

020615

An Investigation of  
THE RECOVERY OF LEAD AND ZINC  
from Grum Deposit Samples  
submitted by  
KERR ADDISON MINES LIMITED  
Progress Report No. 9

Project No. L.R. 1991

NOTE:

This report refers to the samples as received.

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LAKEFIELD RESEARCH OF CANADA LIMITED  
Lakefield, Ontario  
March 3, 1978

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

This report contains the results of tests performed in the period from August 16, 1977, to September 1, 1977, on the recovery of lead and zinc from Grum Deposit Sample No. 2, submitted by Kerr Addison Mines Limited.

Flotation testwork was conducted to evaluate possible reagent changes that might improve flotation results. Composite No. 2 sample was prepared from the eight individual samples described in Progress Report No. 8 (Page 2), and it contained 20 % ore sample A-77.

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A handwritten signature in cursive script, reading "S. Bulatovic".

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Project Metallurgist

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## S U M M A R Y

### 1. Head Analyses

The sample for this investigation was prepared from the eight individual laboratory samples (Progress Report No. 7), The head analyses as calculated from the testwork were as follows:

lead (Pb)	5.96 %
zinc (Zn)	9.25 %
silver (Ag)	2.39 oz/ton

### 2. General Evaluation

The laboratory test program was conducted to examine the responses of the ore to different types of zinc and pyrite depressants and with different lead and zinc collectors. The variables studied included:

- 1) Effect of  $\text{Na}_2\text{SO}_3$  and  $\text{Na}_2\text{S}$  on Pb flotation.
- 2) Effect of different Pb collectors.
- 3) Effect of different Pb frothers.
- 4) Effect of different zinc collectors.

The laboratory results from the tests performed showed that collector Z-6 was most effective for the lead cleaning, and combinations of collector M-748 and Z-11 were most effective in the zinc flotation circuit.

Laboratory tests using  $\text{Na}_2\text{S}$  yielded inferior metallurgical results in the lead circuit. The lead concentrate recovery decreased sharply when 1.0 lb/ton  $\text{Na}_2\text{S}$  was added to the primary grind. Additions of  $\text{Na}_2\text{SO}_3$  to the lead rougher and cleaning had little effect on lead recovery and on zinc rejection in the Pb cleaning.

Summary - Continued

3. Testwork

3.1. Pb Circuit

3.1.1. Effect of Na<sub>2</sub>S and Na<sub>2</sub>SO<sub>3</sub> Additions

Several flotation tests were conducted to investigate the effect of Na<sub>2</sub>S and Na<sub>2</sub>SO<sub>3</sub> additions on zinc and pyrite depression. The conditions and results for these tests are shown in table No. 1 below.

Table No. 1

Test No.	Reagent Added lb/ton		Product	Weight %	Assays, %		% Distribution	
	Na <sub>2</sub> S	Na <sub>2</sub> SO <sub>3</sub>			Pb	Zn	Pb	Zn
249	Nil	Nil	Pb Cl. Conc.	8.43	63.7	6.13	90.8	5.4
			Pb 1st Cl. Conc.	12.42	44.4	9.15	93.4	11.8
			Pb Comb. Tail.	87.58	0.45	9.71	6.5	88.2
260	1.0	1.0	Pb Cl. Conc.	4.08	64.3	5.01	45.5	2.2
			Pb 1st Cl. Conc.	6.82	47.10	8.11	55.7	5.9
			Pb Comb. Tail.	93.18	2.74	9.44	44.3	94.1
261	Nil	0.7	Pb Cl. Conc.	8.00	63.9	5.01	90.9	5.4
			Pb 1st Cl. Conc.	11.72	47.0	8.74	93.0	10.7
			Pb Comb. Tail.	88.28	0.47	9.58	7.0	84.3

The additions of Na<sub>2</sub>S to the primary grind depressed lead (test 260) which resulted in a low lead recovery. The Na<sub>2</sub>SO<sub>3</sub> additions seemed to have little effect on pyrite and zinc depression.

Summary - Continued

3. Testwork

3.1. Pb Circuit

3.1.2. Effect of Different Collectors

In series of tests 231 and 253 several different collectors alone or in combination were examined. These results are summarized in table No. 2 below.

Table No. 2

Effect of Different Collectors in the Pb Rougher and Cleaning

Test No.	Reagents Added, pounds per ton					
	Z-11	Z-6	AX-350	Z-6:* Z-11	Z-6/* 241	R-242
231	0.13	-	-	-	-	0.03
248	0.18	-	-	-	-	-
249	-	0.18	-	-	-	-
250	-	-	0.18	-	-	-
251	-	-	-	0.18	-	-
252	-	0.12	-	-	-	0.07
253	-	-	-	-	0.18	-

Summary - Continued

3. Testwork

3.1. Pb Circuit

3.1.2. Effect of Different Collectors

Table No. 2

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
231	Pb Cleaner Conc.	8.31	61.45	6.77	87.5	4.2
	Pb 1st Cl. Conc.	11.64	46.83	9.15	93.6	11.7
	Pb Comb. Tail.	88.36	0.44	9.07	6.4	88.3
248	Pb Cleaner Conc.	8.13	62.10	6.28	88.0	5.3
	Pb 1st Cl. Conc.	11.10	47.60	8.80	92.1	10.2
	Pb Comb. Tail.	88.90	0.51	9.69	7.9	89.8
249	Pb Cleaner Conc.	8.43	63.7	6.16	90.8	5.4
	Pb 1st Cl. Conc.	12.42	44.4	9.15	93.4	11.8
	Pb Comb. Tail.	87.58	0.45	9.71	6.5	88.2
250	Pb Cleaner Conc.	8.32	64.1	5.81	90.9	5.0
	Pb 1st Cl. Conc.	11.90	45.9	8.48	93.2	10.4
	Pb Comb. Tail.	88.10	0.45	9.81	6.8	89.6
251	Pb Cleaner Conc.	7.68	63.1	5.64	83.0	4.4
	Pb 1st Cl. Conc.	12.26	44.0	9.30	92.3	11.6
	Pb Comb. Tail.	87.74	0.51	9.86	7.7	88.4
252	Pb Cleaner Conc.	7.57	65.9	5.50	85.9	4.4
	Pb 1st Cl. Conc.	12.81	42.1	9.46	92.9	12.8
	Pb Comb. Tail.	87.19	0.48	9.45	7.1	87.2
253	Pb Cleaner Conc.	7.85	65.1	5.54	87.7	4.5
	Pb 1st Cl. Conc.	13.29	40.8	9.35	93.1	12.9
	Pb Comb. Tail.	86.71	0.46	9.68	6.9	87.1

The above results indicated that neither the collector combinations, nor the strong collector (Z-6) produced a significant improvement in the lead rougher circuit. The use of collector Z-6 in the lead cleaning however, improved lead recovery significantly without causing deterioration in the Pb-Zn selectivity.

Summary - Continued

3. Testwork

3.1. Pb Circuit

3.1.3. Effect of Different Frothers

In this series of tests the frother MIBC, D-250, and mixture of cresylic acid and MIBC were examined. The results from these tests are presented in table No. 3 below.

Table No. 3

Test No.	Frother Added lb/ton			Product	Weight %	Assays, %		% Distr.	
	MIBC/* C.A.	MIBC	DF-250			Pb	Zn	Pb	Zn
242	0.11	-	-	Pb Cleaner Conc.	7.80	62.6	6.27	86.0	5.3
				Pb 1st Cl. Conc.	13.73	39.8	9.46	93.6	13.8
				Pb Comb. Tail.	86.63	0.42	9.02	6.4	86.2
245	-	0.13	-	Pb Cleaner Conc.	7.56	61.0	6.33	80.1	5.1
				Pb 1st Cl. Conc.	13.49	39.2	9.65	91.8	13.9
				Pb Comb. Tail.	86.51	0.54	9.40	8.2	86.1
246	-	-	0.09	Pb Cleaner Conc.	7.13	62.9	5.84	76.5	4.4
				Pb 1st Cl. Conc.	13.89	38.7	9.59	91.7	14.1
				Pb Comb. Tail.	86.11	0.57	9.53	8.3	85.9

\* MIBC : Cresylic Acid = 3:1

The additions of frother D-250 adversely affected lead cleaning.

3.2. Zinc Circuit

3.2.1. Effect of Different Zinc Collectors

A series of tests were performed to compare the effectiveness of collectors M-748, Z-11, AX-350 and Z-6/Z-11 mixture. The results and conditions for these tests are shown in the following table.

Summary - Continued

3. Testwork

3.2. Zinc Circuit

3.2.1. Effect of Different Zinc Collectors

Table No. 4

Effect of Type of Collector in the Zinc Circuit

Test No.	Reagents Added, pounds per ton				
	M-748	Z - 11	Z - 6	AX-250	Z-6:* Z-11
235	0.14	0.085	-	-	-
244	0.10	0.06	-	-	-
248	-	0.155	-	-	-
249	-	-	0.155	-	-
250	-	-	-	0.155	-
251	-	-	-	-	0.155

\* Z-6 : Z-11 = 1:1

Test No.	Product	Weight %	Assays, %		% Distribution	
			Pb	Zn	Pb	Zn
235	Zn Cleaner Conc.	15.25	0.59	58.4	1.6	79.3
	Zn Ro. Conc.	23.56	0.77	<del>39.4</del>	3.1	<del>82.7</del>
	Zn Flot. Tail.	63.49	0.36	0.67	4.0	3.8
244	Zn Cleaner Conc.	11.57	0.44	57.2	0.9	69.5
	Zn Ro. Conc.	24.30	0.59	33.0	2.4	84.1
	Zn Flot. Tail.	63.12	0.46	0.53	4.9	3.4
248	Zn Cleaner Conc.	11.59	0.52	57.6	1.1	<del>75.1</del>
	Zn Ro. Conc.	21.61	0.67	37.7	2.6	85.0
	Zn Flot. Tail.	67.29	0.46	0.70	5.3	4.8
249	Zn Cleaner Conc.	11.96	0.42	57.9	0.8	71.8
	Zn Ro. Conc.	22.74	0.58	35.7	2.1	84.2
	Zn Flot. Tail.	64.84	0.40	0.59	4.5	4.0
250	Zn Cleaner Conc.	11.80	0.46	57.3	0.9	71.0
	Zn Ro. Conc.	22.55	0.58	36.6	2.2	75.6
	Zn Flot. Tail.	65.55	0.41	0.58	4.6	4.0
251	Zn Cleaner Conc.	12.05	0.49	57.1	1.0	70.3
	Zn Ro. Conc.	23.06	0.64	35.9	2.5	84.5
	Zn Flot. Tail.	64.68	0.47	0.59	5.2	3.9

Summary - Continued

3. Testwork

3.2. Zinc Circuit

3.2.1. Effect of Different Zinc Collectors

Combinations of collectors M-748 and Z-11 appeared to be the most selective of the collectors tested.

DETAILS OF TESTS

Test No. 242

Purpose: To investigate the effect of omitting collector additions to the Pb regrind, and add collector to the Pb 1st cleaner.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	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	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	0.03	-	2	3	9.2
	-	-	-	0.01	-	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	-	-	0.005	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.4

Stage	Rougher	Pb Reagrind	1st and 2nd Cl.	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. 242 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.63	67.8	5.26	79.1	3.8
2. Pb 4th Cl. Tail.	1.17	33.3	12.0	6.9	1.5
3. Pb 3rd Cl. Tail.	1.61	14.6	14.7	4.1	2.6
4. Pb 2nd Cl. Tail.	3.96	5.05	13.6	3.5	5.9
5. Pb 1st Cl. Tail.	14.64	0.77	11.1	2.0	17.9
6. Pb Rougher Tail.	71.99	0.35	8.60	4.4	68.3
Head (Calculated)	100.00	5.68	9.08	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.80	62.6	6.27	86.0	5.3
Products 1 to 3	9.41	54.4	7.71	90.1	7.9
Products 1 to 4	13.37	39.8	9.46	93.6	13.8
Products 1 to 5	28.01	19.4	10.3	95.6	31.7

Test No. 243

Purpose: To repeat test No. 242, but with longer conditioning time after the collector addition to the Pb 1st cleaner.

Procedure: As for test No. 242.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	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	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	0.03	-	10	3	9.1
	-	-	-	0.01	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	1	3	9.2
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.3

Test No. 243 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.84	65.9	5.85	77.3	4.4
2. Pb 4th Cl. Tail.	1.08	33.3	11.7	6.2	1.4
3. Pb 3rd Cl. Tail.	1.42	18.2	14.0	4.4	2.2
4. Pb 2nd Cl. Tail.	4.34	6.32	13.6	4.7	6.5
5. Pb 1st Cl. Tail.	14.44	0.96	11.4	2.4	18.1
6. Pb Rougher Tail.	71.88	0.41	8.54	5.0	67.4
Head (Calculated)	100.00	5.83	9.10	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.92	61.5	6.65	83.5	5.8
Products 1 to 3	9.34	54.9	7.77	87.9	8.0
Products 1 to 4	13.68	39.5	9.62	92.6	14.5
Products 1 to 5	28.12	19.7	10.5	95.0	32.6

Test No. 244

**Purpose:** To repeat test No. 243, but condition at high density and high speed, and use Teefroth A as the only frother in zinc circuit and omit Na<sub>2</sub>SiO<sub>3</sub>.

**Procedure:** As for test No. 242, but combine lead rougher and 1st cleaner tailings and add the zinc circuit.

**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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC C.A.	R-242	Ca-(OH) <sub>2</sub>	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	-	-	-	-	40	-	-	-
Allow reground pulp to settle and decant water.											
Cond. Solids	-	-	-	0.01	-	0.03	-	-	10	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	-	1	3	8.9
	-	-	-	0.01	-	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	-	-	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.											
		CuSO <sub>4</sub>			M-748	Tee-Froth A					
Condition	-	1.0	-	-	-	-	2.5	-	2	-	-
Zn Rougher	-	-	-	0.01	0.06	0.02	-	-	2	3	10.9
	-	0.2	-	0.02	0.02	0.01	-	-	2	5	-
Zn Conc. Reagr.	-	0.3	-	-	0.02	-	1.0	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	10.8
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	-	-	-	-	0.5	-	1	3	11.0
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	-	-	-	0.005	-	-	0.3	-	1	3	11.2

Test No. 244 - Continued

Conditions:

Stage	Pb Rougher	Pb Re grind	Pb 1st Cl. Cond.	Pb 1st and 2nd Cl.
Equipment	1000 g D-1	Rod Mill	500 g D-1	500 g D-1
Speed: r.p.m.	1800	-	1800	1300
% Solids	33	-	40	-

Stage	Pb 3rd and 4th Cl.	Zn Rougher	Zn Re grind	Zn Cleaners
Equipment	250 g D-1	1000g D-1	Pebble Mill	500 g D-1
Speed: r.p.m.	1000	1800	-	1300

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.78	67.6	5.02	77.7	3.6
2. Pb 4th Cl. Tail.	0.84	33.4	11.1	4.8	1.0
3. Pb 3rd Cl. Tail.	1.29	17.7	13.7	3.9	1.9
4. Pb 2nd Cl. Tail.	3.67	10.2	15.5	6.3	6.0
5. Zn Cleaner Conc.	11.57	0.44	57.2	0.9	69.5
6. Zn 3rd Cl. Tail.	2.53	0.81	35.8	0.3	9.5
7. Zn 2nd Cl. Tail.	2.66	0.92	12.3	0.4	3.4
8. Zn 1st Cl. Tail.	7.54	0.63	2.19	0.8	1.7
9. Zn Rougher Tail.	63.12	0.46	0.53	4.9	3.4
Head (Calculated)	100.00	5.90	9.53	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.62	63.8	5.69	82.5	4.6
Products 1 to 3	8.91	57.2	6.85	86.4	6.5
Products 1 to 4	12.58	43.5	9.37	92.7	12.5
Products 5 and 6	14.10	0.51	53.4	1.2	79.0
Products 5 to 7	16.76	0.57	46.8	1.6	82.4
Products 5 to 8	24.30	0.59	33.0	2.4	84.1

Test No. 245

Purpose: To investigate the effect of using MIBC alone as frother in the lead circuit, and Teefroth A in the zinc circuit.

Procedure: As for test No. 244.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC	R-242	Ca-(OH) <sub>2</sub>	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	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	-	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	0.03	-	-	2	3	9.2
	-	-	-	0.005	-	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.005	-	-	-	1	3	9.2
	-	-	-	-	-	0.01	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	-	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	2	9.3
Combine lead rougher and 1st cleaner tailings for zinc flotation.											
		CuSO <sub>4</sub>			M-748	Tee Froth A					
Condition	-	1.0	-	-	-	-	2.5	-	2	-	10.9
Zn Rougher	-	-	-	0.01	0.06	0.01	-	-	2	3	-
	-	0.2	-	0.02	0.02	0.01	-	-	2	5	-
Zn Conc. Reagr.	-	0.3	-	-	0.04	-	1.0	15	-	-	-
Zn 1st Cl.	-	-	-	0.02	-	-	-	-	1	3	10.9
	-	-	-	0.01	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	-	0.005	-	-	0.5	-	1	3	11.2
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	-	-	-	0.005	-	-	0.3	-	1	3	11.3

Test No. 245 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.21	65.8	5.49	71.0	3.6
2. Pb 4th Cl. Tail.	1.35	39.0	10.2	9.1	1.5
3. Pb 3rd Cl. Tail.	1.77	19.0	13.6	5.8	2.6
4. Pb 2nd Cl. Tail.	4.16	8.15	14.0	5.9	6.2
5. Zn Cleaner Conc.	11.87	0.59	57.1	1.2	71.8
6. Zn 3rd Cl. Tail.	2.22	1.32	30.6	0.5	7.2
7. Zn 2nd Cl. Tail.	1.69	1.48	8.74	0.4	1.6
8. Zn 1st Cl. Tail.	5.25	0.96	2.38	0.9	1.3
9. Zn Rougher Tail.	65.48	0.45	0.62	5.2	4.2
Head (Calculated)	100.00	5.76	9.44	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.56	61.0	6.33	80.1	5.1
Products 1 to 3	9.33	53.1	7.71	85.9	7.7
Products 1 to 4	13.49	39.2	9.65	91.8	13.9
Products 5 and 6	14.09	0.70	52.9	1.7	79.0
Products 5 to 7	15.78	0.79	48.2	2.1	80.6
Products 5 to 8	21.03	0.83	36.8	3.0	81.9

Test No. 246

Purpose: To investigate the effect of using DF-250 as frother in the lead circuit and AF-65 in the zinc circuit, and return Na<sub>2</sub>SiO<sub>3</sub> to the Zn circuit.

Procedure: As for test No. 244.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	DF-250	R-242	Ca-(OH) <sub>2</sub>	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.05	-	-	-	1	3	9.1
	-	-	-	0.02	0.01	-	-	-	1	3	--
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	-	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	0.02	-	-	2	3	9.1
	-	-	-	0.005	-	0.01	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.005	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	-	-	-	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	-	1	2	9.3
Combine lead rougher and 1st cleaner tailings for zinc flotation.											
		CuSO <sub>4</sub>	Na <sub>2</sub> SiO <sub>3</sub>		M-748	AF-65					
Condition	-	1.0	-	-	-	-	2.5	-	2	-	10.9
Zn Rougher	-	-	-	0.01	0.06	0.02	-	-	2	3	-
	-	0.2	-	0.02	0.02	0.02	-	-	2	5	-
Zn Conc. Reagr.	-	0.3	0.2	-	0.04	-	1.0	15	-	-	-
Zn 1st Cl.	-	-	-	0.02	-	-	-	-	1	3	10.9
	-	-	-	0.01	-	0.005	-	-	1	3	-
Zn 2nd Cl.	-	-	0.1	0.005	-	-	0.5	-	1	3	11.2
	-	-	-	0.005	-	-	-	-	1	1	-
Zn 3rd Cl.	-	-	0.1	0.005	-	-	0.3	-	1	3	11.2

Stage Pb Cleaners  
 Flotation Cell 500 g D - 1  
 Speed: r.p.m. 1300

Test No. 246 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.13	62.9	5.84	76.5	4.4
2. Pb 4th Cl. Tail.	1.31	31.1	12.2	7.0	1.7
3. Pb 3rd Cl. Tail.	1.85	14.9	14.2	4.7	2.8
4. Pb 2nd Cl. Tail.	3.60	5.67	13.7	3.5	5.2
5. Zn Cleaner Conc.	12.47	0.56	56.5	1.2	73.8
6. Zn 3rd Cl. Tail.	1.51	1.53	22.1	0.4	3.5
7. Zn 2nd Cl. Tail.	2.51	1.33	9.70	0.6	2.6
9. Zn 1st Cl. Tail.	6.38	0.91	2.75	1.0	1.8
9. Zn Rougher Tail.	63.24	0.48	0.65	5.1	4.2
Head (Calculated)	100.00	5.86	9.54	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.44	58.0	6.83	83.5	6.1
Products 1 to 3	10.29	50.2	8.15	88.2	8.9
Products 1 to 4	13.89	38.7	9.59	91.7	14.1
Products 5 and 6	13.98	0.66	52.8	1.6	77.3
Products 5 to 7	16.49	0.77	46.2	2.2	79.9
Products 5 to 8	22.87	0.81	34.1	3.2	81.7

Test No. 247

Purpose: To investigate the effect of a coarser primary grind on the flotation of composite No. 2.

Procedure: Standard.

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

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

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC	R-242	Ca-(OH) <sub>2</sub>	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	-	-	20	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.0
	-	-	-	0.02	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	-	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	0.03	-	-	2	3	9.1
	-	-	-	0.005	-	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	-	1	3	9.2
	-	-	-	-	-	0.01	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	-	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	2	9.3
Combine Pb rougher and 1st cleaner tailings for zinc flotation.											
		CuSO <sub>4</sub>	Na <sub>2</sub> -SiO <sub>3</sub>		M-748	DF-250					
Condition	-	1.5	-	-	-	-	2.5	-	2	-	10.9
Zn Rougher	-	-	-	0.01	0.06	0.02	-	-	2	3	-
	-	-	-	0.02	0.02	0.01	-	-	2	5	-
Zn Conc. Reagr.	-	0.5	-	-	0.04	-	1.0	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	10.9
	-	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	0.1	-	-	-	0.5	-	1	2	11.1
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	-	-	0.1	0.005	-	0.005	0.3	-	1	3	11.2

Test No. 247 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.48	62.9	5.89	71.0	4.0
2. Pb 4th Cl. Tail.	1.01	31.9	10.0	5.6	1.1
3. Pb 3rd Cl. Tail.	1.38	16.0	12.6	3.8	1.8
4. Pb 2nd Cl. Tail.	4.35	14.7	14.9	11.1	6.8
5. Zn Cleaner Conc.	12.76	0.58	56.2	1.3	75.1
6. Zn 3rd Cl. Tail.	1.52	1.54	23.4	0.4	3.7
7. Zn 2nd Cl. Tail.	2.17	1.50	8.60	0.6	1.9
8. Zn 1st Cl. Tail.	7.40	0.88	1.73	1.1	1.3
9. Zn Rougher Tail.	62.93	0.46	0.65	5.1	4.3
Head (Calculated)	100.00	5.74	9.56	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.49	58.7	6.44	76.6	5.1
Products 1 to 3	8.87	52.1	7.40	80.4	6.9
Products 1 to 4	13.22	39.8	9.87	91.5	13.7
Products 5 and 6	14.28	0.68	52.7	1.7	78.8
Products 5 to 7	16.45	0.79	46.9	2.3	80.7
Products 5 to 8	23.85	0.82	32.9	3.4	82.0

Test No. 248

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

Procedure: Standard.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	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	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	0.04	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.3
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	-	-	1	3	9.3
	-	-	-	0.01	0.005	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.005	-	-	-	1	3	9.4
Pb 4th Cl.	0.1	-	0.05	-	0.01	-	-	-	1	2	9.4
Combine lead rougher and 1st cleaner tailing for zinc flotation.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	-	-	10.9
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Reagr.	-	-	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	-	0.2	-	0.01	-	-	-	-	1	3	11.0
	0.005	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.2
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.3

Test No. 248 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.64	70.4	4.62	81.5	3.2
2. Pb 4th Cl. Tail.	0.70	33.9	12.1	4.1	0.9
3. Pb 3rd Cl. Tail.	0.79	17.2	15.1	2.4	1.2
4. Pb 2nd Cl. Tail.	2.97	7.94	15.7	4.1	4.9
5. Zn Cleaner Conc.	11.59	0.52	57.6	1.1	69.6
6. Zn 3rd Cl. Tail.	2.01	0.90	35.6	0.3	7.5
7. Zn 2nd Cl. Tail.	2.30	0.96	16.9	0.4	4.1
8. Zn 1st Cl. Tail.	5.71	0.79	6.35	0.8	3.8
9. Zn Rougher Tail.	67.29	0.46	0.70	5.3	4.8
Head (Calculated)	100.00	5.74	9.59	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.34	66.9	5.33	85.6	4.1
Products 1 to 3	8.13	62.1	6.28	88.0	5.3
Products 1 to 4	11.10	47.6	8.80	92.1	10.2
Products 5 and 6	13.60	0.58	54.4	1.4	77.1
Products 5 to 7	15.90	0.63	48.9	1.8	81.2
Products 5 to 8	21.61	0.67	37.7	2.6	85.0

Test No. 249

Purpose: To investigate the effect of using Z-6 as the only collector in both lead and zinc circuits.

Procedure: Standard.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z - 6	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	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	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.20	0.04	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.3
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	-	-	1	3	9.4
	-	-	-	0.01	0.005	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.005	-	-	-	1	3	9.4
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailings for zinc flotation.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	-	-	11.0
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Regr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1
	0.005	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.3
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.4

Test No. 249 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.42	69.3	4.99	87.0	3.8
2. Pb 4th Cl. Tail.	1.01	22.3	14.8	3.8	1.6
3. Pb 3rd Cl. Tail.	1.08	7.40	16.9	1.4	1.9
4. Pb 2nd Cl. Tail.	2.91	2.48	14.9	1.2	4.5
5. Zn Cleaner Conc.	11.96	0.42	57.9	0.8	71.8
6. Zn 3rd Cl. Tail.	1.45	0.86	36.1	0.2	5.4
7. Zn 2nd Cl. Tail.	2.69	0.95	16.8	0.4	4.7
8. Zn 1st Cl. Tail.	6.64	0.65	3.39	0.7	2.3
9. Zn Rougher Tail.	64.84	0.40	0.59	4.5	4.0
Head (Calculated)	100.00	5.91	9.64	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.43	63.7	6.16	90.8	5.4
Products 1 to 3	9.51	57.3	7.38	92.2	7.3
Products 1 to 4	12.42	44.4	9.15	93.4	11.8
Products 5 and 6	13.41	0.47	55.5	1.0	77.2
Products 5 to 7	16.10	0.55	49.1	1.4	81.9
Products 5 to 8	22.74	0.58	35.7	2.1	84.2

Test No. 250

Purpose: To investigate the effect of using Aero Xanthate 350 as the only collector in both lead and zinc circuits.

Procedure: Standard.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	AX-350	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	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	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	0.04	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.2
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	-	-	1	3	9.3
	-	-	-	0.01	0.005	-	-	-	1	3	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.005	-	-	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	2	9.4
Combine Pb rougher and 1st cleaner tailings for zinc flotation.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	2	-	10.9
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Reagr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1
	0.005	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.3
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.4

Test No. 250 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.24	70.3	4.51	86.8	3.4
2. Pb 4th Cl. Tail.	1.08	22.4	14.5	4.1	1.6
3. Pb 3rd Cl. Tail.	1.12	6.99	15.8	1.3	1.8
4. Pb 2nd Cl. Tail.	2.46	2.25	14.2	1.0	3.6
5. Zn Cleaner Conc.	11.80	0.46	57.3	0.9	70.1
6. Zn 3rd Cl. Tail.	1.69	0.78	34.9	0.2	6.1
7. Zn 2nd Cl. Tail.	2.57	0.82	18.5	0.4	4.9
8. Zn 1st Cl. Tail.	6.49	0.64	6.70	0.7	4.5
9. Zn Rougher Tail.	65.55	0.41	0.58	4.6	4.0
Head (Calculated)	100.00	5.86	9.65	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.32	64.1	5.81	90.9	5.0
Products 1 to 3	9.44	57.3	6.99	92.2	6.8
Products 1 to 4	11.90	45.9	8.48	93.2	10.4
Products 5 and 6	13.49	0.50	54.5	1.1	76.2
Products 5 to 7	16.06	0.55	48.7	1.5	81.1
Products 5 to 8	22.55	0.58	36.6	2.2	85.6

Test No. 251

Purpose: To investigate the effect of using a 1:1 mixture of Z-6 and Z-11 as collector in both lead and zinc circuits.

Procedure: Standard.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-6: Z-11	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	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	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.20	0.04	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.3
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	-	-	1	3	9.5
	-	-	-	0.01	0.005	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	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.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	2	-	-
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Regr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1
	0.01	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.3
	-	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.5

Test No. 251 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.68	63.1	5.64	83.0	4.4
2. Pb 4th Cl. Tail.	1.04	33.4	13.5	6.0	1.4
3. Pb 3rd Cl. Tail.	1.60	10.6	16.7	1.9	1.8
4. Pb 2nd Cl. Tail.	2.48	3.40	15.7	1.4	4.0
5. Zn Cleaner Conc.	12.05	0.49	57.1	1.0	70.3
6. Zn 3rd Cl. Tail.	1.35	0.96	34.3	0.2	4.7
7. Zn 2nd Cl. Tail.	2.52	0.94	17.9	0.4	4.6
8. Zn 1st Cl. Tail.	7.14	0.73	6.66	0.9	4.9
9. Zn Rougher Tail.	64.68	0.47	0.59	5.2	3.9
Head (Calculated)	100.00	5.84	9.79	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.72	59.6	6.58	89.0	5.8
Products 1 to 3	9.78	54.3	7.67	90.9	7.6
Products 1 to 4	12.26	44.0	9.30	92.3	11.6
Products 5 and 6	13.40	0.54	54.8	1.2	75.0
Products 5 to 7	15.92	0.60	49.0	1.6	79.6
Products 5 to 8	23.06	0.64	35.9	2.5	84.5

Test No. 252

Purpose: To investigate the effect of using Z-6 as collector in the lead rougher and R-241 as collector in the lead cleaners.

Procedure: Lead circuit only.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-6	MIBC	R-241	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	0.03	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	-	-	0.05	40	-	-	-
Pb 1st Cl.	-	-	-	-	-	-	-	1	3	9.3
	-	-	-	-	-	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	-	-	-	1	3	9.3
	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	-	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	1	2	9.4

Test No. 252 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.85	69.5	4.78	82.0	3.5
2. Pb 4th Cl. Tail.	0.72	31.4	12.4	3.9	0.9
3. Pb 3rd Cl. Tail.	1.52	16.0	15.8	4.2	2.5
4. Pb 2nd Cl. Tail.	3.72	4.32	14.9	2.8	5.9
5. Pb 1st Cl. Tail.	13.49	0.75	12.2	1.7	17.4
6. Pb Rougher Tail.	73.70	0.43	8.95	5.4	69.8
Head (Calculated)	100.00	5.81	9.45	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.57	65.9	5.50	85.9	4.4
Products 1 to 3	9.09	57.5	7.23	90.1	6.9
Products 1 to 4	12.81	42.1	9.46	92.9	12.8
Products 1 to 5	26.30	20.9	10.9	94.6	30.2

Test No. 253

Purpose: To investigate the effect of using a 3:1 mixture of Z-6:241 as lead collector.

Procedure: Lead circuit only.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-6:241	MIBC	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.30	0.07	-	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. Regr.	1.0	0.5	0.20	0.05	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	1	3	9.2
	-	-	-	0.01	0.005	-	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	-	-	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	-	-	1	2	9.4

Test No. 253 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.85	65.1	5.54	87.7	4.5
2. Pb 4th Cl. Tail.	1.00	16.9	15.2	2.9	1.6
3. Pb 3rd Cl. Tail.	1.55	5.96	15.8	1.6	2.5
4. Pb 2nd Cl. Tail.	2.89	1.82	14.2	0.9	4.3
5. Pb 1st Cl. Tail.	14.70	0.68	12.6	1.7	19.2
6. Pb Rougher Tail.	72.01	0.42	9.08	5.2	67.9
Head (Calculated)	100.00	5.83	9.63	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.85	59.7	6.63	90.6	6.1
Products 1 to 3	10.40	51.7	8.00	92.2	8.6
Products 1 to 4	13.29	40.8	9.35	93.1	21.9
Products 1 to 5	27.99	19.7	11.1	94.8	32.1

Test No. 254

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

Procedure: Standard.

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	D.O. O <sub>2</sub> ppm
	Na <sub>2</sub> - CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC	Ca- (OH) <sub>2</sub>	CuSO <sub>4</sub>	Grind	Cond.	Froth		
Primary Grind	2.0	1.0	0.3	0.05	-	-	-	30	-	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.2	8.0
	-	-	-	0.02	0.03	-	-	-	1	3	-	-
	-	-	-	0.01	0.03	-	-	-	1	3	-	-
Pb Conc. Regr.	0.7	0.5	0.20	0.03	-	-	-	30	-	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.2	-
	-	-	-	0.01	0.01	-	-	-	1	3	-	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	-	-	1	3	9.5	-
	-	-	-	0.01	0.005	-	-	-	1	1	-	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	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 tailing for zinc flotation.												
	DF- 250	Na <sub>2</sub> - SiO <sub>3</sub>										
Condition	-	-	-	-	-	2.5	1.5	-	2	-	11.0	-
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-	-
	0.02	-	-	0.04	-	-	-	-	1	5	-	-
Zn Conc. Regr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	1	3	11.1	-
	0.04	-	-	0.02	-	-	-	-	1	3	-	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.3	-
	0.02	-	-	0.01	-	-	-	-	1	3	-	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.5	-

Test No. 254 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.57	61.5	6.99	89.0	4.9
2. Pb 4th Cl. Tail.	0.76	6.16	17.1	1.0	1.4
3. Pb 3rd Cl. Tail.	1.23	3.61	15.7	1.0	2.1
4. Pb 2nd Cl. Tail.	2.36	1.31	14.0	0.7	3.5
6. Zn Cleaner Conc.	13.14	0.45	57.0	1.3	80.3
7. Zn 3rd Cl. Tail.	0.62	1.63	22.3	0.2	1.5
8. Zn 2nd Cl. Tail.	1.21	1.25	8.68	0.3	1.1
9. Zn 1st Cl. Tail.	6.02	0.78	2.29	1.0	1.5
10. Zn Rougher Tail.	68.09	0.36	0.50	5.5	3.7
Head (Calculated)	100.00	4.54	9.32	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.33	55.8	8.04	90.0	6.3
Products 1 to 3	8.56	48.3	9.14	91.0	8.4
Products 1 to 4	10.92	38.1	10.2	91.7	11.9
Products 5 and 6	13.76	0.50	55.4	1.5	81.8
Products 5 to 7	14.97	0.56	51.7	1.8	82.9
Products 5 to 8	20.99	0.63	37.5	2.8	84.4

Test No. 255

Purpose: To investigate the effect on the lead flotation of adding SO<sub>2</sub> to the grind.

Procedure: Lead circuit only.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	SO <sub>2</sub>	Z-11	MIBC	R-242	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	0.30	1.5	0.07	-	-	30	-	-	-
Pb Rougher	1.0	-	-	-	0.02	0.06	-	-	1	3	8.5
	-	-	-	-	0.02	0.03	-	-	1	3	-
	-	-	-	-	0.01	0.03	-	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.20	-	-	-	0.05	40	-	-	-
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	-	1	3	9.2
Pb 4th Cl.	0.1	-	0.05	-	-	-	-	-	1	2	9.2

Test No. 255 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.80	72.9	3.91	72.3	2.4
2. Pb 4th Cl. Tail.	0.93	46.5	9.59	7.4	1.0
3. Pb 3rd Cl. Tail.	1.13	24.9	13.8	4.8	1.7
4. Pb 2nd Cl. Tail.	2.99	8.04	14.7	4.1	4.7
5. Pb 1st Cl. Tail.	10.40	1.15	12.9	2.0	14.4
6. Pb Rougher Tail.	78.75	0.69	8.99	9.4	75.8
Head (Calculated)	100.00	5.85	9.33	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.73	69.3	4.65	79.7	3.4
Products 1 to 3	7.86	62.9	5.96	84.5	5.1
Products 1 to 4	10.85	47.8	8.37	88.6	9.8
Products 1 to 5	21.25	25.0	10.6	90.6	24.2

Test No. 256

Purpose: To repeat test No. 255, but omit cyanide and slightly reduce SO<sub>2</sub> addition.

Procedure: Lead circuit only.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	SO <sub>2</sub>	Z-11	MIBC	NaCN	R-242	Grind	Cond.	Froth	
Primary Grind	4.0	1.0	1.0	0.07	-	-	-	30	-	-	-
Pb Rougher	0.5	-	-	0.04	0.09	-	-	-	1	3	8.6
	-	-	-	0.02	0.03	-	-	-	1	3	-
	-	-	-	0.02	0.03	-	-	-	1	3	-
Pb Conc. Regr.	1.0	0.5	-	-	-	0.20	0.05	40	-	-	-
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
	-	-	-	-	-	-	0.01	-	1	1	-
Pb 3rd Cl.	0.1	0.1	-	-	-	0.05	0.005	-	1	3	9.2
Pb 4th Cl.	0.1	-	-	-	-	0.05	-	-	1	2	9.2

Test No. 256 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.44	68.4	4.53	64.1	2.7
2. Pb 4th Cl. Tail.	1.35	42.3	9.60	9.8	1.4
3. Pb 3rd Cl. Tail.	1.58	20.6	12.8	5.6	2.2
4. Pb 2nd Cl. Tail.	4.64	6.50	12.7	5.2	6.3
5. Pb 1st Cl. Tail.	12.04	1.68	12.0	3.5	15.5
6. Pb Rougher Tail.	74.95	0.91	8.92	11.8	71.9
Head (Calculated)	100.00	5.80	9.30	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.79	63.2	5.54	73.9	4.1
Products 1 to 3	8.37	55.2	6.91	79.5	6.3
Products 1 to 4	13.01	37.8	8.97	84.7	12.6
Products 1 to 5	25.05	20.4	10.4	88.2	28.1

Test No. 257

Purpose: To perform the standard test on Composite No. 5.  
 Procedure: Standard.  
 Feed: 2000 grams minus 10 mesh 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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z-11	MIBC	R-242	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	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	0.03	-	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	-	-	0.05	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	0.005	-	-	-	-	-	1	3	9.2
	-	-	-	0.005	-	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.1	-	-	-	-	-	-	1	2	9.3
	-	-	-	-	-	0.01	-	-	-	1	2	-
Pb 3rd Cl.	0.1	0.1	0.05	-	-	0.005	-	-	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	-	1	2	9.4
Combine lead rougher and 1st cleaner tailings for zinc flotation.												
	M-748	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	-	2.5	1.5	-	3	-	11.0
Zn Rougher	0.06	0.01	-	0.02	-	-	-	-	-	2	4	-
	0.02	0.01	-	0.03	-	-	-	-	-	1	5	-
Zn Conc. Reagr.	0.02	-	0.2	-	-	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	-	0.01	-	0.01	-	-	-	-	-	1	3	11.2
	-	0.01	-	0.02	-	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	0.1	-	-	-	0.5	-	-	1	3	11.3
	-	-	-	0.01	-	-	-	-	-	1	2	-
Zn 3rd Cl.	-	-	0.1	0.005	-	-	0.3	-	-	1	3	11.4

Test No. 257 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.30	60.9	7.90	87.4	6.1
2. Pb 4th Cl. Tail.	0.86	13.0	17.2	1.9	1.4
3. Pb 3rd Cl. Tail.	1.63	6.87	17.7	1.9	2.7
4. Pb 2nd Cl. Tail.	4.92	2.50	16.1	2.1	7.4
5. Zn Cleaner Conc.	14.53	0.53	53.6	1.3	72.5
6. Zn 3rd Cl. Tail.	3.33	1.09	15.4	0.6	4.8
7. Zn 2nd Cl. Tail.	2.44	0.95	6.43	0.4	1.5
8. Zn 1st Cl. Tail.	8.87	0.60	1.52	0.9	1.3
9. Zn Rougher Tail.	55.12	0.35	0.47	3.5	2.3
Head (Calculated)	100.00	5.78	10.7	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.16	56.4	8.78	89.3	7.5
Products 1 to 3	10.79	48.9	10.1	91.2	10.2
Products 1 to 4	15.71	34.4	12.0	93.3	17.6
Products 5 and 6	17.86	0.63	46.5	1.9	77.3
Products 5 to 7	20.30	0.67	41.7	2.3	78.8
Products 5 to 8	29.17	0.65	29.5	3.2	80.1

Test No. 258

Purpose: To repeat the lead circuit of test No. 249 (Z-6 as collector), but regrind the lead rougher concentrate in the ball mill.

Procedure: Lead circuit only.

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 <sub>2</sub> CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z - 6	MIBC	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	0.03	-	1	3	-
	-	-	-	0.01	0.03	-	1	3	-
Pb Conc. Reagr.	1.0	0.5	0.20	0.04	-	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	1	3	9.2
	-	-	-	0.01	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	1	3	9.4
	-	-	-	0.01	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.01	-	1	3	9.4
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.5

Stage	Pb Rougher	Pb Reagrind	Pb 1st Cleaner	Pb 2nd to 4th Cleaner
Equipment	1000 g D - 1	Lab Ball Mill	500 g D - 1	250 g D - 1
Speed: r.p.m.	1800	-	1300	1000
% Solids	33	-	-	-

Test No. 258 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.62	58.4	7.10	85.8	6.6
2. Pb 4th Cl. Tail.	1.10	18.6	15.0	3.5	1.8
3. Pb 3rd Cl. Tail.	1.27	7.48	15.0	1.6	2.0
4. Pb 2nd Cl. Tail.	2.63	2.70	14.1	1.2	4.0
5. Pb 1st Cl. Tail.	14.74	1.09	12.0	2.7	19.0
6. Pb Rougher Tail.	71.64	0.42	8.66	5.2	66.6
Head (Calculated)	100.00	5.87	9.31	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	9.72	53.9	8.00	89.3	8.4
Products 1 to 3	10.99	48.5	8.80	90.9	10.4
Products 1 to 4	13.62	39.7	9.83	92.1	14.4
Products 1 to 5	28.36	19.6	11.0	94.8	33.4
Products 5 and 6	86.38	0.53	9.23	7.9	85.6

Screen Analyses

Composite Pb Cleaner Products

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 25.6 μm	8.2	8.2	91.8
19.9	7.8	16.0	84.0
13.9	16.3	32.3	67.7
9.5	16.6	48.9	51.1
7.4	10.5	59.4	40.6
- 7.4	40.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.55

Test No. 259

Purpose: To repeat test No. 258, but increase lead regrind time to 40 minutes.

Procedure: Lead circuit only.

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 <sub>2</sub> CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Z - 6	MIBC	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	0.03	-	1	3	-
	-	-	-	0.01	0.03	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.20	0.05	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	1	3	9.1
	-	-	-	0.01	0.01	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.10	-	0.01	-	1	3	9.2
	-	-	-	0.01	0.005	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.01	-	1	3	9.3
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	1	2	9.4

Stage                      Pb Regrind  
Equipment                Ball Mill

Test No. 259 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	7.05	64.8	5.76	77.6	4.4
2. Pb 4th Cl. Tail.	1.31	33.3	12.0	7.4	1.7
3. Pb 3rd Cl. Tail.	1.49	14.1	14.4	3.6	2.3
4. Pb 2nd Cl. Tail.	2.59	5.24	14.0	2.3	3.9
5. Pb 1st Cl. Tail.	13.80	1.82	12.3	4.3	18.4
6. Pb Rougher Tail.	73.76	0.39	8.69	4.8	69.3
Head (Calculated)	100.00	5.89	9.25	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.36	59.9	6.74	85.0	6.1
Products 1 to 3	9.85	52.9	7.90	88.6	8.4
Products 1 to 4	12.44	43.0	9.17	90.9	12.3
Products 1 to 5	26.24	21.3	10.8	95.2	30.7
Products 5 and 6	87.56	0.62	9.26	9.1	87.7

Screen Analyses - Composite Pb Cleaner Products

Particle Size	% Retained		% Passing Cumulative
	Individual	Cumulative	
+ 25.6 µm	4.2	4.2	95.8
19.9	5.7	9.9	90.1
13.9	14.2	24.1	75.9
9.5	16.5	40.6	59.4
7.4	11.3	51.9	48.1
- 7.4	48.1	100.0	-
Total	100.0	-	-

Specific Gravity 4.60

Test No. 260

Purpose: To grind with Na<sub>2</sub>S, Na<sub>2</sub>SO<sub>3</sub>, Ca(OH)<sub>2</sub> and Z-6 and condition with SO<sub>2</sub> at pH 6.8 prior to lead flotation.

Procedure: Standard.

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 <sub>2</sub> S	Na <sub>2</sub> -SO <sub>3</sub>	Ca-(OH) <sub>2</sub>	Z - 6	MIBC	SO <sub>2</sub>	Na <sub>2</sub> -CO <sub>3</sub>	NaCN	Grind	Cond.	Froth	
Primary Grind	1.0	1.0	2.0	0.07	-	-	-	-	30	-	-	11.1
Condition	-	-	-	-	-	2.1	-	-	-	5	-	6.8
Pb Rougher	-	-	-	0.05	0.06	-	-	-	-	1	3	-
	-	-	-	0.02	0.03	-	-	-	-	1	3	-
	-	-	-	0.01	0.02	-	-	-	-	1	3	-
Pb Conc. Reagr.	-	-	-	0.04	-	-	1.0	0.20	40	-	-	-
Pb 1st Cl.	-	-	-	0.01	-	-	-	-	-	1	3	8.8
	-	-	-	0.01	-	-	-	-	-	1	3	-
Pb 2nd Cl.	-	-	-	-	-	-	0.2	0.10	-	1	2	9.3
	-	-	-	0.01	0.005	-	-	-	-	1	2	-
Pb 3rd Cl.	-	-	-	0.005	0.005	-	0.1	0.05	-	1	3	9.4
Pb 4th Cl.	-	-	-	-	0.005	-	0.1	0.05	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailings for zinc flotation.												
	Cu-SO <sub>4</sub>	DF-250										
Condition	1.5	-	3.0	-	-	-	-	-	-	3	-	11.1
Zn Rougher	-	0.01	-	0.10	-	-	-	-	-	1	3	-
	-	-	-	0.05	-	-	-	-	-	1	5	-
Zn Conc. Reagr.	0.5	-	1.0	0.03	-	-	-	-	15	-	-	-
Zn 1st Cl.	-	-	-	0.01	-	-	-	-	-	1	3	11.1
	-	0.005	-	0.02	-	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	0.5	-	-	-	-	-	-	1	2	11.4
	-	0.005	-	0.01	-	-	-	-	-	1	2	-
Zn 3rd Cl.	-	0.005	0.3	0.01	-	-	-	-	-	1	3	11.6

Test No. 260 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	3.49	68.6	4.29	41.5	1.6
2. Pb 4th Cl. Tail.	0.59	39.1	9.30	4.0	0.6
3. Pb 3rd Cl. Tail.	0.99	29.8	11.5	5.1	1.2
4. Pb 2nd Cl. Tail.	1.75	16.8	13.4	5.1	2.5
5. Zn Cleaner Conc.	14.45	3.20	51.4	8.0	79.4
6. Zn 3rd Cl. Tail.	2.11	14.4	17.8	5.3	4.0
7. Zn 2nd Cl. Tail.	4.53	12.9	6.07	10.1	2.9
8. Zn 1st Cl. Tail.	12.53	5.31	1.74	11.5	2.3
9. Zn Rougher Tail.	59.56	0.90	0.84	9.4	5.5
Head (Calculated)	100.00	5.77	9.35	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	4.08	64.3	5.01	45.5	2.2
Products 1 to 3	5.07	57.6	6.28	50.6	3.4
Products 1 to 4	6.82	47.1	8.11	55.7	5.9
Products 5 and 6	16.56	4.63	47.1	13.3	83.4
Products 5 to 7	21.09	6.40	38.3	23.4	86.3
Products 5 to 8	33.62	6.00	24.7	34.9	88.6

Test No. 261

Purpose: To investigate the effect of replacing some of the NaCN with Na<sub>2</sub>SO<sub>3</sub> in the grind and in the lead circuit.

Procedure: Standard.

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 <sub>2</sub> -CO <sub>3</sub>	ZnSO <sub>4</sub>	NaCN	Na <sub>2</sub> -SO <sub>3</sub>	Z - 6	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	Grind	Cond.	Froth	
Primary Grind	2.0	1.0	0.20	0.50	0.07	-	-	-	30	-	-	-
Pb Rougher	-	-	-	-	0.02	0.06	-	-	-	1	3	8.9
	-	-	-	-	0.02	0.03	-	-	-	1	3	-
	-	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Regr.	1.0	0.5	0.15	0.25	0.04	-	-	-	40	-	-	-
Pb 1st Cl.	-	-	-	-	-	0.005	-	-	-	1	3	9.1
	-	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.2	0.05	0.10	-	0.01	-	-	-	1	3	9.1
	-	-	-	-	0.01	0.005	-	-	-	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
Combine Pb rougher and 1st cleaner tailings for zinc flotation.												
	M-748	DF-250										
Condition	-	-	-	-	-	-	2.5	1.2	-	3	-	11.0
Zn Rougher	0.06	0.01	-	-	0.04	-	-	-	-	2	3	-
	0.04	0.02	-	-	0.04	-	-	0.3	-	2	5	-
Zn Conc. Regr.	0.04	-	-	-	-	-	1.0	0.5	10	-	-	-
Zn 1st Cl.	-	0.005	-	-	0.02	-	-	-	-	1	3	11.1
	-	0.010	-	-	0.03	-	-	-	-	1	3	-
Zn 2nd Cl.	-	-	-	-	0.01	-	0.5	-	-	1	2	11.3
	-	0.005	-	-	0.01	-	-	-	-	1	2	-
Zn 3rd Cl.	-	0.005	-	-	0.01	-	0.3	-	-	1	3	11.5

Test No. 261 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	8.00	66.6	5.60	89.9	4.7
2. Pb 4th Cl. Tail.	0.44	13.8	15.9	1.0	0.7
3. Pb 3rd Cl. Tail.	0.99	7.87	16.5	1.3	1.7
4. Pb 2nd Cl. Tail.	2.29	1.97	15.0	0.8	3.6
5. Zn Cleaner Conc.	14.29	0.53	54.9	1.3	82.7
6. Zn 3rd Cl. Tail.	1.72	1.09	9.91	0.3	1.8
7. Zn 2nd Cl. Tail.	2.54	0.83	2.24	0.4	0.6
8. Zn 1st Cl. Tail.	3.59	0.68	1.08	0.4	0.5
9. Zn Rougher Tail.	66.14	0.42	0.52	4.6	3.7
Head (Calculated)	100.00	5.93	9.48	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	8.44	63.9	6.14	90.9	5.4
Products 1 to 3	9.43	57.9	7.22	92.2	7.1
Products 1 to 4	11.72	47.0	8.74	93.0	10.7
Products 5 and 6	16.01	0.59	50.1	1.6	84.5
Products 5 to 7	18.55	0.62	43.5	2.0	85.1
Products 5 to 8	22.14	0.63	36.6	2.4	85.6

Test No. 262

Purpose: To conduct a flotation test to determine the effect of replacing ZnSO<sub>4</sub> additions with Na<sub>2</sub>SO<sub>3</sub>.

Procedure: Standard.

Feed: 2000 grams minus 10 mesh ore composite 3.

Grind: 30 minutes at 65 percent solids.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na <sub>2</sub> -CO <sub>3</sub>	Na <sub>2</sub> -SO <sub>3</sub>	NaCN	Z-11	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	Grind	Cond.	Froth	
Primary Grind	2.0	1.5	0.2	0.05	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.5
	-	-	-	0.02	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	0.7	0.75	0.2	0.03	-	-	-	30	-	-	-
Pb 1st Cl.	-	-	-	0.02	0.005	-	-	-	1	4	9.7
	-	-	-	0.002	0.005	-	-	-	1	4	-
Pb 2nd Cl.	0.2	0.3	0.1	-	0.01	-	-	-	1	3	9.6
	-	-	-	0.01	0.005	-	-	-	1	2	-
Pb 3rd Cl.	0.1	0.2	0.05	0.005	0.005	-	-	-	1	3	9.5
	-	-	-	0.005	0.005	-	-	-	1	1	-
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	3	9.6
Combine Pb rougher and 1st cleaner tailing for zinc flotation.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	2	-	-
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	11.1
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Reagr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	0.01	-	-	0.01	-	-	-	-	1	3	11.2
	0.02	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	2	11.5
	0.02	-	-	0.01	-	-	-	-	1	3	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	3	11.6

Comments: Addition of Na<sub>2</sub>SO<sub>3</sub> to Pb rougher regrind appeared excessive. Pb minerals were not activated after regrind.

Stage	Rougher	Pb 1st to 3rd Cl.	Pb 4th Cleaner	Zn Cleaners
Flotation Cell	1000 g D - 1	500 g D - 1	250 g D - 1	500 g D - 1
Speed: r.p.m.	1700	1150	900	1150

Test No. 262 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	6.36	61.4	8.07	84.6	5.4
2. Pb 4th Cl. Tail.	1.19	15.1	19.1	3.9	2.4
3. Pb 3rd Cl. Tail.	1.83	5.87	18.3	2.3	3.5
4. Pb 2nd Cl. Tail.	5.44	1.88	18.1	2.2	10.4
5. Zn Cleaner Conc.	10.81	0.42	53.3	1.0	60.7
6. Zn 3rd Cl. Tail.	2.42	0.74	27.8	0.4	7.1
7. Zn 2nd Cl. Tail.	2.60	0.67	13.9	0.4	3.8
8. Zn 1st Cl. Tail.	7.29	0.50	4.88	0.8	3.8
9. Zn Rougher Tail.	62.06	0.33	0.44	4.4	2.9
Head (Calculated)	100.0	4.62	9.48	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	7.55	54.1	9.81	88.5	7.8
Products 1 to 3	9.38	44.7	11.5	90.8	11.3
Products 1 to 4	14.82	29.0	13.9	93.0	21.7
Products 5 and 6	13.23	0.48	48.6	1.4	67.8
Products 5 to 7	15.83	0.51	42.9	1.8	71.6
Products 5 to 8	23.12	0.51	30.9	2.6	75.4

Test No. 263

Purpose: To conduct a flotation test to determine the effect of replacing Z-11 with Z-6 as collector.

Procedure: Standard.

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

Grind: 30 minutes at 65 percent solids.

Conditions:

Stage	Reagents Added, pounds per ton							Time, minutes			pH
	Na <sub>2</sub> -CO <sub>3</sub>	Na <sub>2</sub> -SO <sub>3</sub>	NaCN	Z - 6	MIBC	Ca-(OH) <sub>2</sub>	CuSO <sub>4</sub>	Grind	Cond.	Froth	
Primary Grind	2.0	1.5	0.2	0.05	-	-	-	30	-	-	-
Pb Rougher	-	-	-	0.02	0.06	-	-	-	1	3	9.5
	-	-	-	0.02	0.03	-	-	-	1	3	-
	-	-	-	0.01	0.03	-	-	-	1	3	-
Pb Conc. Reagr.	0.7	0.3	0.2	0.03	-	-	-	30	-	-	-
Pb 1st Cl.	-	-	-	-	0.005	-	-	-	1	3	9.8
	-	-	-	0.01	0.01	-	-	-	1	3	-
Pb 2nd Cl.	0.2	0.1	0.10	-	0.01	-	-	-	1	3	-
	-	-	-	0.01	0.005	-	-	-	1	1	-
Pb 3rd Cl.	0.1	0.1	0.05	0.005	0.005	-	-	-	1	3	-
Pb 4th Cl.	0.1	-	0.05	-	0.005	-	-	-	1	2	9.5
Combine Pb rougher and 1st cleaner tailing for zinc flotation.											
	DF-250	Na <sub>2</sub> -SiO <sub>3</sub>									
Condition	-	-	-	-	-	2.5	1.5	-	2	-	11.1
Zn Rougher	0.01	-	-	0.05	-	-	-	-	1	3	-
	0.02	-	-	0.04	-	-	-	-	1	5	-
Zn Conc. Reagr.	-	0.2	-	0.02	-	1.0	0.5	15	-	-	-
Zn 1st Cl.	0.01	-	-	0.01	-	-	-	-	1	3	11.3
	0.02	-	-	0.02	-	-	-	-	1	3	-
Zn 2nd Cl.	-	0.1	-	-	-	0.5	-	-	1	3	-
	0.02	-	-	0.01	-	-	-	-	1	3	-
Zn 3rd Cl.	0.005	0.1	-	0.005	-	0.3	-	-	1	4	11.5

Comments: Zn minerals were present in Pb 3rd rougher stage, probably due to increased strength of Z-6 over Z-11.

Test No. 263 - Continued

Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
1. Pb Cleaner Conc.	5.98	61.9	7.86	82.6	4.9
2. Pb 4th Cl. Tail.	0.84	17.6	18.1	3.3	1.6
3. Pb 3rd Cl. Tail.	2.06	11.0	18.5	5.1	4.0
4. Pb 2nd Cl. Tail.	6.05	1.38	18.4	1.9	11.7
5. Zn Cleaner Conc.	13.41	0.40	51.1	1.2	72.1
6. Zn 3rd Cl. Tail.	1.02	1.11	13.8	0.3	1.5
7. Zn 2nd Cl. Tail.	1.73	0.76	2.59	0.3	0.5
8. Zn 1st Cl. Tail.	8.77	0.46	0.98	0.9	0.9
9. Zn Rougher Tail.	60.14	0.33	0.44	4.4	2.8
Head (Calculated)	100.00	4.48	9.51	100.0	100.0

Calculated Grades and Recoveries

Products 1 and 2	6.82	56.4	9.12	85.9	6.5
Products 1 to 3	8.88	45.9	11.3	91.0	10.5
Products 1 to 4	14.93	27.9	14.2	92.9	22.2
Products 5 and 6	14.43	0.45	48.5	1.5	73.6
Products 5 to 7	16.16	0.48	43.6	1.8	74.1
Products 5 to 8	24.93	0.47	28.6	2.7	75.0

LAKEFIELD RESEARCH OF CANADA LIMITED  
 Lakefield, Ontario  
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