Tail.	0.59	0.80	50.7	0.1	4.3
4. Zn 3rd Cl. Tail.	1.76	1.07	42.4	0.5	10.8
5. Zn 2nd Cl. Tail.	2.55	0.80	17.3	0.5	6.4
6. Zn 1st Cl. Tail.	5.16	0.62	2.14	0.8	1.6
7. Zn Rougher Tail.	73.86	0.39	0.76	7.1	8.1
Head (Calculated)	100.00	4.06	6.89	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	7.09	0.39	59.8	0.7	61.6
Products 2 to 4	8.85	0.52	56.3	1.2	72.4
Products 2 to 5	11.40	0.58	47.6	1.7	78.8
Products 2 to 6	16.56	0.60	33.4	2.5	80.4

Test No. 220 - Continued

Cyclosizer Result

Zn Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 150 mesh	0.2	0.2	99.8
200	1.8	2.0	98.0
270	4.1	6.1	93.9
29.4 μ m	18.2	24.3	75.7
22.8	9.7	34.0	66.0
15.9	14.9	48.9	51.1
10.9	13.5	62.4	37.6
8.5	7.8	70.2	29.8
- 8.5	29.8	100.0	-
Total	100.0	-	-

Specific Gravity 3.78

Test No. 221

Purpose: To repeat test No. 220, but increase the zinc regrind to 15 minutes.

Procedure: As for test No. 220.

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ -SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.3
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Regrind	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and cleaner tailings.											
	Ca(OH) ₂	CuSO ₄	M-748								
Cond.	2.0	1.0	-	-	-	-	-	-	2	-	11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	-	2	5	-
Zn Conc. Regr.	0.75	0.15	0.02	-	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	11.0
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	-	0.1	-	1	3	11.2
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.3
Zn 4th Cl.	0.2	-	-	-	-	-	0.1	-	1	2	11.3

Test No. 221 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	10.54	36.5	8.54	91.7	13.5
2. Zn Cleaner Conc.	8.00	0.40	57.0	0.8	68.5
3. Zn 4th Cl. Tail.	0.27	1.32	36.4	0.1	1.5
4. Zn 3rd Cl. Tail.	1.04	1.47	30.2	0.4	4.7
5. Zn 2nd Cl. Tail.	1.92	1.08	10.6	0.5	3.1
6. Zn 1st Cl. Tail.	8.76	0.51	1.91	1.1	2.5
7. Zn Rougher Tail.	69.47	0.33	0.60	5.4	6.2
Head (Calculated)	100.00	4.19	6.66	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	8.27	0.43	56.3	0.9	70.0
Products 2 to 4	9.31	0.55	53.4	1.3	74.7
Products 2 to 5	11.23	0.64	46.1	1.8	77.8
Products 2 to 6	19.99	0.58	26.7	2.9	80.3

Cyclosizer Result

Zn Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	0.8	0.8	99.2
270	2.3	3.1	96.9
29.4 μm	16.9	20.0	80.0
22.8	10.6	30.6	69.4
15.9	17.1	47.7	52.3
10.9	14.4	62.1	37.9
8.5	8.2	70.3	29.7
- 8.5	29.7	100.0	-
Total	100.0	-	-

Specific Gravity 3.78

Test No. 222

Purpose: To investigate the effect of using two week old tailing water on the flotation of lead and zinc.

Procedure: As for test No. 216, using tailing water from test No. 215 for dilution through out the test. (Water pH - 7.9)

Feed: 2000 grams minus 10 mesh Overall Composite No. 1..

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MEBC C.A.	R-242	Grind	Cond.	Froth.	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.02	-	-	1	3	9.2
	-	-	-	0.02	0.01	-	-	1	3	-
	-	-	-	0.01	0.01	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.3
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4
Combine Pb rougher and 1st cleaner tailings for zinc flotation.										

Test No. 222 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	Z-200	Na ₂ SiO ₃	MIBC C.A.	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.04	0.02	-	0.04	-	1	3	11.0
	-	-	0.02	0.02	-	0.02	-	1	5	-
Zn Conc. Reagr.	0.8	0.1	-	0.02	0.2	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	11.0
	-	-	0.005	0.005	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	0.1	-	-	1	3	11.2
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.1	-	-	1	3	11.3
Zn 2nd Cl.	0.2	-	-	-	0.1	-	-	1	2	11.3
Comments:	Froth conditions in both lead and zinc circuits were much improved over those of the first test with tailing water.									

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cl. Conc.	5.80	60.8	5.59	85.8	4.7
2. Pb 4th Cl. Tail.	0.97	13.7	12.2	3.2	1.7
3. Pb 3rd Cl. Tail.	1.02	5.23	11.9	1.3	1.8
4. Pb 2nd Cl. Tail.	1.67	1.67	10.2	0.8	2.5
5. Zn Cl. Conc.	8.59	0.39	59.0	0.8	73.8
6. Zn 4th Cl. Tail.	0.50	0.91	36.1	0.1	2.6
7. Zn 3rd Cl. Tail.	0.60	0.94	24.2	0.1	2.1
8. Zn 2nd Cl. Tail.	1.84	0.94	9.31	0.4	2.5
9. Zn 1st Cl. Tail.	5.91	0.52	1.53	0.7	1.3
10. Zn Rougher Tail.	73.10	0.38	0.66	6.8	7.0
Head (Calculated)	100.00	4.11	6.87	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.77	54.0	6.54	89.0	6.4
Products 1 to 3	7.79	47.7	7.24	90.3	8.2
Products 1 to 4	9.46	39.5	7.76	91.1	10.7
Products 5 plus 6	9.09	0.42	57.7	0.9	76.4
Products 5 to 7	9.69	0.45	55.7	1.0	78.5
Products 5 to 8	11.53	0.53	48.3	1.4	81.0
Products 5 to 9	17.44	0.53	32.4	2.1	82.3

Test No. 223

Purpose: To repeat test No. 220, but increase the zinc regrind time to 20 minutes.

Procedure: As for test No. 220.

Feed: 2000 grams minus 10 mesh Overall Composite No 1.

Grind: 20 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ - SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.2
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Reagr.	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and cleaner tailings.											
		Ca(OH) ₂	CuSO ₄	M-748							
Condition	2.0	1.0	-	-	-	-	-	-	2		11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	-	0.2	20	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1
	-	-	-	0.01	0.005	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	-	0.1	-	1	3	11.3
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.4
Zn 4th Cl.	0.2	-	-	-	-	-	0.1	-	1	2	11.4

Test No. 223 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	9.42	39.2	7.89	91.6	11.0
2. Zn Cleaner Conc.	7.41	0.37	59.80	0.7	65.9
3. Zn 4th Cl. Tail.	0.58	0.95	43.40	0.1	3.7
4. Zn 3rd Cl. Tail.	1.18	1.06	32.90	0.3	5.8
5. Zn 2nd Cl. Tail.	2.74	0.88	12.60	0.6	5.1
6. Zn 1st Cl. Tail.	8.03	0.54	1.63	1.1	1.9
7. Zn Rougher Tail.	70.64	0.32	0.62	5.6	6.6
Head (Calculated)	100.00	4.03	6.73	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	7.99	0.41	58.6	0.8	69.6
Products 2 to 4	9.17	0.49	55.3	1.1	75.4
Products 2 to 5	11.91	0.58	45.5	1.7	80.5
Products 2 to 6	19.94	0.57	27.8	2.8	82.4

Cyclosizer Result

Zn Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	0.3	0.3	99.7
270	1.5	1.8	98.2
30.0 µm	12.3	14.1	85.9
23.2	9.8	23.9	76.1
16.2	17.8	41.7	58.3
11.1	16.1	57.8	42.2
8.6	9.2	67.0	33.0
- 8.6	33.0	100.0	-
Total	100.0	-	-

Specific Gravity 3.73

Test No. 224

Purpose: To repeat test No. 223, but with a finer primary grind.
 Procedure: As for test No. 220.
 Feed: 2000 grams minus 10 mesh Overall Composite No. 1.
 Grind: 30 minutes at 65 percent solids in the laboratory ball mill.
 Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ - SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.2
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Regr.	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and cleaner tailings.											
	Ca(OH) ₂	CuSO ₄	M-748								
Condition	2.0	1.0	-	-	-	-	-	-	2	-	11.0
Zn Rougher	-	-	0.06	-	0.02	-	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	-	2	5	-
Zn Conc. Regr.	1.0	0.2	0.02	-	-	-	0.2	20	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1
	-	-	-	0.01	0.005	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	-	0.1	-	1	3	11.3
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	-	0.1	-	1	3	11.4
Zn 4th Cl.	0.2	-	-	-	-	-	0.1	-	1	2	11.3

Test No. 224 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	10.40	35.4	7.70	92.0	12.2
2. Zn Cleaner Conc.	7.65	0.36	58.3	0.7	68.3
3. Zn 4th Cl. Tail.	0.42	0.86	42.0	0.1	2.8
4. Zn 3rd Cl. Tail.	1.32	0.99	30.9	0.3	6.2
5. Zn 2nd Cl. Tail.	2.11	0.93	8.09	0.5	2.6
6. Zn 1st Cl. Tail.	7.83	0.49	1.50	1.0	1.8
7. Zn Rougher Tail.	70.27	0.31	0.57	5.4	6.1
Head (Calculated)	100.00	4.00	6.53	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	8.07	0.39	57.4	0.8	71.1
Products 2 to 4	9.39	0.47	53.7	1.1	77.3
Products 2 to 5	11.50	0.55	45.3	1.6	79.9
Products 2 to 6	19.33	0.53	27.6	2.6	81.7

Cyclosizer Result

Zinc Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 200 mesh	0.2	0.2	99.8
270	0.7	0.9	99.1
29.8 µm	10.1	11.0	89.0
23.1	8.7	19.7	80.3
16.1	17.2	36.9	63.1
11.1	16.8	53.7	46.3
8.6	10.0	63.7	36.3
- 8.6	36.3	100.0	-
Total	100.0	-	-

Specific Gravity 3.72

Test No. 225

Purpose: To investigate the flotation of lead and zinc from Composite No. 3.

Procedure: Grind and float a lead concentrate. Re grind the lead concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Re grind the zinc concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 3.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.1
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.0
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.1
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.3

Stage	Pb Rougher	Pb Re grind	Pb 1st and 2nd Cl.	Pb 3rd and 4th Cl.
Equipment	1000 g D - 1	lab rod mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 225 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Zn Circiut (Pb rougher and 1st cleaner tailings)										
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.06	0.02	0.04	-	-	2	3	-
	-	0.2	0.02	0.03	0.02	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	0.01	-	-	1	3	11.0
	-	-	-	0.01	0.005	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	0.1	-	1	3	11.2
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	0.1	-	1	3	11.2

Stage	Zn Rougher	Zn Reagrind	Zn Cleaners
Equipment	1000 g D - 1	Pebble Mill	500 g D - 1
Speed: r.p.m.	1800	-	1300

Test No. 225 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.92	63.5	6.83	83.7	4.2
2. Pb 4th Cl. Tail.	0.65	25.8	12.0	3.7	0.8
3. Pb 3rd Cl. Tail.	0.95	12.2	15.4	2.6	1.5
4. Pb 2nd Cl. Tail.	2.97	3.93	14.9	2.7	4.6
5. Zn Cleaner Conc.	13.01	0.39	58.2	1.1	79.3
6. Zn 3rd Cl. Tail.	1.16	1.11	21.0	0.3	2.5
7. Zn 2nd Cl. Tail.	2.19	0.87	6.81	0.4	1.6
8. Zn 1st Cl. Tail.	10.25	0.45	1.57	1.0	1.7
9. Zn Rougher Tail.	62.90	0.32	0.57	4.5	3.8
Head (Calculated)	100.00	4.49	9.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.57	59.8	7.34	87.4	5.0
Products 1 to 3	7.52	53.8	8.36	90.0	6.5
Products 1 to 4	10.49	39.7	10.2	92.7	11.1
Products 5 plus 6	14.17	0.45	55.2	1.4	81.8
Products 5 to 7	16.36	0.51	48.7	1.8	83.4
Products 5 to 8	26.61	0.48	30.5	2.8	85.1

Test No. 226

Purpose: To investigate the flotation of lead and zinc from Composite No. 2.

Procedure: As for test No. 225.

Feed: 2000 grams minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	1	3	9.0
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.1
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.4

Test No. 226 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Zn Circuit (Pb rougher and 1st cleaner tailings)										
Condition	2.0	1.0	-	-	-	-	-	2	-	10.9
Zn Rougher	-	-	0.06	0.02	0.04	-	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	1	3	11.1
	-	-	-	0.01	-	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	0.1	-	1	3	11.3
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	0.1	-	1	3	11.4

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.44	61.3	7.18	88.0	6.3
2. Pb 4th Cl. Tail.	0.82	17.8	13.5	2.5	1.2
3. Pb 3rd Cl. Tail.	1.29	7.66	15.9	1.7	2.1
4. Pb 2nd Cl. Tail.	2.94	3.27	14.6	1.6	4.5
5. Zn Cleaner Conc.	11.48	0.37	60.5	0.7	72.2
6. Zn 3rd Cl. Tail.	1.81	1.00	34.7	0.3	6.5
7. Zn 2nd Cl. Tail.	2.29	1.13	10.1	0.5	2.4
8. Zn 1st Cl. Tail.	6.32	0.68	2.20	0.7	1.4
9. Zn Rougher Tail.	64.61	0.36	0.50	4.0	3.4
Head (Calculated)	100.00	5.88	9.62	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	9.26	57.5	7.74	90.5	7.5
Products 1 to 3	10.55	51.4	8.74	92.2	9.6
Products 1 to 4	13.49	40.9	10.0	93.8	14.1
Products 5 plus 6	13.29	0.46	57.0	1.0	78.7
Products 5 to 7	15.58	0.56	50.1	1.5	81.1
Products 5 to 8	21.90	0.59	36.3	2.2	82.5

Test No. 227

Purpose: To investigate the flotation of lead and zinc from Composite No. 4.

Procedure: As for test No. 225.

Feed: 2000 grams minus 10 mesh Overall Composite No. 4.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	8.9
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	1	3	9.0
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.1
	-	-	-	-	0.005	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.3

Test No. 227 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Zn Circuit (Pb rougher and 1st cleaner tailings)										
Condition	2.0	1.0	-	-	-	-	-	2	-	-
Zn Rougher	-	-	0.06	0.02	0.04	-	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	0.01	-	-	1	3	10.9
	-	-	-	0.01	0.005	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.005	0.005	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	0.1	-	1	3	11.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.87	61.8	8.42	77.2	5.3
2. Pb 4th Cl. Tail.	1.35	31.9	14.8	7.8	1.8
3. Pb 3rd Cl. Tail.	1.67	15.4	17.8	4.7	2.7
4. Pb 2nd Cl. Tail.	4.56	4.81	16.8	4.0	7.0
5. Zn Cleaner Conc.	13.05	0.40	59.5	0.9	70.7
6. Zn 3rd Cl. Tail.	1.35	1.08	33.1	0.3	4.1
7. Zn 2nd Cl. Tail.	2.60	1.11	15.3	0.5	3.6
8. Zn 1st Cl. Tail.	7.91	0.61	1.74	0.9	1.3
9. Zn Rougher Tail.	60.64	0.33	0.64	3.7	3.5
Head (Calculated)	100.00	5.50	11.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.22	56.9	9.47	85.0	7.1
Products 1 to 3	9.89	49.9	10.9	89.7	9.8
Products 1 to 4	14.45	35.7	12.7	93.7	16.8
Products 5 plus 6	14.40	0.46	57.0	1.2	74.8
Products 5 to 7	17.00	0.56	50.6	1.7	78.4
Products 5 to 8	24.91	0.58	35.1	2.6	79.7

Test No. 228

Purpose: To investigate the flotation of lead and zinc drom Composite No.5.

Procedure: As for test No. 225.

Feed: 2000 grams minus 10 mesh Overall Composite No. 5.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	8.9
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	1	3	9.0
	-	-	-	0.005	0.005	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.1
	-	-	-	-	0.005	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.2

Test No. 228 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Na ₂ SiO ₃	Grind	Cond.	Froth	
Zn Circuit (Pb rougher and 1st cleaner tailings)										
Condition	2.0	1.0	-	-	-	-	-	2	-	10.8
Zn Rougher	-	-	0.06	0.02	0.04	-	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	0.005	-	-	1	3	10.9
	-	-	-	0.01	0.005	-	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	-	0.1	-	1	3	11.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.64	62.2	8.32	70.2	5.0
2. Pb 4th Cl. Tail.	1.46	39.6	13.2	9.8	1.7
3. Pb 3rd Cl. Tail.	1.54	24.6	15.9	6.4	2.2
4. Pb 2nd Cl. Tail.	4.40	8.21	16.3	6.1	6.5
5. Zn Cleaner Conc.	13.76	0.61	59.2	1.4	73.7
6. Zn 3rd Cl. Tail.	1.38	2.27	30.5	0.5	3.8
7. Zn 2nd Cl. Tail.	1.65	2.08	11.1	0.6	1.7
8. Zn 1st Cl. Tail.	9.24	0.78	2.54	1.2	2.1
9. Zn Rougher Tail.	59.93	0.36	0.60	3.7	3.3
Head (Calculated)	100.00	5.89	11.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.10	58.1	9.20	80.0	6.7
Products 1 to 3	9.64	52.8	10.3	86.4	8.9
Products 1 to 4	14.04	38.8	12.2	92.6	15.4
Products 5 plus 6	15.14	0.76	56.6	1.9	77.5
Products 5 to 7	16.79	0.89	52.1	2.5	79.2
Products 5 to 8	26.03	0.85	34.5	3.7	81.3

Test No. 229

Purpose: To perform the standard test on Composite No. 1, using tailing water stored for 5 weeks.

Procedure: As for test No. 216, using tailing water from test No. 215, after a 5 week period. (Tailing water pH: 7.7).

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.04	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	8.8
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.1
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.2
Combine Pb rougher and 1st cleaner tailings for zinc flotation.										

Test No. 229 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	Z-200	Na ₂ SiO ₃	MIBC C.A.	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	10.8
Zn Rougher	-	-	0.04	0.02	-	0.04	-	1	3	-
	-	-	0.02	0.02	-	0.02	-	1	5	-
Zn Conc. Reagr.	1.0	0.1	-	0.02	0.2	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	10.9
	-	-	0.005	0.005	-	0.005	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	0.1	-	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.1	0.005	-	1	3	11.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.50	63.6	5.01	77.4	3.7
2. Pb 4th Cl. Tail.	0.99	30.5	9.64	7.3	1.4
3. Pb 3rd Cl. Tail.	1.35	16.2	11.4	5.3	2.2
4. Pb 2nd Cl. Tail.	2.26	3.18	10.8	1.7	3.5
5. Zn Cleaner Conc.	9.54	0.51	55.6	1.2	77.1
6. Zn 3rd Cl. Tail.	0.43	1.89	18.2	0.2	1.1
7. Zn 2nd Cl. Tail.	2.04	1.50	8.55	0.7	2.5
8. Zn 1st Cl. Tail.	7.05	0.60	1.28	1.0	1.3
9. Zn Rougher Tail.	71.29	0.30	0.69	5.2	7.2
Head (Calculated)	100.00	4.15	6.88	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.04	58.2	5.77	84.7	5.1
Products 1 to 3	7.39	50.5	6.80	90.0	7.3
Products 1 to 4	9.65	39.4	7.73	91.7	10.8
Products 5 plus 6	9.97	0.57	54.0	1.4	78.2
Products 5 to 7	12.01	0.73	46.3	2.1	80.7
Products 5 to 8	19.06	0.68	29.6	3.1	82.0

Test No. 230

Purpose: To perform a locked-cycle test on Composite No. 3, with a completely-closed lead circuit, but reject zinc 1st cleaner tailing.

Procedure: See flowsheet.

Feed: Six 2000 gram charges minus 10 mesh Overall Composite No. 3.

Grind: 30 minutes per charge at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.05	-	-	1	3	9.1
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Reagr.	0.5	0.5	0.20	0.01	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	1	3	9.1
	-	-	-	0.01	-	-	-	1	2	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.2
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	2½	9.2
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2	9.3

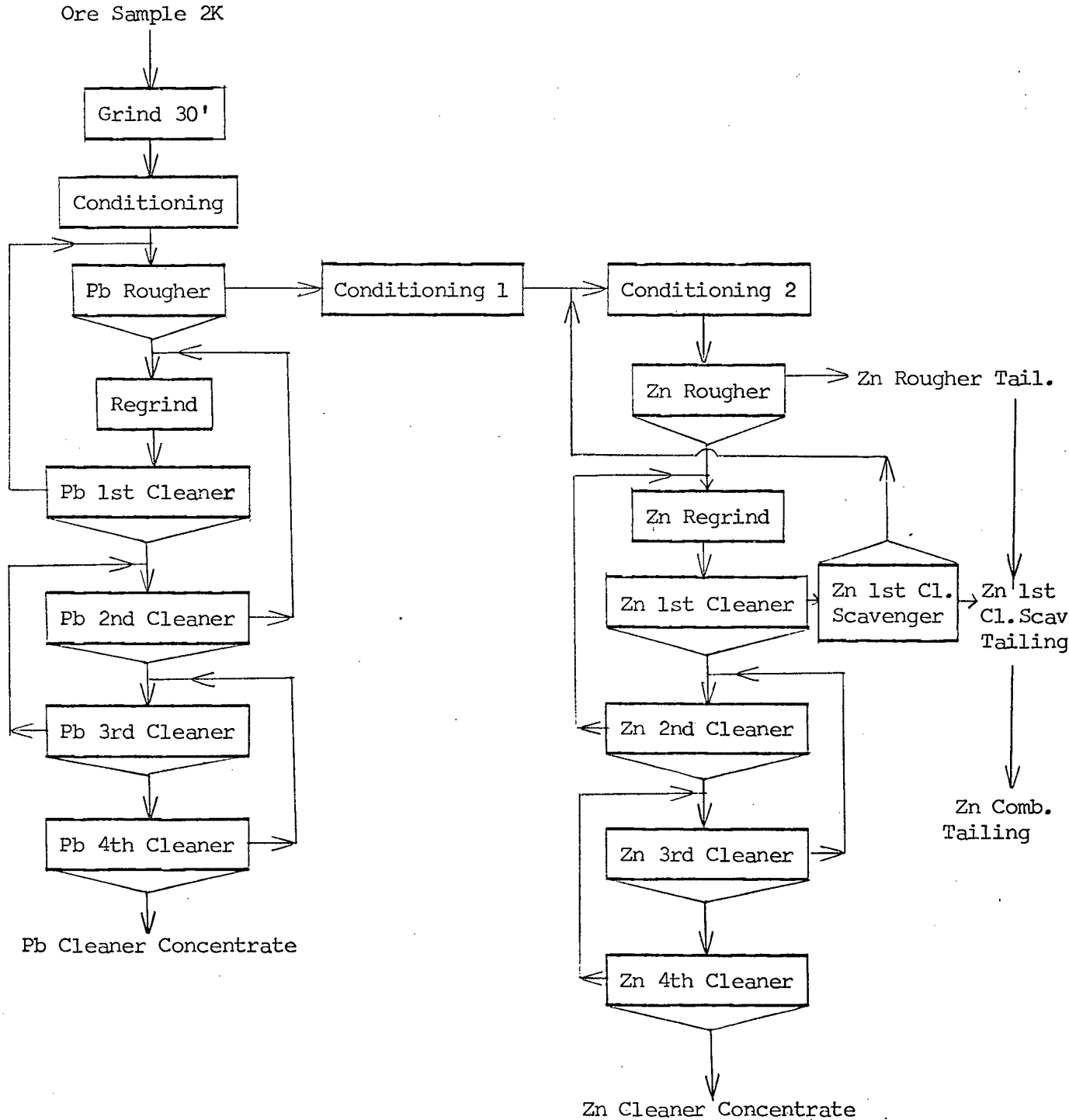
Test No. 230 - Continued

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ SiO ₃	Tee Froth A	Grind	Cond.	Froth	
Condition	2.5	1.0	-	-	-	-	-	-	5	-	-
Zn Rougher	-	-	0.06	-	0.01	-	0.005	-	1	3	10.6
	-	-	0.02	0.02	0.005	-	-	-	1	5	-
Zn Conc. Reagr.	0.8	0.2	0.02	-	-	0.2	-	15	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	0.005	-	1	3	11.2
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 1st Cl. Scav.	-	-	-	0.02	-	-	0.005	-	1	3	11.1
Zn 2nd Cl.	0.2	-	-	-	-	0.1	-	-	1	2	11.3
	-	-	-	0.005	0.005	-	-	-	1	2	-
Zn 3rd Cl.	0.2	-	-	-	0.005	0.1	-	-	1	3½	11.3
Zn 4th Cl.	0.2	-	-	-	0.005	0.1	-	-	1	3	11.3

Test No. 230 - Continued

Flowsheet



Test No. 230 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution	
		Pb	Zn	As	Pb	Zn
1. Pb Cl. Conc. A	0.71	70.7	4.76	-	11.1	0.4
2. Pb Cl. Conc. B	0.68	63.3	5.51	-	9.6	0.4
3. Pb Cl. Conc. C	1.05	64.0	5.84	-	14.9	0.7
4. Pb Cl. Conc. D	0.82	62.9	6.01	-	11.5	0.5
5. Pb Cl. Conc. E	0.86	61.9	6.02	-	11.8	0.6
6. Pb Cl. Conc. F	1.07	62.9	6.26	-	14.9	0.7
7. Pb 4th Cl. Tail. F	0.57	46.8	10.5	-	5.9	0.6
8. Pb 3rd Cl. Tail. F	0.98	31.2	13.9	-	6.8	1.5
9. Pb 2nd Cl. Tail. F	1.64	11.6	14.8	-	4.2	2.6
10. Pb 1st Cl. Tail. F	3.05	2.49	14.1	-	1.7	4.6
11. Zn Cl. Conc. A	2.01	0.32	51.2	0.18	0.1	11.1
12. Zn Cl. Conc. B	2.31	0.33	55.4	0.12	0.2	13.7
13. Zn Cl. Conc. C	2.16	0.32	57.3	0.10	0.2	13.3
14. Zn Cl. Conc. D	2.60	0.47	52.8	0.15	0.3	14.6
15. Zn Cl. Conc. E	2.27	0.38	57.2	0.085	0.2	13.9
16. Zn Cl. Conc. F	2.29	0.41	58.4	0.085	0.2	14.4
17. Zn 4th Cl. Tail. F	0.10	1.85	18.7	-	0.1	0.2
18. Zn 3rd Cl. Tail. F	0.24	1.60	8.48	-	0.1	0.2
19. Zn 2nd Cl. Tail. F	0.48	1.15	4.95	-	0.1	0.3
20. Zn 1st Cl. Scav. Conc. F	0.46	1.24	7.67	-	0.1	0.4
21. Zn 1st Cl. Tail. A	0.98	0.30	0.65	-	0.1	0.1
22. Zn 1st Cl. Tail. B	0.99	0.31	0.73	-	0.1	0.1
23. Zn 1st Cl. Tail. C	1.02	0.40	0.87	-	0.1	0.1
24. Zn 1st Cl. Tail. D	1.18	0.39	0.84	-	0.1	0.1
25. Zn 1st Cl. Tail. E	1.01	0.43	0.90	-	0.1	0.1
26. Zn 1st Cl. Tail. F	1.14	0.50	0.90	-	0.1	0.1
27. Zn Rougher Tail. A	8.38	0.29	0.41	-	0.5	0.4
28. Zn Rougher Tail. B	11.83	0.35	0.57	-	0.9	0.7
29. Zn Rougher Tail. C	11.60	0.38	0.64	-	1.0	0.8
30. Zn Rougher Tail. D	11.68	0.39	0.64	-	1.0	0.8
31. Zn Rougher Tail. E	11.97	0.41	0.84	-	1.1	1.1
32. Zn Rougher Tail. F	11.87	0.43	0.71	-	1.1	0.9
Head (Calculated)	100.00	4.51	9.31	-	100.0	100.0

Calculated Grades and Recoveries

Comb. Pb. Cl. Concs.	5.19	64.1	5.79	-	73.8	3.3
Comb. Pb Cl. Tails.	6.24	13.4	13.9	-	18.6	9.3
Comb. Zn Cl. Concs.	13.64	0.37	55.4	0.12	1.2	81.0
Comb. Zn Cl. Tails.	1.28	1.32	7.67	-	0.4	1.1
Comb. Zn 1st Cl. Tails.	6.32	0.39	0.82	-	0.4	0.6
Comb. Zn Ro. Tails.	67.33	0.38	0.65	-	5.6	4.7

Test No. 230 - Continued

Metallurgical Results

Projected Results of Cycles E and F (Noranda Procedure)

Product	Weight %	Assays, %			% Distribution	
		Pb	Zn	As	Pb	Zn
1. Pb Cleaner Conc.	5.82	62.5	6.16	-	80.6	3.9
2. Zn Cleaner Conc.	13.75	0.39	57.8	0.085	1.2	85.4
3. Zn Final Tail.	80.43	1.02	1.25	-	18.2	10.7
Head (Calculated)	100.00	4.51	9.31	-	100.0	100.0

Projected Results of Cycles E and F (3 Product Formula)

Pb Cleaner Conc.	6.60	62.5	6.16	-	91.4	4.4
Zn Cleaner Conc.	14.32	0.39	57.8	-	1.2	88.9
Zn Final Tailing	79.08	0.42	0.79	-	7.4	6.7
Head (Calculated)	100.00	4.51	9.31	-	100.0	100.0

Test No. 231

Purpose: To repeat the test on Composite No. 2, but increase lead regrind time and reagent additions.

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.7	0.5	0.20	-	-	0.05	-	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.0
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.1
	-	-	-	-	-	0.01	-	-	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.2

Stage	Pb Rougher	Pb Regrind	1st & 2nd Cl.	3rd & 4th Cl.
Equipment	1000 g D - 1	lab rod mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 231 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.69	72.4	4.42	70.6	2.8
2. Pb 4th Cl. Tail.	1.32	48.8	9.75	11.0	1.4
3. Pb 3rd Cl. Tail.	1.30	26.4	14.0	5.9	2.0
4. Pb 2nd Cl. Tail.	3.33	10.7	15.1	6.1	5.5
5. Pb 1st Cl. Tail.	12.75	0.85	12.9	1.9	18.1
6. Pb Rougher Tail.	75.61	0.37	8.42	4.5	70.2
Head (Calculated)	100.00	5.84	9.07	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.01	67.96	5.42	81.6	4.2
Products 1 to 3	8.31	61.45	6.77	87.5	6.2
Products 1 to 4	11.64	46.83	9.15	93.6	11.7
Products 1 to 5	24.39	22.79	11.1	95.5	29.8
Products 5 and 6	88.36	0.44	9.07	6.4	88.3

Cyclosizer Result

Pb Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 24.5 μ m	3.6	3.6	96.4
19.0	6.2	9.8	90.2
13.2	19.6	29.4	70.6
9.1	20.9	50.3	49.7
7.0	12.0	62.3	37.7
- 7.0 μ m	37.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.70

Test No. 232

Purpose: To repeat test No. 231, but with still finer lead regrind.
 Procedure: As for test No. 231.
 Feed: 2000 grams minus 10 mesh Overall Composite No. 2.
 Grind: 30 minutes at 65 percent solids in the laboratory ball mill.
 Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MEBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Regr.	0.8	0.5	0.20	-	-	0.06	50	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	8.9
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.3	0.2	0.10	-	0.005	-	-	1	3	9.1
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	0.005	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.2

Test No. 232 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.20	69.7	4.42	63.2	2.6
2. Pb 4th Cl. Tail.	1.53	51.9	8.84	13.8	1.5
3. Pb 3rd Cl. Tail.	1.39	30.7	12.5	7.4	1.9
4. Pb 2nd Cl. Tail.	4.39	10.6	13.8	8.1	6.7
5. Pb 1st Cl. Tail.	12.47	1.36	12.6	3.0	17.5
6. Pb Rougher Tail.	75.02	0.34	8.36	4.5	69.8
Head (Calculated)	100.00	5.74	8.99	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.73	65.7	5.43	77.0	4.1
Products 1 to 3	8.12	59.7	6.64	84.4	6.0
Products 1 to 4	12.51	42.5	9.15	92.5	12.7
Products 1 to 5	24.98	21.9	10.9	95.5	30.2
Products 5 and 6	87.49	0.48	8.96	7.5	87.3

Cyclosizer Result

Pb Concentrate Cleaning Feed

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 24.5 μ m	2.0	2.0	98.0
19.0	3.5	5.5	94.5
13.2	15.8	21.3	78.7
9.1	21.8	43.1	56.9
7.0	14.0	57.1	42.9
- 7.0	42.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.67

Test No. 233

Purpose: To investigate the effect of adding Na₂S to the grind, and of stage additions of ZnSO₄ and Na₂CO₃.

Procedure: As for test No. 231.

Feed: 2000 grams minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Na ₂ S	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	0.5	0.30	1.0	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	-	0.02	0.06	-	-	1	3	9.6
	0.3	0.3	-	-	0.02	0.02	-	-	2	3	-
	0.3	0.3	-	-	0.01	0.02	-	-	2	3	9.5
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.0
	-	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	0.005	-	-	1	3	9.1
	-	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	0.005	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	-	1	2	9.3

Test No. 233 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.03	66.5	5.55	69.2	3.6
2. Pb 4th Cl. Tail.	1.24	44.7	10.5	9.6	1.4
3. Pb 3rd Cl. Tail.	1.67	26.3	14.1	7.6	2.6
4. Pb 2nd Cl. Tail.	3.53	10.5	15.0	6.4	5.8
5. Pb 1st Cl. Tail.	11.01	1.14	13.2	2.2	15.8
6. Pb Rougher Tail.	76.52	0.39	8.52	5.0	70.8
Head (Calculated)	100.00	5.80	9.20	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.27	62.8	6.39	78.8	5.0
Products 1 to 3	8.94	56.0	7.84	86.4	7.6
Products 1 to 4	12.47	43.1	9.86	92.8	13.4
Products 1 to 5	23.48	23.4	11.4	95.0	29.2
Products 5 plus 6	87.53	0.48	9.11	7.2	86.6

Test No. 234

Purpose: To repeat test No. 233 but aerate for 10 minutes prior to lead rougher flotation.

Procedure: Grind, aerate and float a lead concentrate. Regrind the lead concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Na ₂ S	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	0.5	0.30	1.0	0.07	-	-	30	-	-	-
Aeration	-	-	-	-	-	-	-	-	10	-	9.6- 9.5
Pb Rougher	-	-	-	-	0.02	0.06	-	-	1	3	-
	0.3	0.3	-	-	0.02	0.02	-	-	2	3	-
	0.3	0.3	-	-	0.01	0.02	-	-	2	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.0
	-	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	-	1	3	9.1
	-	-	-	-	-	0.005	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	0.005	-	1	3	9.1
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	-	1	2	-

Test No. 234 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.59	66.8	5.60	63.9	3.3
2. Pb 4th Cl. Tail.	1.48	48.9	9.26	12.4	1.5
3. Pb 3rd Cl. Tail.	1.38	31.6	12.7	7.5	1.9
4. Pb 2nd Cl. Tail.	4.01	11.0	14.3	7.6	6.1
5. Pb 1st Cl. Tail.	10.75	1.48	13.2	2.7	15.2
6. Pb Rougher Tail.	76.79	0.45	8.78	5.9	72.0
Head (Calculated)	100.00	5.84	9.36	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	7.07	63.1	6.36	76.3	4.8
Products 1 to 3	8.45	57.9	7.40	83.8	6.7
Products 1 to 4	12.46	42.8	9.62	91.4	12.8
Products 1 to 5	23.21	23.7	11.3	94.1	28.0
Products 5 plus 6	87.54	0.58	9.32	8.6	87.2

Test No. 235

Purpose: To repeat the test on Composite No. 4, but with slightly longer lead regrind time, and longer cleaning times.

Procedure: Grind and float a lead concentrate. Regrind the lead concentrate and clean four times. Combine the lead rougher and 1st cleaner tailings and float a zinc concentrate. Regrind the Zn concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Overall Composite No. 4.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.2
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.7	0.5	0.20	-	-	0.05	40	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.01	-	0.02	-	1	4	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	-
	-	-	-	0.005	-	0.01	-	1	2	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.4
	-	-	-	-	-	0.01	-	1	1	-
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	1	3	9.5

Stage	Pb Rougher	Pb Reagrind	Pb 1st & 2nd Cl.	Pb 3rd & 4th Cl.
Equipment	1000 g D - 1	lab rod mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 235 - Continued

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Zn Circuit (Pb rougher and 1st cleaner tailing)									
Condition	2.0	1.0	-	-	-	-	2	-	10.9
Zn Rougher	-	-	0.06	0.02	0.04	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.04	-	-	20	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	1	3	10.8
	-	-	-	0.01	0.005	-	1	3	-
Zn 2nd Cl.	0.5	-	-	-	-	-	1	3	11.1
	-	-	-	0.01	0.005	-	1	2	-
Zn 3rd Cl.	0.3	-	-	-	-	-	1	3	11.2
	-	-	-	0.005	0.005	-	1	1	-

Stage	Zn Rougher	Zn Reagrind	Zn Cleaners
Equipment	1000 g D - 1	Pebble Mill	500 g D - 1
Speed: r.p.m.	1800	-	1200

Test No. 235 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cl. Conc.	7.00	66.6	6.91	81.1	4.3
2. Pb 4th Cl. Tail.	1.16	30.4	15.8	6.1	1.6
3. Pb 3rd Cl. Tail.	1.27	14.3	19.2	3.2	2.2
4. Pb 2nd Cl. Tail.	3.52	3.97	17.4	2.5	5.4
5. Zn Cl. Conc.	15.25	0.59	58.4	1.6	79.3
6. Zn 3rd Cl. Tail.	0.81	2.12	17.0	0.3	1.2
7. Zn 2nd Cl. Tail.	1.24	1.62	8.21	0.3	0.9
8. Zn 1st Cl. Tail.	6.26	0.87	2.32	0.9	1.3
9. Zn Rougher Tail.	63.49	0.36	0.67	4.0	3.8
Head (Calculated)	100.00	5.48	11.2	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.16	61.5	8.17	87.2	5.9
Products 1 to 3	9.43	55.1	9.66	90.4	8.1
Products 1 to 4	12.95	41.2	11.8	92.9	13.5
Products 5 plus 6	16.06	0.67	56.3	1.9	80.5
Products 5 to 7	17.30	0.74	52.9	2.2	81.4
Products 5 to 8	23.56	0.77	39.4	3.1	82.7

Test No. 236

Purpose: To repeat the test on Composite No. 5, but with slightly longer lead regrind time and longer cleaning times.

Procedure: As for test No. 235.

Feed: 2000 grams minus 10 mesh Overall Composite No. 5.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	9.1
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.7	0.5	0.20	-	-	0.05	40	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.1
	-	-	-	0.01	-	0.02	-	1	4	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.1
	-	-	-	0.005	-	0.01	-	1	2	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.2
	-	-	-	-	-	0.01	-	1	1	-
Pb 4th Cl.	0.1	-	0.05	-	-	0.005	-	1	3	9.3

Test No. 236 - Continued

Conditions:

Stage	Reagents Added, pounds per ton					Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC C.A.	Grind	Cond.	Froth	
Zn Circuit (Pb rougher and 1st cleaner tailing)									
Condition	2.0	1.0	-	-	-	-	2	-	10.7
Zn Rougher	-	-	0.06	0.02	0.04	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.04	-	-	20	-	-	-
Zn 1st Cl.	-	-	-	0.01	0.01	-	1	3	10.8
	-	-	-	0.01	0.005	-	1	3	-
Zn 2nd Cl.	0.5	-	-	-	-	-	1	3	11.1
	-	-	-	0.01	0.005	-	1	2	-
Zn 3rd Cl.	0.3	-	-	-	-	-	1	3	11.2
	-	-	-	0.005	0.005	-	1	1	-

Test No. 236 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.81	64.0	7.99	83.0	5.7
2. Pb 4th Cl. Tail.	0.91	27.6	15.6	4.2	1.3
3. Pb 3rd Cl. Tail.	1.35	14.2	18.6	3.2	2.3
4. Pb 2nd Cl. Tail.	3.86	4.37	16.7	2.8	5.9
5. Zn Cleaner Conc.	13.87	0.49	59.0	1.1	74.3
6. Zn 3rd Cl. Tail.	0.58	1.75	26.6	0.2	1.4
7. Zn 2nd Cl. Tail.	1.68	1.51	14.3	0.4	2.2
8. Zn 1st Cl. Tail.	7.94	0.87	4.60	1.1	3.3
9. Zn Rougher Tail.	62.00	0.39	0.66	4.0	3.6
Head (Calculated)	100.00	6.02	11.0	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	8.72	60.2	8.79	87.2	7.0
Products 1 to 3	10.07	54.0	10.1	90.4	9.3
Products 1 to 4	13.93	40.3	11.9	93.2	15.2
Products 5 plus 6	14.45	0.54	57.7	1.3	75.7
Products 5 to 7	16.13	0.64	53.2	1.7	77.9
Products 5 to 8	24.07	0.72	37.2	2.8	81.2

Test No. 237

Purpose: To perform a locked-cycle test on Composite No. 2, following the conditions of test No. 230.

Procedure: See flowsheet.

Feed: Six 2000 gram charges minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes per charge at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	1	3	8.8
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Reagr.	0.7	0.5	0.20	-	-	0.05	40	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	1	3	8.9
	-	-	-	-	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	4	9.0
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.0
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2½	9.1

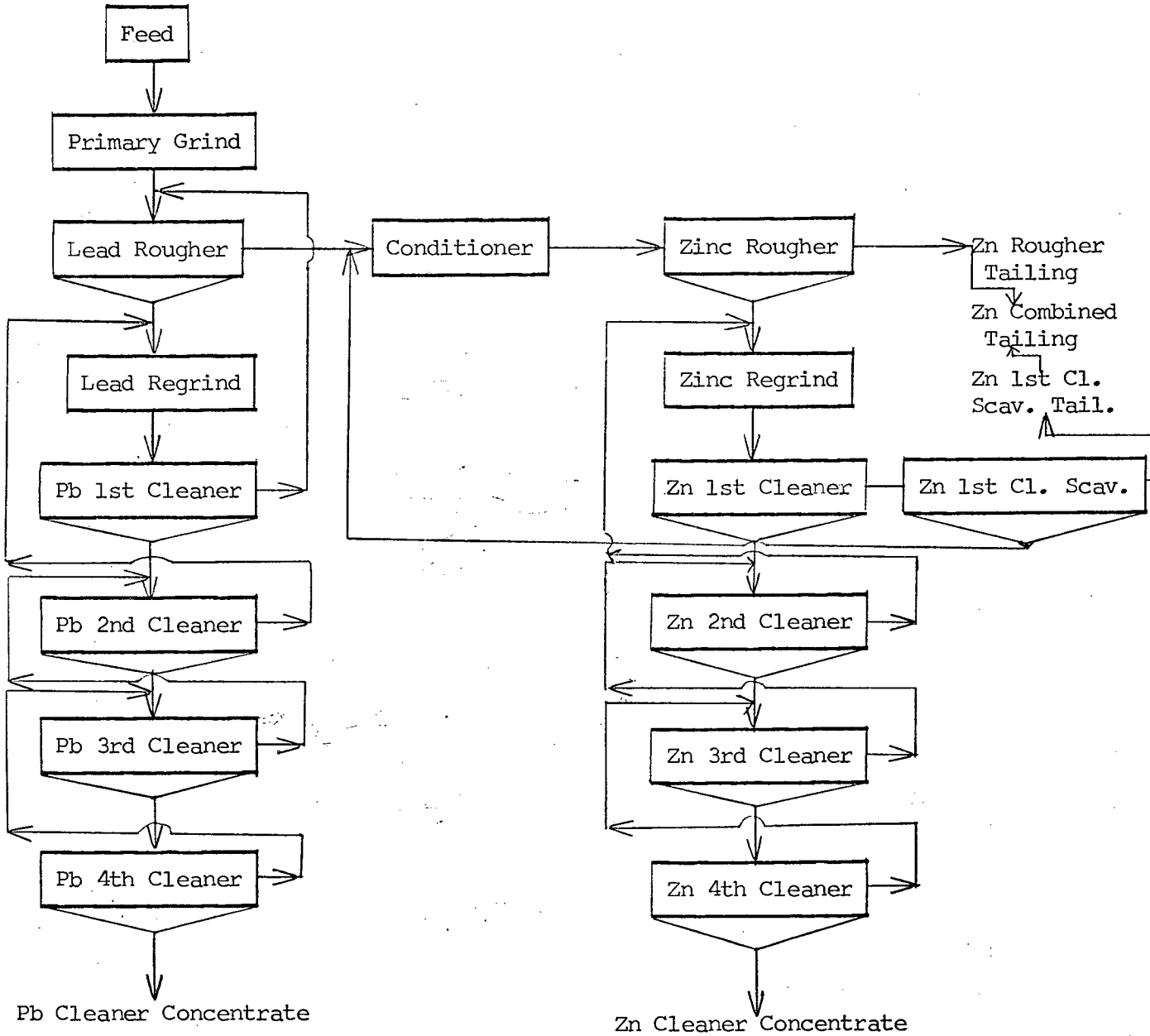
Test No. 237 - Continued

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ SiO ₃	Tee Froth A	Grind	Cond.	Froth	
Condition	2.5	1.5	-	-	-	-	-	-	5	-	10.0
Zn Rougher	-	-	0.06	-	0.01	-	0.005	-	3	3	-
	-	-	0.02	0.02	0.005	-	-	-	1	5	-
Zn Conc. Regr.	0.8	0.5	0.02	-	-	0.2	-	15	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	0.005	-	1	3	11.0
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 1st Cl. Scav.	-	-	-	0.03	-	-	0.005	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	-	0.1	-	-	1	2	-
	-	-	-	0.005	0.005	-	-	-	1	2	-
Zn 3rd Cl.	0.2	-	-	-	0.005	0.1	-	-	1	3½	-
Zn 4th Cl.	0.2	-	-	-	0.005	0.1	-	-	1	3	-

Test No. 237 - Continued

Flowsheet



Test No. 237 - Continued

Metallurgical Results

Product	Weight %	Assays, %			% Distribution	
		Pb	Zn	As	Pb	Zn
1. Pb Cl. Conc. A	0.95	71.9	4.87	-	11.7	0.5
2. Pb Cl. Conc. B	1.20	62.9	6.40	-	12.9	0.8
3. Pb Cl. Conc. C	1.16	62.9	6.40	-	12.5	0.8
4. Pb Cl. Conc. D	1.18	62.4	6.50	-	12.6	0.8
5. Pb Cl. Conc. E	1.50	60.3	7.23	-	15.5	1.2
6. Pb Cl. Conc. F	1.54	59.1	7.71	-	15.6	1.3
7. Pb 4th Cl. Tail. F	0.62	33.3	14.2	-	3.5	1.0
8. Pb 3rd Cl. Tail. F	0.96	19.9	15.7	-	3.3	1.6
9. Pb 2nd Cl. Tail. F	2.80	8.98	14.5	-	4.2	4.4
10. Pb 1st Cl. Tail. F	3.29	2.41	12.2	-	1.4	4.3
11. Zn Cl. Conc. A	1.61	0.57	57.0	0.13	0.2	9.9
12. Zn Cl. Conc. B	2.25	0.38	47.5	0.12	0.1	11.6
13. Zn Cl. Conc. C	2.22	0.47	57.0	0.12	0.2	13.7
14. Zn Cl. Conc. D	2.09	0.41	58.1	0.095	0.1	13.1
15. Zn Cl. Conc. E	2.37	0.50	56.5	0.13	0.2	14.5
16. Zn Cl. Conc. F	2.40	0.61	55.0	0.13	0.3	14.3
17. Zn 4th Cl. Tail. F	0.28	1.40	13.5	-	0.1	0.4
18. Zn 3rd Cl. Tail. F	0.34	1.71	10.3	-	0.1	0.4
19. Zn 2nd Cl. Tail. F	0.43	1.37	5.54	-	0.1	0.3
20. Zn 1st Cl. Scav. Conc. F	0.60	1.34	5.57	-	0.1	0.4
21. Zn 1st Cl. Scav. Tail. A	0.44	1.21	4.15	-	0.1	0.2
22. Zn 1st Cl. Scav. Tail. B	0.82	0.50	1.24	-	0.1	0.1
23. Zn 1st Cl. Scav. Tail. C	0.99	0.50	0.91	-	0.1	0.1
24. Zn 1st Cl. Scav. Tail. D	1.09	0.55	1.10	-	0.1	0.1
25. Zn 1st Cl. Scav. Tail. E	1.06	0.58	1.02	-	0.1	0.1
26. Zn 1st Cl. Scav. Tail. F	1.04	0.66	1.27	-	0.1	0.1
27. Zn Rougher Tailing A	9.38	0.35	0.54	-	0.6	0.5
28. Zn Rougher Tailing B	10.49	0.37	0.49	-	0.7	0.6
29. Zn Rougher Tailing C	11.24	0.41	0.62	-	0.8	0.8
30. Zn Rougher Tailing D	11.29	0.44	0.61	-	0.9	0.7
31. Zn Rougher Tailing E	11.30	0.46	0.61	-	0.9	0.7
32. Zn Rougher Tailing F	11.07	0.44	0.57	-	0.8	0.7
Head (Calculated)	100.00	5.84	9.25	-	100.0	100.0

Calculated Grades and Recoveries

Comb. Pb Cl. Concs.	7.53	62.7	6.66	-	80.8	5.4
Comb. Pb Cl. Tails.	7.67	9.50	13.6	-	12.4	11.3
Comb. Zn Cl. Concs.	12.94	0.49	55.1	0.12	1.1	77.1
Comb. Zn Cl. Tails.	1.65	1.43	7.88	-	0.4	1.5
Comb. Zn 1st Cl. Scav. Tails.	5.44	0.52	1.13	-	0.6	0.7
Comb. Zn Rougher Tails.	64.77	0.41	0.58	-	4.7	4.0

Test No. 237 - Continued

Metallurgical Results

Projected Results of Cycles E and F (Noranda Method)

Product	Weight %	Assays, %			% Distribution	
		Pb	Zn	As	Pb	Zn
1. Pb Cleaner Conc.	9.12	59.7	7.47	-	93.3	7.4
2. Zn Cleaner Conc.	14.31	0.56	55.7	0.13	1.4	86.2
3. Zn Comb. Tail.	76.57	0.41	0.78	-	5.3	6.4
Head (Calculated)	100.00	5.84	9.25	-	100.0	100.0

Projected Results of Cycles E and F (3 Product Formula)

1. Pb Cleaner Conc.	9.05	59.7	7.47	-	92.6	7.3
2. Zn Cleaner Conc.	14.51	0.56	55.7	-	1.4	87.4
3. Zn Comb. Tail.	76.44	0.46	0.64	-	6.0	5.3
Head (Calculated)	100.00	5.84	9.25	-	100.0	100.0

Test No. 238

Purpose: To investigate the effect of longer conditioning with $\text{Ca}(\text{OH})_2$ and CuSO_4 on zinc flotation. (Compare with test 226).

Procedure: Grind and float a lead concentrate. Regrind the concentrate and clean once. Combine the lead rougher and 1st cleaner tailings, and float a zinc concentrate. Regrind the zinc concentrate and clean three times.

Feed: 2000 grams minus 10 mesh Overll Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na_2CO_3	ZnSO_4	NaCN	Z-11	MIBC C.A.	R-242	Na_2SiO_3	Grind	Cond	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.1
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	8.9
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combine Pb rougher and 1st cleaner tailings.											
	$\text{Ca}(\text{OH})_2$	CuSO_4	M-748								
Condition	2.0	-	-	-	-	-	-	-	5	-	10.9
	-	1.0	-	-	-	-	-	-	5	-	10.6
Zn Ro.	-	-	0.06	0.02	0.04	-	-	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	-	-	2	5	-
Zn Conc. Reagr.	1.0	0.2	0.02	-	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	10.9
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 2nd Cl.	0.4	-	-	-	-	-	0.1	-	1	3	11.1
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	-	0.1	-	1	3	11.2

Test No. 238 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	13.12	42.4	10.0	92.2	13.7
2. Zn Cl. Conc.	11.25	0.52	59.0	1.0	69.4
3. Zn 3rd Cl. Tail.	1.79	1.39	41.5	0.4	7.8
4. Zn 2nd Cl. Tail.	1.63	2.34	15.2	0.6	2.6
5. Zn 1st Cl. Tail.	6.21	1.27	3.58	1.3	2.3
6. Zn Rougher Tail.	66.00	0.41	0.60	4.5	4.2
Head (Calculated)	100.00	6.03	9.56	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	13.04	0.64	56.6	1.4	77.2
Products 2 to 4	14.67	0.83	52.0	2.0	79.8
Products 2 to 5	20.88	0.96	37.6	3.3	82.1

Test No. 239

Purpose: To repeat test No. 238, but increase Ca(OH)₂ and CuSO₄ conditioning time to 20 minutes total.

Procedure: As for test No. 238.

Feed: 2000 grams minus 10 mesh Overall Composite No. 2.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Na ₂ SiO ₃	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	1	3	-
Pb Conc. Regr.	0.5	0.5	0.20	-	-	0.03	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	8.9
	-	-	-	0.005	-	0.01	-	-	1	3	-
Combined Pb rougher and 1st cleaner tailings.											
	Ca(OH) ₂	CuSO ₄	M-748								
Condition	2.0	-	-	-	-	-	-	-	10	-	11.1
	-	1.0	-	-	-	-	-	-	10	-	10.6
Zn Rougher	-	-	0.06	0.02	0.04	-	-	-	2	3	-
	-	0.2	0.04	0.03	0.04	-	-	-	2	5	-
Zn Conc. Regr.	1.0	0.2	0.02	-	-	-	0.2	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	10.7
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 2nd Cl.	0.4	-	-	-	-	-	0.1	-	1	3	11.0
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.005	-	0.1	-	1	3	11.1

Test No. 239 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb 1st Cl. Conc.	12.70	43.9	9.44	92.8	12.6
2. Zn Cl. Conc.	11.21	0.45	59.2	0.8	69.6
3. Zn 3rd Cl. Tail.	1.34	1.06	44.8	0.2	6.3
4. Zn 2nd Cl. Tail.	1.71	1.58	22.4	0.5	4.0
5. Zn 1st Cl. Tail.	6.17	0.96	4.73	1.0	3.1
6. Zn Rougher Tail.	66.87	0.42	0.63	4.7	4.4
Head (Calculated)	100.00	6.01	9.53	100.0	100.0

Calculated Grades and Recoveries

Products 2 plus 3	12.55	0.51	57.7	1.0	75.9
Products 2 to 4	14.26	0.64	53.4	1.5	79.9
Products 2 to 5	20.43	0.74	38.7	2.5	83.0

Test No. 240

Purpose: To repeat test No. 237, but decrease regrind times and pass Pb 2nd cleaner tail to Pb 1st cleaner instead of to regrind.

Procedure: See flowsheet

Feed: Six 2000 gram charges minus 10 mesh Overall Composite No. 2.

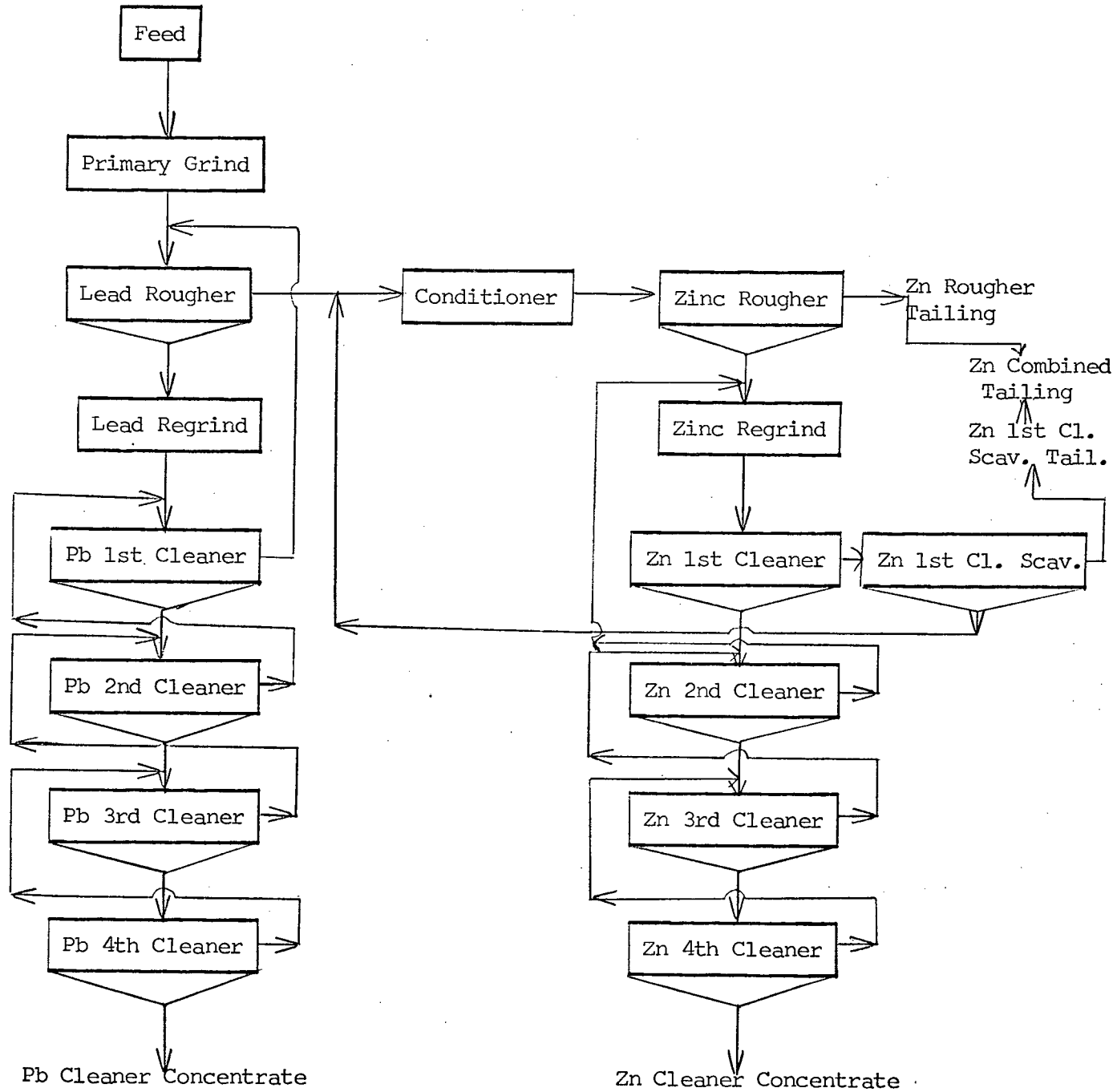
Grind: 30 minutes per charge at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	30	-	-	-
Pb Rougher.	-	-	-	0.02	0.06	-	-	1	3	9.0
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Reagr.	1.0	0.5	0.20	-	-	0.05	30	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	1	3	9.1
	-	-	-	-	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	4	9.2
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	1	2½	9.3

Test No. 240 - Continued

Flowsheet



Test No. 240 - Continued

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Ca (OH) ₂	CuSO ₄	M-748	Z-11	MIBC	Na ₂ SiO ₃	Tee Froth A	Grind	Cond.	Froth	
Condition	2.5	1.5	-	-	-	-	-	-	5	-	-
Zn Rouhger	-	-	0.06	-	0.01	-	0.005	-	2	3	11.1
	-	-	0.02	0.03	0.005	-	-	-	1	5	-
Zn Conc. Reagr.	1.0	0.5	0.02	-	-	0.2	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	0.005	-	1	3	11.2
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 1st Cl.	-	-	-	0.03	-	-	0.005	-	1	3	-
Scav.	-	-	-	-	-	-	-	-	-	-	-
Zn 2nd Cl.	0.25	-	-	-	-	0.1	-	-	1	2	11.2
	-	-	-	0.005	0.005	-	0.005	-	1	3	-
Zn 3rd Cl.	0.2	-	-	-	-	0.1	-	-	1	4	11.2
Zn 4th Cl.	0.25	-	-	-	0.005	0.1	-	-	1	3	11.3

Test No. 240 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cl. Conc. A	1.18	66.0	5.59	13.3	0.7
2. Pb Cl. Conc. B	1.46	61.2	6.74	15.2	1.0
3. Pb Cl. Conc. C	1.40	59.0	7.18	14.1	1.1
4. Pb Cl. Conc. D	1.38	61.0	6.78	14.4	1.0
5. Pb Cl. Conc. E	1.44	59.7	7.05	14.7	1.1
6. Pb Cl. Conc. F	1.58	58.5	7.42	15.6	1.2
7. Pb 4th Cl. Tail. F	0.46	22.3	15.7	1.8	0.8
8. Pb 3rd Cl. Tail. F	0.97	14.4	16.3	2.4	1.7
9. Pb 2nd Cl. Tail. F	1.53	5.61	14.6	1.5	2.3
10. Pb 1st Cl. Tail. F	2.99	1.64	13.0	0.8	4.1
11. Zn Cl. Conc. A	1.84	0.43	52.9	0.1	10.2
12. Zn Cl. Conc. B	2.26	0.40	54.6	0.1	12.9
13. Zn Cl. Conc. C	2.29	0.46	56.0	0.2	13.5
14. Zn Cl. Conc. D	2.41	0.48	57.1	0.2	14.4
15. Zn Cl. Conc. E	2.42	0.47	55.7	0.2	14.1
16. Zn Cl. Conc. F	2.41	0.49	57.5	0.2	14.4
17. Zn 4th Cl. Tail. F	0.36	1.34	15.0	0.1	0.6
18. Zn 3rd Cl. Tail. F	0.75	1.27	8.25	0.2	0.6
19. Zn 2nd Cl. Tail. F	0.75	1.11	3.64	0.1	0.3
20. Zn 1st Cl. Scav. Conc. F	0.55	1.11	3.77	0.1	0.2
21. Zn 1st Cl. Scav. Tail. A	0.83	0.46	0.75	0.1	0.1
22. Zn 1st Cl. Scav. Tail. B	0.88	0.48	0.93	0.1	0.1
23. Zn 1st Cl. Scav. Tail. C	1.11	0.45	0.74	0.1	0.1
24. Zn 1st Cl. Scav. Tail. D	1.00	0.54	0.81	0.1	0.1
25. Zn 1st Cl. Scav. Tail. E	1.18	0.56	0.87	0.1	0.1
26. Zn 1st Cl. Scav. Tail. F	1.54	0.57	0.88	0.1	0.1
27. Zn Rougher Tail. A	8.71	0.31	0.39	0.5	0.4
28. Zn Rougher Tail. B	10.76	0.34	0.43	0.6	0.5
29. Zn Rougher Tail. C	10.46	0.37	0.44	0.7	0.5
30. Zn Rougher Tail. D	11.09	0.38	0.50	0.7	0.6
31. Zn Rougher Tail. E	11.20	0.40	0.54	0.8	0.6
32. Zn Rougher Tail. F	10.81	0.42	0.50	0.8	0.6
Head (Calculated)	100.00	5.86	9.53	100.0	100.0

Calculated Grades and Recoveries

Comb. Pb Cl. Conc.	8.44	60.7	6.84	87.3	6.1
Comb. Pb Cl. Tails.	5.95	6.34	14.2	6.5	8.9
Comb. Zn Cl. Concs.	13.63	0.46	55.8	1.0	79.5
Comb. Zn Cl. Tails.	2.41	1.19	6.80	0.5	1.7
Comb. Zn 1st Cl. Scav. Tails.	6.54	0.52	0.83	0.6	0.6
Comb. Zn Ro. Tails.	63.03	0.37	0.47	4.1	3.2

Test No. 240 - Continued

Metallurgical Results

Projected Results of Cycles E and F (Noranda Method)

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cl. Conc.	9.06	59.1	7.24	91.4	6.9
2. Zn Cl. Conc.	14.49	0.48	56.6	1.2	86.0
3. Zn Comb. Tail.	76.45	0.57	0.88	7.4	7.1
Head (Calc.)	100.00	5.86	9.53	100.0	100.0

Projected Results of Cycles E and F (3 product formula)

1. Pb Cl. Conc.	9.23	59.1	7.24	93.1	7.0
2. Zn Cl. Conc.	14.90	0.48	56.6	1.2	88.5
3. Zn Comb. Tail.	75.87	0.44	0.57	5.7	4.5
Head (Calc.)	100.00	5.86	9.53	100.0	100.0

Test No. 241

Purpose: To perform the standard test on Composite No. 1 using tailing water stored for 8 weeks.

Procedure: As for test No. 216, using tailing water from test No. 215 after an eight week period. (Tailing water pH - 7.6)

Feed: 2000 grams minus 10 mesh Overall Composite No. 1.

Grind: 30 minutes at 65 percent solids in the laboratory ball mill.

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Na ₂ CO ₃	ZnSO ₄	NaCN	Z-11	MIBC C.A.	R-242	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.05	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.04	-	-	1	3	9.2
	-	-	-	0.02	0.02	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	1	3	-
Pb Conc. Reagr.	0.5	0.5	0.20	-	-	0.03	30	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	1	3	9.1
	-	-	-	0.005	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.2
	-	-	-	-	-	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	0.005	-	-	1	3	9.2
Pb 2nd Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.3
Combine lead rougher and 1st cleaner tailings for zinc flotation.										

Test No. 241 - Continued

Conditions:

Stage	Reagents Added, pounds per ton						Time, minutes			pH
	Ca(OH) ₂	CuSO ₄	Z-11	Z-200	Na ₂ SiO ₃	MIBC C.A.	Grind	Cond.	Froth	
Condition	2.0	1.0	-	-	-	-	-	2	-	10.7
Zn Rougher	-	-	0.04	0.02	-	0.04	-	1	3	-
	-	-	0.02	0.02	-	0.02	-	1	5	-
Zn Conc. Reagr.	1.0	0.1	-	0.02	0.2	-	10	-	-	-
Zn 1st Cl.	-	-	-	-	-	-	-	1	3	10.9
	-	-	0.005	0.005	-	0.005	-	1	3	-
Zn 2nd Cl.	0.3	-	-	-	0.1	-	-	1	3	11.1
	-	-	-	0.005	-	-	-	1	1	-
Zn 3rd Cl.	0.2	-	-	-	0.1	0.005	-	1	3	11.2

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cl. Conc.	5.88	60.5	5.75	86.7	4.9
2. Pb 4th Cl. Tail.	0.70	16.0	11.9	2.7	1.2
3. Pb 3rd Cl. Tail.	0.98	6.71	12.1	1.6	1.7
4. Pb 2nd Cl. Tail.	1.90	2.09	10.3	1.0	2.8
5. Zn Cl. Conc.	9.09	0.40	57.9	0.9	76.5
6. Zn 3rd Cl. Tail.	0.59	1.06	28.0	0.2	2.4
7. Zn 2nd Cl. Tail.	1.37	1.02	11.4	0.3	2.3
8. Zn 1st Cl. Tail.	4.29	0.50	1.36	0.5	0.8
9. Zn Ro. Tail.	75.20	0.33	0.67	6.1	7.4
Head (Calc.)	100.00	4.10	6.88	100.0	100.0

Calculated Grades and Recoveries

Products 1 plus 2	6.58	55.8	6.41	89.4	6.1
Products 1 to 3	7.56	49.4	7.14	91.0	7.8
Products 1 to 4	9.46	39.9	7.78	92.0	10.6
Products 5 plus 6	9.68	0.44	56.1	1.1	78.9
Products 5 to 7	11.05	0.51	50.5	1.4	81.2
Products 5 to 8	15.34	0.51	36.8	1.9	82.0

Settling Test Report

Test No. 1

Purpose: To determine the thickener area requirements for the lead concentrate without flocculant additions.

Feed: 485.4 grams of lead concentrate from tests 215 A and B.

Lime: pH: 8.3

Flocculant: As is.

Pulp Volume: 985 ml.

Pulp Weight: 1403 g

Specific Gravity of Dry Solids: 5.89

Settling Time Minutes	Mudline ml.	Settling Time Minutes	Mudline ml.
0	985	7.5	370
0.5	935	8.0	350
1.0	890	8.5	330
1.5	840	9.0	315
2.0	800	9.5	300
2.5	755	10.0	290
3.0	710	11.0	260
3.5	660	12.0	240
4.0	610	13.0	220
4.5	570	14.0	215
5.0	525	15.0	212
5.5	485	20.0	210
6.0	450	25.0	209
6.5	415	30.0	209
7.0	390	1 hr.	209
-	-	3 hr.	-

Supernatant Liquid: slightly cloudy after ½ hour

Test No. 1 - Continued

Thickener Area Requirements

Calculations

Feed Concentration Zone

Initial pulp density: 1403 g/l

Initial percent solids: 34.6

$$F = 65.4 / 34.6 = 1.89$$

Final pulp density: 2880 g/l

Final percent solids: 80.6

$$D = 19.4 / 80.6 = 0.24$$

R = 4.64 feet per hour

$$1.333 (1.89 - 0.24)$$

$$A = \frac{1.333 (1.89 - 0.24)}{4.64}$$

= 0.47 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Compression Zone

Initial pulp density: 2151 g/l

Initial percent solids: 64.5

$$F = 35.3 / 64.5 = 0.55$$

Final pulp density: 2880 g/l

Final percent solids: 80.6

$$D = 19.4 / 80.6 = 0.24$$

R = 0.70 feet per hour

$$1.333 (0.55 - 0.24)$$

$$A = \frac{1.333 (0.55 - 0.24)}{0.70}$$

= 0.59 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Settling Test Report

Test No. 2

Purpose: Determine settling rate with Superfloc 127 added.
Feed: 471.5 grams of lead concentrate from tests 215 A and B.
Lime: pH: 8.5
Flocculant: 0.015 lbs/ton of Superfloc 127 (2 drops of aerosol added to disperse froth)
Pulp Volume: 1000 ml.
Pulp Weight: 1391 g
Specific Gravity of Dry Solids: 5.89

Settling Time Minutes	Mudline ml.	Settling Time Minutes	Mudline ml.
0	1000	7.5	280
0.5	945	8.0	270
1.0	795	8.5	265
1.5	700	9.0	260
2.0	610	9.5	255
2.5	550	10.0	255
3.0	510	11.0	250
3.5	470	12.0	240
4.0	430	13.0	240
4.5	400	14.0	235
5.0	370	15.0	230
5.5	345	20.0	220
6.0	320	25.0	215
6.5	300	30.0	215
7.0	285	1 hr.	215
-	-	3 hr.	215

Supernatant Liquid: Clear after 1/2 hour

Test No. 2 - Continued

Thickener Area Requirements

Calculations

Feed Concentration Zone

Initial pulp density: 1391 g/l

Initial percent solids: 33.9

$$F = 66.1 / 33.9 = 1.95$$

Final pulp density: 2821 g/l

Final percent solids: 77.7

$$D = 22.3 / 77.7 = 0.29$$

R = 6.66 feet per hour

$$1.333 (1.95 - 0.29)$$

$$A = \frac{1.333 (1.95 - 0.29)}{6.66}$$

= 0.33 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Compression Zone

Initial pulp density: 2017 g/l

Initial percent solids: 60.7

$$F = 39.3 / 60.7 = 0.65$$

Final pulp density: 2821 g/l

Final percent solids: 77.7

$$D = 22.3 / 77.7 = 0.29$$

R = 1.02 feet per hour

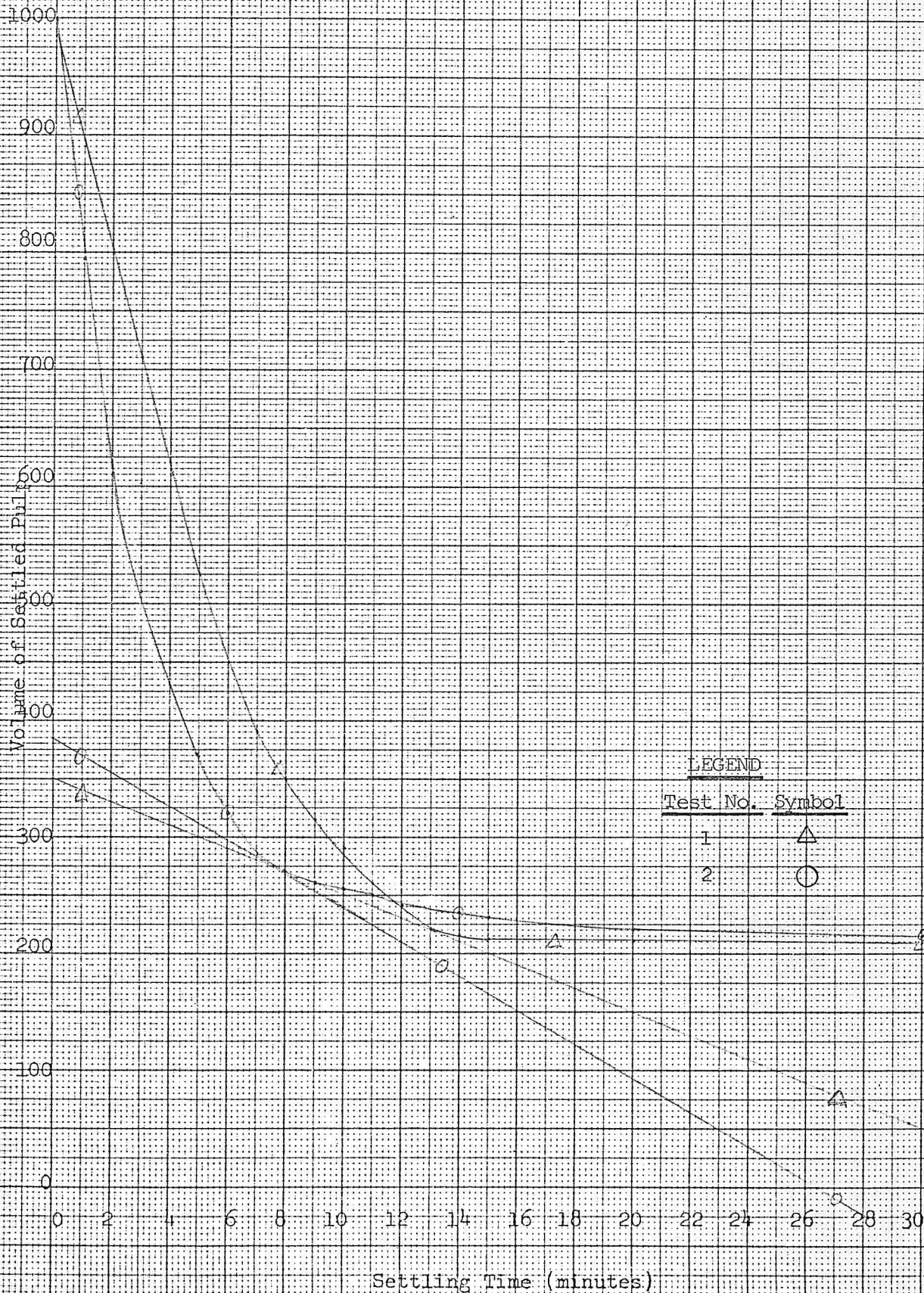
$$1.333 (0.65 - 0.29)$$

$$A = \frac{1.333 (0.65 - 0.29)}{1.02}$$

= 0.47 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Figure No.

SETTLING CURVES



LEGEND

Test No.	Symbol
1	△
2	○

MADE IN CANADA

SPECIFY TRACING OR DRAWING PAPER

Settling Test Report

Test No. 3

Purpose: To determine thickener area requirements of the zinc concentrate without flocculants added.

Feed: 340 grams of zinc concentrate from tests 215 A and B.

Flocculant: As is.

Pulp Volume: 965 ml.

Pulp Weight: 1261 g

Specific Gravity of Dry Solids: 4.03

Settling Time Minutes	Mudline ml.	Settling Time Minutes	Mudline ml.
0	965	7.5	560
0.5	945	8.0	535
1.0	915	8.5	510
1.5	885	9.0	485
2.0	860	9.5	460
2.5	830	10.0	445
3.0	805	10.5	430
3.5	780	11.0	415
4.0	750	11.5	400
4.5	725	12.0	390
5.0	700	13.0	370
5.5	670	14.0	350
6.0	645	15.0	332
6.5	615	16.0	316
7.0	585	17.0	304
-	-	18.0	290
-	-	19.0	280
-	-	20.0	270
-	-	25.0	240
-	-	30.0	236
-	-	1 hr.	235
-	-	2 hr.	235

Supernatnat Liquid: Very cloudy after 1/2 hour

Test No. 3 - Continued

Thickener Area Requirements

Calculations

Feed Concentration Zone

Initial pulp density: 1307 g/l

Initial percent solids: 31.2

$$F = 68.8 / 31.2 = 2.21$$

Final pulp density: 2309.5 g/l

Final percent solids: 75.4

$$D = 24.6 / 75.4 = 0.33$$

R = 3.07 feet per hour

$$A = \frac{1.333 (2.21 - 0.33)}{3.07}$$

= 0.82 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Compression Zone

Initial pulp density: 1521.6 g/l

Initial percent solids: 45.6

$$F = 54.4 / 45.6 = 1.19$$

Final pulp density: 2309.5 g/l

Final percent solids: 75.4

$$D = 24.6 / 75.4 = 0.33$$

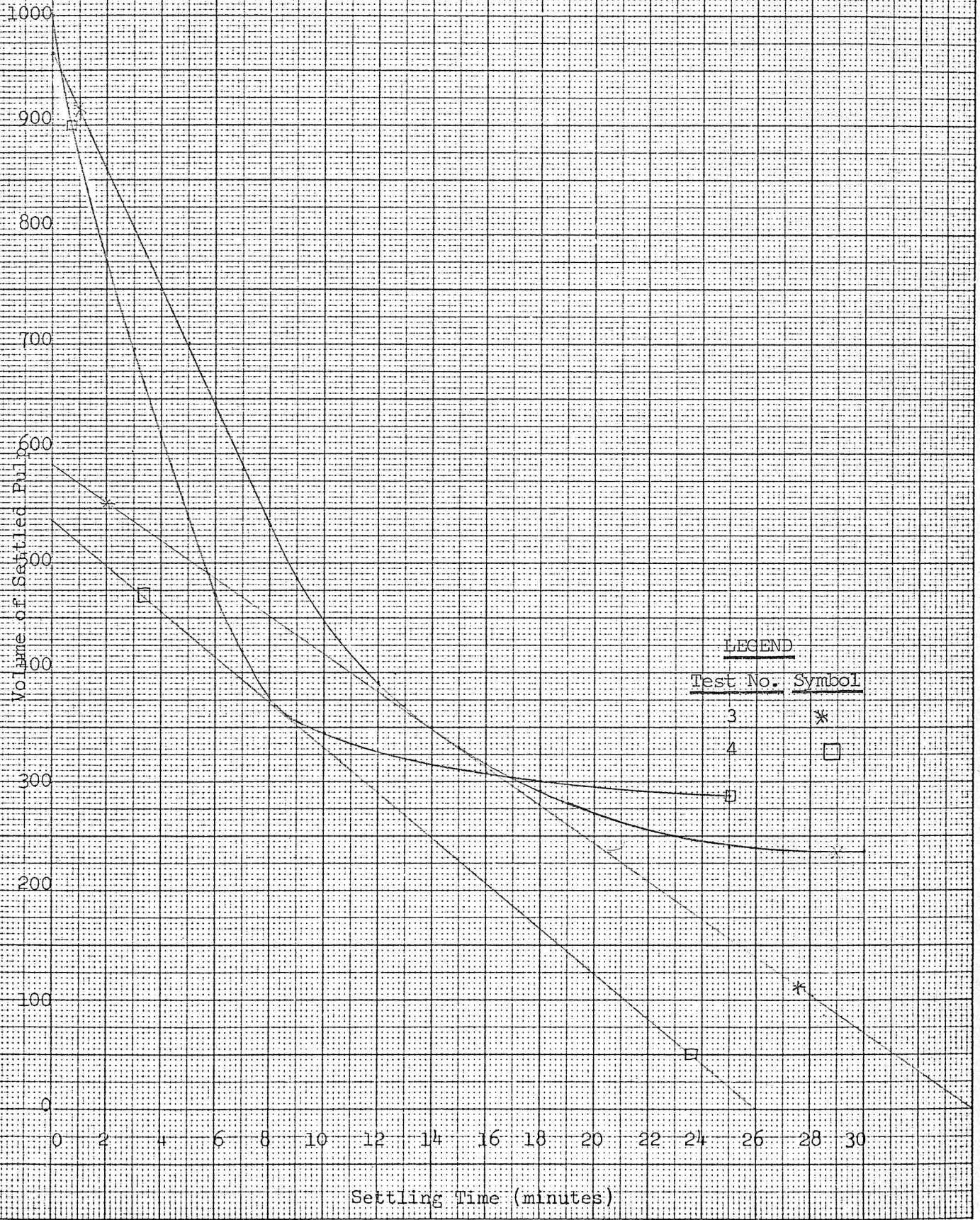
R = 1.21 feet per hour

$$A = \frac{1.333 (1.19 - 0.33)}{1.21}$$

= 0.95 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Figure No. _____

SETTLING CURVES



LEGEND

Test No. Symbol

3 *

4 □

MADE IN CANADA

SPECIFY TRACING OR DRAWING PAPER

Settling Test Report

Test No. 4

Purpose: To determine the thickener area requirements of the zinc concentrate and to investigate the effectiveness of Superfloc 127.

Feed: 406 grams of zinc concentrate from tests 215 A and B.

Lime: pH: 9.5

Flocculant: 0.015 lb/ton of Superfloc 127

Pulp Volume: 1000 ml.

Pulp Weight: 1309 g

Specific Gravity of Dry Solids: 4.03

Settling Time Minutes	Mudline ml.	Settling Time Minutes	Mudline ml.
0	1000	7.5	395
0.5	945	8.0	375
1.0	880	8.5	360
1.5	825	9.0	355
2.0	775	9.5	350
2.5	730	10.0	345
3.0	695	10.5	340
3.5	650	11.0	335
4.0	615	11.5	330
4.5	575	12.0	330
5.0	540	13.0	320
5.5	505	14.0	315
6.0	470	15.0	310
6.5	445	16.0	308
7.0	420	17.0	302
-	-	18.0	300
-	-	19.0	298
-	-	20.0	295
-	-	25.0	286
-	-	30.0	280
-	-	1 hr.	275
-	-	2 hr.	275

Supernatnat Liquid: Cloudy after ½ hour

Observations: Three drops of aerosol were added to break down part of the froth on the surface.

Test No. 4 - Continued

Thickener Area Requirements

Calculations

Feed Concentration Zone

Initial pulp density: 1309 g/l

Initial percent solids: 31.3

$$F = 68.7 / 31.3 = 2.19$$

Final pulp density: 2126.4 g/l

Final percent solids: 70.5

$$D = 29.5 / 70.5 = 0.42$$

R = 5.19 feet per hour

$$1.333 (2.19 - 0.42)$$

$$A = \frac{1.333 (2.19 - 0.42)}{5.19}$$

= 0.45 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Compression Zone

Initial pulp density: 1573.6 g/l

Initial percent solids: 48.5

$$F = 51.5 / 48.5 = 1.06$$

Final pulp density: 2126.4 g/l

Final percent solids: 70.5

$$D = 29.5 / 70.5 = 0.42$$

R = 1.45 feet per hour

$$1.333 (1.06 - 0.42)$$

$$A = \frac{1.333 (1.06 - 0.42)}{1.45}$$

= 0.59 square feet per ton of dry solids per 24 hours
thickener area required (no safety factor applied)

Filtration Test Report

Test No. F-1

Purpose: To investigate the filtration characteristics of the lead concentrate from test 215 A and B.

Procedure: Repulp concentrate to 50 - 60 % solids. Find a suitable form time to give about a 1/2" cake. Choose dry times twice and three times the form time.

Feed: 1470 grams of lead concentrate from test 215 A and B.

Cloth Specifications:

Media Number	CO-6
Material	Cotton
Air-flow (cfm/sq.ft.)	4.50
Yarn	Spun- Staple
Weave	2/2 Twill
Weight (oz/sq. yd.)	14.00
Thread Count	67 x 47
Finish	Grey

Comments: In test F-1 the cake build-up was uneven and cracks developed. The data from test F-2 are considered more indicative of the filtration characteristics of the lead concentrate.

Test Conditions

Test No.	Filter Cloth	Slurry			Filter Vac. (In. Hg)		Filter Time - Sec		
		% Solids	pH	Temp. °C	Form	Dry	Form	Dry	Cycle
1	CO-6	60.7	8.6	23	18	17.5	30	60	135
2	CO-6	60.7	8.6	23	21.5	21.5	30	90	180

Test Results

Test No.	Filter Cake Data						Filtrate Data		
	Cracks No.	Thick. In.	Weight - Grams Wet	Grams Dry	% Moist	Rate *	Volume ml.	Clarity	Rate **
1	3	0.25	180.3	159.1	11.76	93.45	160	Clear	11.27
2	None	0.40	324.6	299.8	7.64	132.07	250	Clear	9.51

* Dry Pounds per Hour per Square Foot

** U.S. Gallons per Hour per Square Foot

Filtration Test Report

Test No. F-2

Purpose: To investigate the filtration characteristics of the zinc concentrate from test 215 A and B.

Procedure: Pulp concentrate to 50 - 60 % solids. Establish form time to give a cake thickness of about 1/2 inch. Choose 2 drying times, twice the form time and three times the form time. 0.15 lb/ton of Aerodri 104 was added to the zinc concentrate.

Feed: 1030 grams of zinc concentrate from test 215 A and B.

Cloth Specifications:

Media Number	CO-6
Material	Cotton
Air-flow (cfm/sq. ft.)	4.50
Yarn	spun-staple
Weave	2/2 Twill
Weight (oz/sq. yd.)	14.00
Thread Count	67 x 47
Finish	Grey

Test Conditions

Test No.	Filter Cloth	Slurry			Filter Vac. Form	(In. Hg) Dry	Filter Time - Sec.		
		% Solids	pH	Temp. °C			Form	Dry	Cycle
1	CO-6	56.7	7.7	24	21	21	20	60	120
2	CO-6	56.7	7.7	24	20	20	30	90	180

Test Results

Test No.	Filter Cake Data						Filtrate Data		
	Cracks No.	Thick. In.	Weight - Grams Wet	Grams Dry	% Moist.	Rate *	Volume ml.	Clarity	Rate **
1	None	0.3	193.0	174.3	9.69	115.2	180	Slightly Cloudy	14.3
2	None	0.4	207.4	188.0	9.35	82.8	200	Clear	10.6

* Dry Pounds per Hour per Square Foot

** U.S. Gallons per Hour per Square Foot

APPENDIX NO. I

Thickening and Filtration Tests on Pb and Zn Concentrates.

Thickening and Filtration Tests

The lead and zinc concentrates used in the thickening and filtration tests were concentrates from test No. 215 (10 kilogram tests).

The chemical analyses of the Pb and Zn concentrate used for thickening and filtration tests were as follows:

Lead Concentrate

lead (Pb) % 53.0

Zinc (Zn) % 7.84

Zinc Concentrate

lead (Pb) % 0.35

Zinc (Zn) % 58.70

Size Analysis

Lead Concentrate

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 22.4 µm	20.2	20.2	79.8
17.4	15.8	36.0	64.0
12.1	22.8	58.8	41.2
8.3	16.2	75.0	25.0
6.4	7.6	82.6	17.4
- 6.4	17.4	100.0	-
Total	100.0	-	-

Specific Gravity 5.96

Zinc Concentrate

+ 270 mesh	3.6	3.6	96.4
28.2 µm	19.8	23.4	76.6
21.9	13.1	36.5	63.5
15.3	19.7	56.2	43.8
10.5	15.7	71.9	28.1
8.1	8.3	80.2	19.8
- 8.1	19.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.08