A Pilot Plant Investigation of

THE RECOVERY OF LEAD AND ZINC

from Grum Deposit Samples

submitted by

KERR ADDISON MINES LIMITED

Progress Report No. 11, (Volume 3)

Project No. L.R. 2027

NOTE:

This report refers to the samples as received.

LAKEFIELD RESEARCH OF CANADA LIMITED
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REPORT COMPOSITION

VOLUME 1 - Summary, Discussion, Description of Equipment
Appendix No. 1 and No. 2
Tests PP-1 to PP-6

VOLUME 2 - Tests PP-7 to PP-23

VOLUME 3 - Tests PP-24 to PP-38

VOLUME 4 - Tests PP-39 to PP-53
Appendix No. 3

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Test No. PP24

1. Grinding

1.1. Purpose: To repeat the conditions of test PP23.

1.2. Method: Similar to test PP1 to 23. The grinding circuit was operated for a period of 7.4 hours at a feed rate of 696 pounds per hour. Samples were taken every 20 minutes during the last 1½ hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P-50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP23.

1.4. Results: The grinding circuit was stable during the test period. Net power consumption in the Hendy mill was 13.86 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 87.3 % minus 200 mesh.

Test No. PP24 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	696 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	600 pounds	
	1 inch balls	400 pounds	
	Total	2000 pounds	
Operating Time:	Total 7.25 hours, test period 2 hours		
Mill Feed:	Total 5046 pounds, test period 1392 pounds		
Circulating Load:	Cyclone underflow 533 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2106	67.9
	Cyclone Overflow	1348	34.2
	Cyclone Underflow	2480	72.1
Average Power:	Gross	6.77 kilowatts	
	No Load	1.92 kilowatts	
	Net	4.85 kilowatts	
Net Power Consumption:	13.86 kilowatt-hours per ton of ½ inch feed.		
Work Index:	11.25		

Test No. PP24 - Continued

1.4. Results:

1.4.2. Lead Regrind Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	103.1 pounds per hour, 14.82 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	380 pounds	
	1 inch balls	820 pounds	
	Total	1200 pounds	
Operating Time:	Total 7.25 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2354	73
	Cyclone Feed	1208	22
	Cyclone Overflow	1118	13
	Cyclone Underflow	2354	73
Average Power:	Gross	6.77 kilowatts	
	No Load	0.92 kilowatts	
	Net	5.85 kilowatts	
Net Power Consumption:	16.71 kilowatt-hours per ton of feed.		

Test No. PP24 - Continued

1.4. Results:

1.4.3. Zinc Regrind Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Rougher Concentrate, zinc 2nd Cl. Tail. and Zinc 1st Cleaner Scavenger Concentrate		
Feed Rate:	275.0 pounds per hour, 39.54 percent of the mill feed		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.25 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2546	80
	Cyclone Overflow	1068	8.5
	Cyclone Underflow	2546	80
Average Power:	Gross	2.02 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.10	kilowatts
Net Power Consumption:	3.14 kilowatt-hours per ton of feed.		

Test No. PP24 - Continued

1.4.4. Screen Analyses

Hendy Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	2.9	2.9	97.9
3	12.9	15.8	84.2
4	11.6	27.4	72.6
6	11.5	38.9	61.1
8	9.1	48.0	52.0
10	7.3	55.3	44.7
14	6.2	61.5	38.5
20	4.6	66.1	33.9
28	4.0	70.1	29.9
35	3.3	73.4	26.6
48	3.5	76.9	23.1
65	3.5	80.4	19.6
100	2.8	83.2	16.8
150	2.8	86.0	14.0
200	3.0	89.0	11.0
- 200	11.0	100.0	-
Total	100.0	-	-

Cyclone Underflow

+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.3	0.6	99.4
28	0.5	1.1	98.9
35	0.9	2.0	98.0
48	2.1	4.1	95.9
65	4.0	8.1	91.9
100	6.7	14.8	85.2
150	11.9	26.7	73.3
200	20.3	47.0	53.0
270	15.2	62.2	37.8
400	18.7	80.9	19.1
- 400	19.1	100.0	-
Total	100.0	-	-

Test No. PP24 - Continued

1.4.4. Screen Analyses

Mill Discharge

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 14	0.2	0.2	99.8
20	0.3	0.5	99.5
28	0.4	0.9	99.1
35	0.7	1.6	98.4
48	1.8	3.4	96.6
65	3.4	6.8	93.2
100	6.0	12.8	87.2
150	10.8	23.6	76.4
200	18.8	42.4	57.6
270	14.4	56.8	43.2
400	18.4	75.2	24.8
- 400	24.8	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.6	0.6	99.4
100	1.2	1.8	98.2
150	3.1	4.9	95.1
200	7.8	12.7	87.3
270	8.1	20.8	79.2
400	15.3	36.1	63.9
- 400	63.9	100.0	-
Total	100.0	-	-

Test No. PP24 - Continued

1.4.4. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	7.0	7.0	93.0
270	7.4	14.4	85.6
27.2 µm	17.6	32.0	68.0
21.1	8.6	40.6	59.4
14.6	12.6	53.2	46.8
10.1	10.8	64.0	36.0
7.8	7.2	71.2	28.8
- 7.8	28.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.86

Pb Regrind Discharge

+ 27.2 µm	12.4	12.4	87.6
21.1	9.1	21.5	78.5
14.7	22.4	43.9	56.1
10.1	23.8	67.7	32.3
7.8	10.6	78.3	21.7
- 7.8	21.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.96

Pb Regrind Cyclone Underflow

+ 200 mesh	2.6	2.6	97.4
270	3.6	6.2	93.8
27.2 µm	14.6	20.8	79.2
21.1	10.6	31.4	68.6
14.7	22.8	54.2	45.8
10.1	23.7	77.9	22.1
7.8	10.2	88.1	11.9
- 7.8	11.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.93

Test No. PP24 - Continued

1.4.4. Screen Analyses

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 27.8 µm	0.5	0.5	99.5
21.5	0.5	1.0	99.0
15.0	2.5	3.5	96.5
10.3	7.7	11.2	88.8
7.9	14.8	26.0	74.0
- 7.9	74.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.69

Pb 4th Cleaner Concentrate

+ 24.1 µm	4.0	4.0	96.0
18.7	2.8	6.8	93.2
13.0	10.2	17.0	83.0
8.9	16.4	33.4	66.6
6.9	13.6	47.0	53.0
- 6.9	53.0	100.0	-
Total	100.0	-	-

Specific Gravity 5.87

Zn Regrind Cyclone Underflow

+ 200 mesh	8.7	8.7	91.3
270	16.0	24.7	75.3
28.0 µm	16.7	41.4	58.6
217.	46.7	88.1	11.9
15.2	7.6	95.7	4.3
10.4	1.0	96.7	3.3
8.1	0.4	97.1	2.9
- 8.1	2.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.63

Test No. PP24 - Continued

1.4.4. Screen Analyses

Zn Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 29.0 µm	12.6	12.6	87.4
22.5	10.6	23.2	76.8
15.7	13.8	37.0	63.0
10.8	15.2	52.2	47.8
8.3	9.0	61.2	38.8
- 8.3	38.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.39

Zn 4th Cleaner Concentrate

+ 30.3 µm	5.4	5.4	94.6
23.5	9.4	14.8	85.2
16.4	17.5	32.3	67.7
11.3	14.3	46.6	53.4
8.6	9.6	56.2	43.8
- 8.6	43.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.12

Zn Combined Tailing

+ 200 mesh	10.0	10.0	90.0
270	6.6	16.6	83.4
33.2 µm	7.3	23.9	76.1
25.7	9.0	32.9	67.1
17.9	14.1	47.0	53.0
12.3	11.8	58.8	41.2
9.5	7.0	65.8	34.2
- 9.5	34.2	100.0	-
Total	100.0	-	-

Specific Gravity 3.60

Test No. PP24 - Continued

1.4.4. Screen Analyses

Zn Regrind Discharge

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 200 mesh	7.2	7.2	92.8
270	15.6	22.8	77.2
28.0 µm	15.6	38.4	61.6
21.7	43.4	81.8	18.2
15.2	12.4	94.2	5.8
10.4	1.4	95.6	4.4
8.1	0.6	96.2	3.8
- 8.1	3.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.67

Test No. PP24 - Continued

2. Flotation

2.1. Purpose:

1) To improve lead concentrate grade and recovery.
2) To improve zinc recovery.

2.2. Method:

The following mechanical and reagent changes were made:

A. Pb Circuit

1) Added Na_2S to the mill at a rate of 0.5 lb/ton.
2) Increased R-242 addition to the Pb rougher conditioner from 0.02 lb/t to 0.04 lb/t, and to the Pb 1st cleaner from 0.015 to 0.03 lb/t.

B. Zinc Circuit

1) Increased zinc flotation time by 4 minutes. The zinc scavenger No. 1 was a bank of 6 Fagergren No. 12 cells. The scavenger concentrate No. 2 was returned to the zinc 1st scavenger feed.
2) Increased Z-11 additions to the Zn rougher from 0.2 to 0.3 lb/ton, and increased Z-200 to the zinc cleaners.
3) pH in the zn rougher was maintained at pH 9.7 and in the zinc cleaners at pH 11.0

2.2.1. Flotation Equipment

As for test PP21, except that one bank of Fagergren No. 12 cells was used in the zinc 2nd scavenger circuit.

2.2.2. Flotation Reagents

See following page.

2.4. Results:

The addition of Na_2S to the mill resulted in improved selectivity between Pb-Zn and pyrite, as well as in improved froth conditions. However, lead middlings were depressed and poor recovery was obtained.

Changes in the zinc circuit improved zinc recovery.

Test No. PP24 - Continued

2.2.2. Reagent Additions

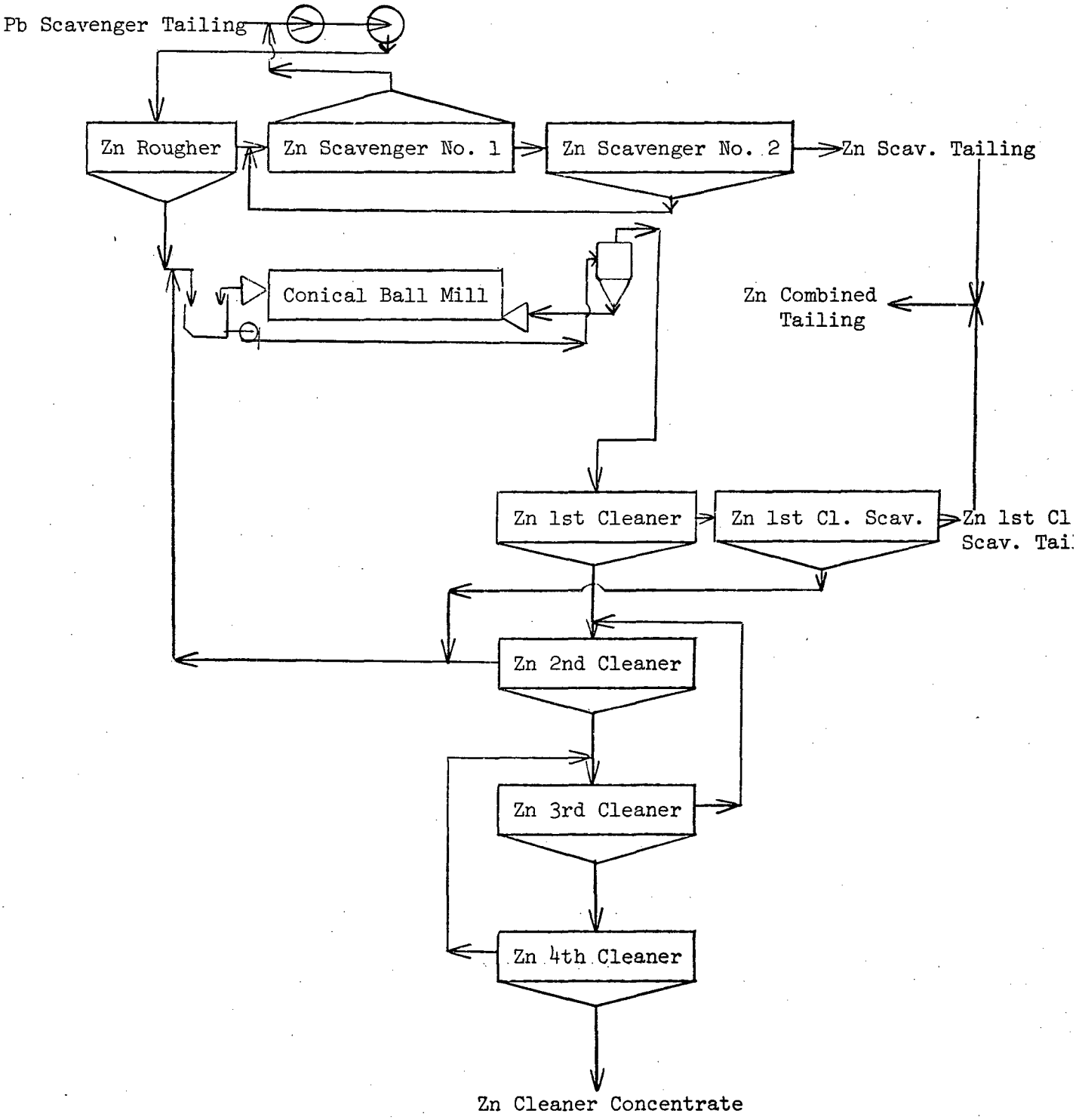
Type	Pounds of Reagent per Ton of Conc.	Point of Addition
Na_2CO_3	4.44	Ball Mill Feed
NaCN	0 31	Ball Mill Feed
Z-11	0.13	Ball Mill Feed
Na_2S	0.54	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.076	Pb Rougher Feed Pump
Z-11	0.03	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
R-242	0.08	Pb Regrind Mill
MIBC	0.030	Pb 1st Cleaner Feed
Z-11	0.02	Pb 1st Cleaner 4th Cell
NaCN	0.08	Pb 2nd Cleaner Feed
$CuSO_4$	2.04	Zn Ro. Conditioner No. 1
$Ca(OH)_2$	1.84	Zn Ro. Conditioner No. 2
Z-11	0.30	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
Z-200	0.156	Zn Rougher Feed Pump
MIBC	0.12	Zn Rougher Feed
Z-11	0.03	Zn Scavenger No. 1
DF-250	0.03	Zn Scavenger No. 1
Z-11	0.04	Zn Scavenger No. 2
Z-200	0.03	Zn Scavenger No. 2
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
Z-11	0.03	Zn 1st Cleaner Feed
DF-250	0.031	Zn 1st Cleaner Feed
$Ca(OH)_2$	1.02	Zn 1st Cleaner Feed
Z-200	0.022	Zn 1st Cleaner Scavenger
Z-11	0.04	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.44	Zn 2nd Cleaner Feed
Z-200	0.022	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 3rd Cleaner Feed
DF-250	0.18	Zn 3rd Cleaner Feed
Z-200	0.03	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 4th Cleaner Feed

Test No. PP24 - Continued

2.3. Flowsheet

a) Pb Circuit: As for test PP18

b) Zinc Circuit



Test No. PP24 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.1
Pb Rougher Feed	9.1
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	8.3
Pb 1st Cleaner Feed	9.3
Pb 2nd Cleaner Feed	9.5
Pb 3rd Cleaner Feed	9.5
Pb 4th Cleaner Feed	9.5
Pb Rougher Feed	9.8
Zn Scavenger Tailing	9.4
Zn 1st Cleaner Scav. Feed	10.7
Zn 1st Cleaner Feed	10.8
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	11.0
Zn 4th Cleaner Feed	11.1
Zn Scavenger No. 2 Tail.	9.4

2.4.2 Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1208
Pb Scavenger Tailing	1185
Pb 1st Cleaner Feed	1118
Zn Rougher Feed	1200
Zn Scav. No. 2 Tail.	1112
Zn 1st Cleaner Feed	1068

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	25
Pb Regrind Mill Discharge	31
Zn Rougher Feed	27
Zn Regrind Mill Discharge	26

Test No. PP24 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.96	10.2
Pb Rougher Feed	6.48	11.4
Pb Rougher Concentrate	25.1	15.6
Pb Rougher Tailing	2.63	10.2
Pb Scavenger Concentrate	6.82	15.0
Pb Scavenger Tailing	1.99	9.55
Pb 1st Cleaner Concentrate	30.2	17.7
Pb 1st Cleaner Tailing	10.9	16.9
Pb Regrind Cyclone Overflow	24.7	18.0
Pb Regrind Cyclone Underflow	22.6	16.2
Pb Cleaner Concentrate	58.4	10.8
Zn Rougher Feed	1.83	6.76
Zn Rougher Concentrate	2.09	15.9
Zn Rougher Tailing	1.79	2.24
Pb Scavenger Conc. No. 1	1.66	2.79
Zn Scavenger Conc. No. 2	1.52	1.50
Zn Scavenger Tail. No. 1	1.85	1.50
Zn Scavenger Tail. No. 2	1.72	1.46
Zn 1st Cleaner Tailing	2.66	4.70
Zn 1st Cleaner Concentrate	4.76	40.7
Zn Regrind Cyclone Overflow	3.59	17.5
Zn Regrind Cyclone Underflow	1.46	12.1
Zn 1st Cl. Scav. Concentrate	3.96	9.92
Zn 1st Cl. Scav. Tailing	2.36	1.80
Zn Combined Tailing	2.06	1.60
Zn Cleaner Concentrate	3.87	52.0

Test No. PP24 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Ro. Concentrate	14.82	25.1	15.6	62.4	21.0
Pb Ro. Tailing	85.18	2.63	10.2	37.6	79.0
Cyclone Overflow (meas)	100.00	5.96	10.2	100.0	100.0
(Calc.)	-	5.96	11.0	-	-
Pb Scav. Concentrate	11.29	6.82	15.0	12.9	15.4
Pb Scav. Tailing	73.89	1.99	9.55	24.7	64.2
Pb Ro. Tailing (meas)	85.18	2.63	10.2	37.6	85.2
(Calc.)	-	2.63	10.3	37.6	79.6
Pb 1st Cl. Conc.	10.90	30.2	17.7	55.2	17.5
Pb 1st Cl. Tail.	3.92	10.9	16.9	7.17	6.02
Pb Ro. Conc. (meas)	14.82	25.1	15.6	62.4	22.7
(Calc.)	-	25.1	17.5	62.4	23.6
Zn Ro. Concentrate	39.54	2.09	15.9	13.9	57.2
Zn Ro. Tailing	34.35	1.79	2.24	10.3	6.99
Pb Scav. Tailing (meas)	73.89	1.99	9.55	24.7	69.2
(Calc.)	-	1.95	9.55	24.2	64.1
Zn Scav. Conc. No. 1	19.70	1.66	2.79	5.49	4.74
Zn Scav. Tail. No. 1	14.65	1.85	1.50	4.55	1.89
Zn Ro. Tailing (meas)	34.35	1.79	2.24	10.3	7.54
(Calc.)	-	1.74	2.24	10.0	6.63
Zn 1st Cl. Conc.	12.30	4.76*	40.7	-	45.5
Zn 1st Cl. Tail.	27.24	2.66*	4.70	-	11.6
Zn Ro. Concentrate (meas)	39.54	2.09*	15.9	-	61.6
(Calc.)	-	-	15.9	-	57.1

* Pb recovery calculations resulted in negative tailings and therefore are not included.

Three-Product Formula

Pb 4th Cl. Concentrate	6.43	58.4	10.8	63.0	6.8
Zn 4th Cl. Concentrate	15.89	3.81	52.0	10.2	81.0
Zn Combined Tailing	77.68	2.06	1.60	26.8	12.2
Cyclone Overflow	100.00	5.96	10.2	100.0	100.0

Test No. PP25

1. Grinding

1.1. Purpose: To repeat the conditions of test PP24.

1.2. Method: Similar to test PP1 - PP24. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 700 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P-50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was stable during the test run. Net power consumption in the Hendy mill was 16.58 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 88.5 % minus 200 mesh.

Test No. PP25 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.5 percent moisture content.		
Feed Rate:	700 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	600 pounds	
	1 inch balls	400 pounds	
	Total	2000 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5425 pounds, test period 1400 pounds		
Circulating Load:	Cyclone Underflow 395 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2322	76
	Cyclone Overflow	1360	35
	Cyclone Underflow	2542	80
Average Power:	Gross	7.72 kilwoatts	
	No Load	1.92 kilowatts	
	Net	5.80 kilowatts	
Net Power Consumption:	16.57 kilowatt-hours per ton of ½ inch feed.		
Work Index:	11.91		

Test No. PP25 - Continued

1.4. Results:

1.4.2 Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Pb 2nd Cleaner Tailing		
Feed Rate:	161.0 pounds per hour, 23.02 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	380 pounds	
	1 inch balls	820 pounds	
	Total	1200 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2322	72
	Cyclone Feed	1222	23
	Cyclone Overflow	1120	13.5
	Cyclone Underflow	2322	72
Average Power:	Gross	6.77 kilowatts	
	No Load	0.92 kilowatts	
	Net	5.85 kilowatts	
Net Power Consumption:	16.71 kilowatt-hours per ton of feed		

Test No. PP25 - Continued

1.4. Results:

1.4.3. Zinc Regrind Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zn Ro. Conc., Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc.		
Feed Rate:	179.0 pounds per hour, 25.52 percent of the mill feed		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2620	81
	Cyclone Overflow	1088	11
	Cyclone Underflow	2620	81
Average Power:	Gross	2.26 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.34 kilowatts	
Net Power Consumption:	3.82 kilowatt-hours per ton of feed.		

Test No. PP25 - Continued

1.4.4. Screen Analyses

Hendy Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	2.8	2.8	97.2
3	13.3	16.1	83.9
4	14.8	30.9	69.1
6	11.2	42.1	57.9
8	8.8	50.9	49.1
10	7.6	58.5	41.5
14	6.1	64.6	35.4
20	4.3	68.9	31.1
28	3.7	72.6	27.4
35	3.0	75.6	24.4
48	3.3	78.9	21.1
65	3.1	82.0	18.0
100	2.5	84.5	15.5
150	2.5	87.0	13.0
200	2.8	89.8	10.2
- 200	10.2	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.2	0.4	99.6
28	0.3	0.7	99.3
35	0.6	1.3	98.7
48	1.5	2.8	97.2
65	2.8	5.6	94.4
100	5.1	10.7	89.3
150	9.5	20.2	79.8
200	17.1	37.3	62.7
270	14.0	51.3	48.7
400	18.6	69.9	30.1
- 400	30.1	100.0	-
Total	100.0	-	-

Test No. PP25 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.3	0.5	99.5
28	0.5	1.0	99.0
35	0.8	1.8	98.2
48	1.9	3.7	96.3
65	3.7	7.4	92.6
100	6.4	13.8	86.2
150	11.4	25.2	74.8
200	20.0	45.2	54.8
270	15.7	60.9	39.1
400	19.2	80.1	19.9
- 400	19.9	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.3	0.3	99.7
100	0.9	1.2	98.8
150	2.9	4.1	95.9
200	7.4	11.5	88.5
270	7.8	19.3	80.7
400	15.5	34.8	65.2
- 400	65.2	100.0	-
Total	100.0	-	-

Test No. PP25 - Continued

1.4.4. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	6.9	6.9	93.1
270	7.8	14.7	85.3
27.9 µm	18.6	33.3	66.7
21.6	9.0	42.3	57.7
15.1	12.6	54.9	45.1
10.4	11.0	65.9	34.1
8.0	7.0	72.9	27.1
- 8.0	27.1	100.0	-
Total	100.0	-	-

Specific Gravity 4.75

Pb Regrind Cyclone Underflow

+ 200 mesh	4.3	4.3	95.7
270	5.6	9.9	90.1
27.2 µm	19.4	29.3	70.7
21.1	13.8	43.1	56.9
14.7	25.2	68.3	31.7
10.1	17.8	86.1	13.9
7.8	5.0	91.1	8.9
- 7.8	8.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.85

Pb Regrind Discharge

+ 27.2 µm	16.6	16.6	83.4
21.1	12.3	28.9	71.1
14.7	26.1	55.0	45.0
10.1	17.8	72.8	27.2
7.8	6.4	79.2	20.8
- 7.8	20.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.97

Test No. PP25 - Continued

1.4.4. Screen Analyses

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 28.9 µm	0.5	0.5	99.5
22.4	0.5	1.0	99.0
15.6	4.4	5.4	94.6
10.7	17.0	22.4	77.6
8.3	15.8	38.2	61.8
- 8.3	61.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.48

Pb 4th Cleaner Concentrate

+ 23.8 µm	2.2	2.2	97.8
18.5	1.8	4.0	96.0
12.9	7.3	11.3	88.7
8.9	20.2	31.5	68.5
6.9	15.9	47.4	52.6
- 6.9	52.6	100.0	-
Total	100.0	-	-

Specific Gravity 6.13

Zn Regrind Cyclone Underflow

+ 200 mesh	9.1	9.1	90.9
270	22.5	31.6	68.4
28.0 µm	17.3	48.9	51.1
21.7	44.4	93.3	6.7
15.2	2.8	96.1	3.9
10.4	0.7	96.8	3.2
8.1	0.3	97.1	2.9
- 8.1	2.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.71

Test No. PP25 - Continued

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	8.4	8.4	91.6
270	22.6	31.0	69.0
27.5 µm	16.3	47.3	52.7
21.3	43.3	90.6	9.4
14.9	3.8	94.4	5.6
10.2	1.2	95.6	4.4
7.9	0.6	96.2	3.8
- 7.9	3.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.78

Zn Regrind Cyclone Overflow

+ 29.7 µm	7.2	7.2	92.8
23.0	8.6	15.8	84.2
16.1	19.5	35.3	64.7
11.0	15.2	50.5	49.5
8.5	8.7	59.2	40.8
- 8.5	40.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.33

Zn 4th Cleaner Concentrate

+ 30.5 µm	6.6	6.6	93.4
23.7	9.0	15.6	84.4
16.5	17.0	32.6	67.4
11.3	14.2	46.8	53.2
8.8	8.9	55.7	44.3
- 8.8	44.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.13

Test No. PP25 - Continued

1.4.4. Screen Analyses

Zn Combined Tailing

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 200 mesh	10.0	10.0	90.0
270	6.0	16.0	84.0
33.5 µm	8.6	24.6	75.4
25.9	10.4	35.0	65.0
18.1	14.3	49.3	50.7
12.4	11.4	60.7	39.3
9.6	6.6	67.3	32.7
- 9.6	32.7	100.0	-
Total	100.0	-	-

Specific Gravity 3.57

Test No. PP25 - Continued

2. Flotation

2.1. Purpose: To improve lead recovery.

2.2. Method: The mechanical circuit was similar to test PP24; except that reagent additions to the Pb circuit were changed as follows:

1) The Na_2S was omitted from the circuit, and 0.5 lb/ton of $ZnSO_4$ was added to the Hendy mill feed.
2) The R-242 addition to the Pb 1st cleaner was reduced from 0.03 to 0.02 pound per ton.

2.2.1. Flotation Equipment

As for test PP22.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet: As for test PP24.

2.4. Results: The modification in the Pb reagent balance resulted in an improvement in the Pb concentrate recovery. Lower pH in the zinc cleaning appeared to increase rate of pyrite flotation to the Zn cleaner concentrate. The zinc 4th cleaner concentrate assayed 52.1 % zinc at 81.1 % Zn recovery.

Test No. PP25 - Continued

2.2.2. Reagent Additions

Type	Pound of Reagent per Ton of Feed	Point of Addition
Na_2CO_3	4.40	Ball Mill Feed
NaCN	0.31	Ball Mill Feed
Z-11	0.13	Ball Mill Feed
$ZnSO_4$	0.52	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.089	Pb Ro. Feed Pump
Z-11	0.03	Pb Scavenger Feed
MIBC	0.021	Pb Scavenger Feed
R-242	0.03	Pb Regrind Mill
NaCN	0.32	Pb Regrind Mill
Na_2CO_3	0.16	Pb Regrind Mill
MIBC	0.015	Pb 1st Cleaner Feed
Z-11	0.02	Pb 1st Cl. 4th Cell
NaCN	0.07	Pb 2nd Cleaner Feed
$CuSO_4$	2.06	Zn Rougher Conditioner No. 1
$Ca(OH)_2$	2.44	Zn Rougher Conditioner No. 2
Z-200	0.16	Zn Rougher Feed Pump
Z-11	0.30	Zn Rougher Feed Pump
DF-250	0.074	Zn Rougher Feed Pump
DF-250	0.12	Zn Rougher Feed
Z-11	0.03	Zn Scavenger No. 1
DF-250	0.031	Zn Scavenger No. 1
Z-11	0.04	Zn Scavenger No. 2
$Ca(OH)_2$	1.14	Zn Regrind Mill
$CuSO_4$	0.32	Zn Regrind Mill
Z-200	0.081	Zn Regrind Mill
DF-250	0.03	Zn 1st Cleaner Feed
Z-11	0.03	Zn 1st Cleaner Scavenger
Z-200	0.007	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.26	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.14	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.10	Zn 4th Cleaner Feed

Test No. PP25 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	8.9
Pb Rougher Feed	8.8
Pb Scavenger Tailing	8.7
Pb Regrinding Mill Discharge	9.0
Pb 1st Cleaner Feed	9.1
Pb 2nd Cleaner Feed	9.2
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.3
Zn Rougher Feed	9.9
Zn Scavenger Tailing	9.4
Zn 1st Cleaner Scav. Feed	10.6
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	10.8
Zn 3rd Cleaner Feed	10.9
Zn 4th Cleaner Feed	11.0
Zn Scavenger No. 2 Feed	9.5

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1227
Pb Scavenger Tailing	1221
Pb 1st Cleaner Feed	1120
Zn Rougher Feed	1240
Zn Scavenger Tailing	1090
Zn 1st Cleaner Feed	1088

2.4.3 Pulp Temperature

Product	°C
Pb Rougher Feed	26
Pb Regrind Mill Discharge	30
Zn Rougher Feed	26
Zn Regrind Mill Discharge	25

Test No. PP25 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	6.14	10.3
Pb Rougher Feed	5.53	11.1
Pb Rougher Concentrate	20.9	14.9
Pb Rougher Tailing	1.72	10.1
Pb Scavenger Concentrate	4.34	14.4
Pb Scavenger Tailing	1.42	9.52
Pb 1st Cleaner Concentrate	22.7	19.4
Pb 1st Cleaner Tailing	3.48	16.1
Pb Regrind Cyclone Overflow	16.4	18.5
Pb Regrind Cyclone Underflow	18.1	14.6
Pb Cleaner Concentrate	59.3	11.1
Zn Rougher Feed	1.15	6.74
Zn Rougher Concentrate	1.55	22.7
Zn Rougher Tailing	1.10	1.80
Zn Scavenger Concentrate No. 1	0.90	2.26
Zn Scavenger Concentrate No. 2	0.96	1.34
Zn Scavenger Tailing No. 1	1.25	1.36
Zn Scavenger Tailing No. 2	1.43	1.45
Zn 1st Cleaner Tailing	1.60	4.00
Zn 1st Cleaner Concentrate	2.65	40.2
Zn Regrind Cyclone Overflow	2.29	18.5
Zn Regrind Cyclone Underflow	1.05	8.49
Zn 1st Cleaner Scavenger Concentrate	2.78	10.4
Zn 1st Cleaner Scavenger Tailing	1.19	1.18
Zn Cleaner Concentrate	2.29	52.1

Test No. PP25 - Continued

2.4.5. Metallurgical Results

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Ro. Concentrate	23.02	20.9	14.9	78.4	30.6
Pb Ro. Tailing	76.98	1.72	10.1	21.6	69.4
Cyclone Overflow (meas)	100.00	6.14	10.3	100.0	100.0
(Calc.)	-	6.14	11.2	-	-
Pb Scav. Concentrate	7.91	4.34	14.4	5.60	10.2
Pb Scav. Tailing	69.07	1.42	9.52	16.0	58.7
Pb Ro. Tailing (meas)	76.98	1.72	10.1	21.6	75.5
(Calc.)	-	1.72	10.0	21.6	68.9
Pb 1st Cl. Conc.	20.86	22.7	19.4	77.2	36.1
Pb 1st Cl. Tail.	2.16	3.48	16.1	1.23	3.11
Pb Ro. Concentrate (meas)	23.02	20.9	14.9	78.4	33.3
(Calc.)	-	20.9	19.1	78.4	39.2
Zn Ro. Concentrate	25.51	1.55	22.7	6.44	51.7
Zn Ro. Tailing	43.56	1.10	1.80	7.61	7.00
Pb Scav. Tailing (meas)	69.07	1.42	9.52	16.0	63.8
(Calc.)	-	1.27	9.52	14.3	58.7
Zn Scav. No. 1 Conc.	21.30	0.90	2.26	3.12	4.30
Zn Scav. No. 1 Tail.	22.26	1.25	1.36	4.54	2.70
Zn Ro. Tailing (meas)	43.56	1.10	1.80	7.80	7.61
(Calc.)	-	1.08	1.80	7.66	7.00
Zn 1st Cl. Conc.	13.18	2.65	40.2	5.69	47.3
Zn 1st Cl. Tail.	12.33	1.60	4.00	3.22	4.40
Zn Ro. Conc. (meas)	25.51	1.55	22.7	6.44	56.2
(Calc.)	-	2.14	22.7	8.91	51.7

Three-Product Formula

Pb 4th Cl. Conc.	8.02	59.3	11.1	77.4	8.7
Zn 4th Cl. Conc.	16.04	2.29	52.1	6.0	81.1
Zn Combined Tail.	75.94	1.34	1.39	16.6	96.2
Cyclone Overflow	100.00	6.14	10.3	100.0	100.0

Test No. PP26 - Continued

1.4. Results

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	700 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	700 pounds	
	1½ inch balls	500 pounds	
	1 inch balls	239 pounds	
	Total	1439 pounds	
Operating Time:	Total 7.0 hours, test period 2.0 hours		
Mill Feed:	Total 4900 pounds, test period 1400 pounds		
Circulating Load:	Cyclone Underflow 402 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2084	69
	Cyclone Overflow	1358	35
	Cyclone Underflow	2504	79
Average Power:	Gross	6.29 kilowatts	
	No Load	1.92 kilowatts	
	Net	4.37 kilowatts	
Net Power Consumption:	12.49 kilowatt-hours per ton of ½ inch feed		
Work Index:	11.65		

Test No. PP-26

1. Grinding

1.1. Purpose: To produce a coarser cyclone overflow product.

1.2. Method: The Hendy mill load was reduced from 2000 pounds to 1439 pounds, and the ball size ratio was changed. The grinding circuit was operated for a period of 6.75 hours at a feed rate of 700 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill:	P-50 Dorr Cyclone:	1½ inch diameter 5/8 inch vortex 1/2 inch apex

Pb Regrind

Sala Mill:	Krebs Cyclone:	1 inch diameter 1/4 inch vortex 1/8 inch apex

Zn Regrind

Conical Mill:	Krebs Cyclone:	1½ inch diameter ½ inch vortex 1/4 inch apex

1.3. Flowsheet: As for Test PP-1.

1.4. Results: The grinding circuit did not stabilize during the test run. Net power consumption in the Hendy mill was 12.49 kilowatt-hours per ton of 1/2 inch feed.

The cyclone overflow was 79.9 % minus 200 mesh.

Test No. PP-26 - Continued

1.4. Results

1.4.3. Zinc Regrind Mill Report

Regrind Mill:	Conical Mill		
Feed:	Zn Ro. Conc., Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	1/2 inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.0 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2512	79
	Cyclone Overflow	1080	10
	Cyclone Underflow	2512	79
Average Power:	Gross	1.90 kilowatts	
	No Load	0.92 kilowatts	
	Net	0.98 kilowatts	
Net Power Consumption:	2.80 kilowatt-hours per ton of feed		

Test No. PP-26 - Continued

1.4.4. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.5	4.5	95.5
3	15.6	20.1	79.9
4	12.5	32.6	67.4
6	12.1	44.7	55.3
8	8.5	53.2	46.8
10	7.7	60.9	39.1
14	5.3	66.2	33.8
20	4.2	70.4	29.6
28	3.5	73.9	26.1
35	2.9	76.8	23.2
48	3.0	79.8	20.2
65	2.9	82.7	17.3
100	2.4	85.1	14.9
150	2.4	87.5	12.5
200	2.6	90.1	9.9
- 200	9.9	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.4	0.8	99.2
28	0.7	1.5	98.5
35	1.3	2.8	97.2
48	3.3	6.1	93.9
65	6.3	12.4	87.6
100	9.7	22.1	77.9
150	15.2	37.3	62.7
200	21.0	58.3	41.7
270	12.0	70.3	29.7
400	11.1	81.4	18.6
- 400	18.6	100.0	-
Total	100.0	-	-

Test No. PP-26 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 10	0.2	0.2	99.8
14	0.3	0.5	99.5
20	0.5	1.0	99.0
28	1.0	2.0	98.0
35	1.8	3.8	96.2
48	4.3	8.1	91.9
65	7.9	16.0	84.0
100	11.6	27.6	72.4
150	17.6	45.2	54.8
200	22.7	67.9	32.1
270	12.5	80.4	19.6
400	9.9	90.3	9.7
- 400	9.7	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	1.5	1.5	98.5
100	2.6	4.1	95.9
150	5.4	9.5	90.5
200	10.6	20.1	79.9
270	10.2	30.3	69.7
400	16.8	47.1	52.9
- 400	52.9	100.0	-
Total	100.0	-	-

Test No. PP-26 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	10.1	10.1	89.9
270	10.0	20.1	79.9
27.1 µm	10.0	30.1	69.9
21.6	18.5	48.6	51.4
14.6	10.1	58.7	41.3
10.1	9.4	68.1	31.9
7.8	6.5	74.6	25.4
- 7.8	25.4	100.0	-
Total	100.0	-	-

Specific Gravity = 4.82

Pb Regrind Discharge

+ 270 mesh	3.0	3.0	97.0
26.7 µm	16.0	19.0	81.0
20.7	12.6	31.6	68.4
14.4	26.7	58.3	41.7
9.9	16.8	75.1	24.9
7.7	5.6	80.7	19.3
- 7.7	19.3	100.0	-
Total	100.0	-	-

Specific Gravity = 5.04

Test No. PP-26 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.7	4.7	95.3
270	6.3	11.0	89.0
26.7 µm	20.7	31.7	68.3
20.7	14.0	45.7	54.3
14.4	27.0	72.7	27.3
9.9	16.6	89.3	10.7
7.7	3.8	93.1	6.9
- 7.7	6.9	100.0	-
Total	100.0	-	-

Specific Gravity = 5.05

Pb 4th Cleaner Concentrate

+ 13.1 µm	7.9	7.9	92.1
9.0	23.2	31.1	68.9
7.0	17.9	49.0	51.0
- 7.0	51.0	100.0	-
Total	100.0	-	-

Specific Gravity = 5.83

Test No. PP-26 - Continued

1.4.4. Screen Analysis

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	9.1	9.1	90.9
270	21.0	30.1	69.9
28.3 µm	15.8	45.9	54.1
22.0	44.8	90.7	9.3
15.3	3.8	94.5	5.5
10.5	1.2	95.7	4.3
8.1	0.4	96.1	3.9
- 8.1	3.9	100.0	-
Total	100.0	-	-

Specific Gravity = 4.57

Zinc Regrind Cyclone Underflow

+ 200 mesh	11.7	11.7	88.3
270	20.0	31.7	68.3
28.7 µm	14.5	46.2	53.8
22.3	43.6	89.8	10.2
15.5	5.7	95.5	4.5
10.7	1.3	96.8	3.2
8.3	0.3	97.1	2.9
- 8.3	2.9	100.0	-
Total	100.0	-	-

Specific Gravity = 4.48

Test No. PP-26 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.1	2.1	97.9
270	6.0	8.1	91.9
29.3 µm	25.0	33.1	66.9
22.7	13.0	46.1	53.9
15.8	14.4	60.5	39.5
10.9	9.1	69.6	30.4
8.4	5.1	74.7	25.3
- 8.4	25.3	100.0	-
Total	100.0	-	-

Specific Gravity = 4.34

Zn 4th Cleaner Concentrate

+ 30.5 µm	2.2	2.2	97.8
23.7	4.6	6.8	93.2
16.5	15.0	21.8	78.2
11.3	16.0	37.8	62.2
8.8	11.0	48.8	51.2
- 8.8	51.2	100.0	-
Total	100.0	-	-

Specific Gravity = 4.11

Test No. PP-26 - Continued

1.4.4. Screen Analysis

Zn Scavenger Tailing

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 100 mesh	4.6	4.6	95.4
150	6.0	10.6	89.4
200	8.5	19.1	80.9
270	-	19.1	80.9
34.3 µm	11.1	30.2	69.8
26.6	20.2	50.4	49.6
18.5	9.4	59.8	40.2
12.8	7.8	67.6	32.4
9.9	5.0	72.6	27.4
- 9.9	27.4	100.0	-
Total	100.0	-	-

Specific Gravity = 3.46

Test No. PP-26 - Continued

2. Flotation

2.1. Purpose: To investigate the effect on the Pb and zinc metallurgical results of a coarser primary grind.

2.2. Method: The following chages in the circuit were made:

1) The fineness of primary grind was decreased from 65.5 % minus 400 mesh to 53 % minus 400 mesh.
2) Reduced collector to the Pb rougher flotation.
3) Diluted pulp in the Pb 2nd, 3rd and 4th cleaner feed.
4) Decreased froth discharge in the Pb 1st cleaner, and increased froth discharge in the Pb 2nd and 3rd cleaners.
5) MIBC additions to the Pb 1st cleaner were varied.
6) Decreased collector additions to the zinc rougher.
7) Omitted 2nd zinc scavenger stage from the circuit.
8) pH to the Zn cleaners was maintained at pH 11.0.

2.2.1. Flotation Equipment

As for Test PP-22, except that bank of 6 Fagergren No. 12 cells was removed from the circuit.

2.2.2. Flotation Reagents

See Following Page.

2.3. Flowsheet: As for Test PP-24, except that zinc 2nd scavenger stage was omitted from the circuit.

2.4. Results: The additional changes in the circuit reagent balance made comparison of the effects of a coarser primary grind difficult.

It was observed that the Pb cleaning circuit was unstable during the test period.

Test No. PP-26 - Continued

2.2.2. Reagent Addition

Reagent Addition

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	4.32	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	0.94	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.11	Pb Rougher Feed Pump
MIBC	0.078	Pb Rougher 3rd Cell
Z-11	0.03	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
NaCN	0.30	Pb Regrind Mill
$ZnSO_4$	0.52	Pb Regrind Mill
Na_2CO_3	0.50	Pb Regrind Mill
R-242	0.02	Pb Cyclone Feed Pump
MIBC	0.048	Pb 1st Cleaner Feed
Z-11	0.02	Pb 1st Cleaner 4th Cell
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
NaCN	0.05	Pb 4th Cleaner Feed
$CuSO_4$	2.08	Zn Rougher Conditioner No. 1
$Ca(OH)_2$	2.54	Zn Rougher Conditioner No. 2
Z-11	0.20	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
Z-200	0.156	Zn Rougher Feed Pump
DF-250	0.105	Zn Rougher Feed
Z-11	0.03	Zn Scavenger Feed
DF-250	0.030	Zn Scavenger Feed
Z-11	0.03	Zn Scavenger 2nd Cell
$Ca(OH)_2$	0.90	Zn Regrind Mill
$CuSO_4$	0.34	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
Z-200	0.038	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.36	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 4th Cleaner Feed

Test No. PP-26 - Continued

2.4. Results

2.4.1. pH

Product	pH
Cyclone Overflow	9.0
Pb Rougher Feed	9.0
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	9.1
Pb 1st Cleaner Feed	9.1
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.2
Zn Rougher Feed	10.0
Zn Scavenger Tailing	9.5
Zn 1st Cleaner Scavenger Feed	10.9
Zn 1st Cleaner Feed	11.0
Zn 2nd Cleaner Feed	11.1
Zn 3rd Cleaner Feed	11.1
Zn 4th Cleaner Feed	11.0

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1203
Pb Scavenger Tailing	1175
Pb 1st Cleaner Feed	1070
Zn Rougher Feed	1192
Zn Scavenger Tailing	1095
Zn 1st Cleaner Feed	1080

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	23
Pb Regrind Mill Discharge	29
Zn Rougher Feed	24
Zn Regrind Mill Discharge	25

Test No. PP-26 - Continued

2.4. Results

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	6.15	10.2
Pb Rougher Feed	6.07	11.4
Pb Rougher Concentrate	23.6	15.8
Pb Rougher Tailing	2.28	10.4
Pb Scavenger Concentrate	6.62	15.7
Pb Scavenger Tailing	1.70	9.74
Pb 1st Cleaner Concentrate	35.7	17.0
Pb 1st Cleaner Tailing	7.44	17.2
Pb Regrind Cyclone Overflow	23.8	17.0
Pb Regrind Cyclone Underflow	22.2	13.6
Pb Cleaner Concentrate	57.0	12.4
Zn Rougher Concentrate	2.29	24.9
Zn Scavenger Concentrate	1.48	4.06
Zn Scavenger Tailing	1.42	1.60
Zn Combined Tailing	1.46	1.83
Zn 1st Cleaner Scavenger Tailing	1.79	3.21
Zn Cleaner Concentrate	2.43	56.4

Test No. PP-26 - Continued

2.4. Results

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	18.15	23.6	15.8	69.7	25.2
Pb Rougher Tailing	81.85	2.28	10.4	30.3	74.8
Cyclone Overflow (meas)	100.00	6.15	10.2	100.0	100.0
(calc)		6.15	11.4		
Pb Scavenger Concentrate	9.65	6.62	15.7	10.4	13.3
Pb Scavenger Tailing	72.20	1.70	9.74	20.0	61.8
Pb Rougher Tail. (meas)	81.85	2.28	10.4	30.3	83.5
(calc)		2.28	10.4	30.4	75.1
Pb 1st Cleaner Conc.	10.38	35.7	17.0	60.3	15.5
Pb 1st Cleaner Tailing	7.77	7.44	17.2	9.4	11.7
Pb Rougher Conc. (meas)	18.15	23.6	15.8	69.6	28.0
(calc)		23.6	17.1	69.7	27.2

Three-Product Formula

Pb 4th Cleaner Conc.	8.20	57.0	12.4	76.0	10.0
Zn 4th Cleaner Conc.	13.75	2.43	56.4	5.4	76.0
Zn Combined Tailing	78.05	1.46	1.83	18.6	14.0
Cyclone Overflow	100.00	6.15	10.2	100.0	100.0

Test No. 27

1. Grinding

1.1. Purpose: To repeat conditions of Test PP-26, but attempt to stabilize the recirculating load in the classification circuit.

1.2. Method: As for Test No. PP-26. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 705 pounds per hour, Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill: P-50 Dorr Cyclone:	1½ inch diameter
	5/8 inch vortex
	1/2 inch apex

Pb Regrind

Sala Mill: Krebs Cyclone:	1 inch diameter
	1/4 inch vortex
	1/8 inch apex

Zn Regrind

Conical Mill: Krebs Cyclone	1½ inch diameter
	1/2 inch vortex
	1/4 inch apex

1.3. Flowsheet: As for Test PP-1.

1.4. Results: The grinding circuit was stable during the test run. Net power consumption in the Hendy mill was 10.34 kilowatt-hours per ton of 1/2 inch feed. The cyclone overflow was coarser than required.

Test No. PP-27 - Continued

1.4. Results

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	705 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	700 pounds	
	1½ inch balls	500 pounds	
	1 inch balls	239 pounds	
	Total	1439 pounds	
Operating Time:	Total 7.25 hours, test period 1.5 hours		
Mill Feed:	Total 5111 pounds, test period 1058 pounds		
Circulating Load:	Cyclone underflow 412 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2078	69
	Cyclone Overflow	1358	35
	Cyclone Underflow	2470	79
Average Power:	Gross	5.54 kilowatts	
	No Load	1.92 kilowatts	
	Net	3.62 kilowatts	
Net Power Consumption:	10.34 kilowatt-hours per ton of ½ inch feed		
Work Index:	11.21		

Test No. PP-27 - Continued

1.4. Results

1.4.2. Lead Regrind Mill Report

Regrind Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate		
Feed Rate:	158.2 pounds per hour 22.36 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	384 pounds	
	1 inch balls	689 pounds	
	Total	1073 pounds	
Operating Time:	Total 7.25 hours, test period 1.5 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2393	74
	Cyclone Feed	1257	26
	Cyclone Overflow	1358	34
	Cyclone Underflow	2393	74
Average Power:	Gross	6.81 kilowatts	
	No Load	0.92 kilowatts	
	Net	5.89 kilowatts	
Net Power Consumption:	16.83 kilowatt-hours per ton of feed		

Test No. PP-27 - Continued

1.4. Results

1.4.3. Zinc Regrind Mill Report

Regrind Mill:	Conical Mill		
Feed:	Zn Ro. Conc., Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc		
Mill Speed:	32 r.p.m., 75 percent of ctitical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.25 hours, test period 1.50 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2568	82
	Cyclone Overflow	1147	17.5
	Cyclone Underflow	2568	82
Average Power:	Gross	2.46 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.54 kilowatts	
Net Power Consumption:	4.40 kilowatt-hours per ton of feed		

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.7	4.7	95.3
3	15.1	19.8	80.2
4	14.4	34.2	65.8
6	10.4	44.6	55.4
8	9.0	53.6	46.4
10	6.8	60.4	39.6
14	5.6	66.0	34.0
20	3.9	69.9	30.1
28	3.4	73.3	26.7
35	2.8	76.1	23.9
48	3.0	79.1	20.9
65	2.9	82.0	18.0
100	2.4	84.4	15.6
150	2.5	86.8	13.2
200	2.6	89.4	10.6
- 200	10.6	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.2	0.2	99.8
14	0.3	0.5	99.5
20	0.3	0.8	99.2
28	0.7	1.5	98.5
35	1.2	2.7	97.3
48	2.9	5.6	94.4
65	5.7	11.3	88.7
100	8.8	20.1	79.9
150	14.2	34.3	65.7
200	20.0	54.3	45.7
270	12.1	66.4	33.6
400	12.1	78.5	21.5
- 400	21.5	100.0	-
Total	100.0	-	-

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.3	0.5	99.5
20	0.4	0.9	99.1
28	0.9	1.8	98.2
35	1.5	3.3	96.7
48	3.6	6.9	93.1
65	6.7	13.6	86.4
100	10.3	23.9	76.1
150	16.2	40.1	59.9
200	22.1	62.2	37.8
270	12.9	75.1	24.9
400	12.0	87.1	12.9
- 400	12.9	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	4.7	4.7	95.3
100	4.5	9.2	90.8
150	7.9	17.1	82.9
200	13.6	30.7	69.3
270	10.3	41.0	59.0
400	13.8	54.8	45.2
- 400	45.2	100.0	-
Total	100.0	-	-

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	21.8	21.8	78.2
270	9.3	31.1	68.9
27.6 µm	5.4	36.5	63.5
21.4	19.2	55.7	44.3
14.9	9.2	64.9	35.1
10.3	8.2	73.1	26.9
7.9	5.3	78.4	21.6
- 7.9	21.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.81

Pb Regrind Discharge

+ 200 mesh	2.0	2.0	98.0
270	2.5	4.5	95.5
26.7 µm	17.1	21.6	78.4
20.7	11.9	33.5	66.5
14.5	22.2	55.7	44.3
9.9	15.5	71.2	28.8
7.7	6.2	77.4	22.6
- 7.7	22.6	100.0	-
Total	100.0	-	-

Specific Gravity = 5.06

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	8.3	8.3	91.7
270	6.8	15.1	84.9
27.6 µm	18.2	33.3	66.7
21.4	11.6	44.9	55.1
14.9	21.8	66.7	33.3
10.3	16.6	83.3	16.7
7.9	6.0	89.3	10.7
- 7.9	10.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.83

Pb Regrind Cyclone Overflow

+ 14.9 µm	4.5	4.5	95.5
10.2	14.2	18.7	81.3
7.9	14.2	32.9	67.1
- 7.9	67.1	100.0	-
Total	100.0	-	-

Specific Gravity = 4.71

Pb Cleaner Concentrate

+ 13.3 µm	8.5	8.5	91.5
9.1	18.6	27.1	72.9
7.1	15.3	42.4	57.6
- 7.1	57.6	100.0	-
Total	100.0	-	-

Specific Gravity = 5.76

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	18.9	18.9	81.1
270	27.0	45.9	54.1
28.4 µm	12.0	57.9	42.1
22.1	33.9	91.8	8.2
15.4	2.6	94.4	5.6
10.6	1.1	95.5	4.5
8.2	0.6	96.1	3.9
- 8.2	3.9	100.0	-
Total	100.0	-	-

Specific Gravity = 4.62

Zn Regrind Cyclone Underflow

+ 150 mesh	5.0	5.0	95.0
200	17.3	22.3	77.7
270	26.0	48.3	51.7
27.6 µm	11.1	59.4	40.6
21.4	33.4	92.8	7.2
14.9	2.1	94.9	5.1
10.3	0.7	95.6	4.4
7.9	0.4	96.0	4.0
- 7.9	4.0	100.0	-
Total	100.0	-	-

Specific Gravity = 4.75

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.4	2.4	97.6
270	6.0	8.4	91.6
29.1 µm	18.4	26.8	73.2
22.6	11.0	37.8	62.2
15.8	14.0	51.8	48.2
10.8	12.0	63.8	36.2
8.4	6.8	70.6	29.4
- 8.4	29.4	100.0	-
Total	100.0	-	-

Specific Gravity = 4.37

Zn 4th Cleaner Concentrate

+ 270 mesh	5.3	5.3	94.7
30.4 µm	17.8	23.1	76.9
23.6	10.6	33.7	66.3
16.4	13.1	46.8	53.2
11.3	10.6	57.4	42.6
8.7	7.0	64.4	35.6
- 8.7	35.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.09

Test No. PP-27 - Continued

1.4.4. Screen Analysis

Zn Scavenger Tailing

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 100 mesh	5.0	5.0	95.0
150	6.2	11.2	88.8
200	9.0	20.2	79.8
36.6 µm	9.3	29.5	70.5
28.4	7.6	37.1	62.9
19.8	10.0	47.1	52.9
13.6	8.4	55.5	44.5
10.5	5.4	60.9	39.1
- 10.5	39.1	100.0	-
Total	100.0	-	-

Specific Gravity = 3.15

Test No. PP-27 - Continued

2. Flotation

2.1. Purpose:

1) To improve Pb concentrate grade and recovery.
2) To improve Zn recovery

2.2. Method: The following changes in the circuit were made:

Pb Circuit

1) Added collector Z-11 to the Pb conditioner at a rate of 0.02 lb/ton, and increased collector Z-11 to the Pb scavenger feed from 0.02 to 0.04 lb/ton.
2) Decreased collector R-242 addition to the Pb regrinding feed pump from 0.02 to 0.01 lb/ton, and added Z-11 to the regrind feed pump at a rate of 0.01 lb/ton.
3) Omitted cyanide from Pb 4th cleaner
4) Stabilized Pb cleaning froth discharge

Zn Circuit

1) Increased collector Z-11 to the Zn scavenger stage.
2) Decreased pH of the Zn cleaning from pH 11.2 to 10.6

2.2.1. Flotation Equipment

As for Test PP-26

2.2.2. Flotation Reagents

See following page

2.3. Flowsheet: As for Test PP-26.

2.4. Results: The lead grade and recovery improved after the above changes. Low pH in the zinc cleaning circuit resulted in poor zinc concentrate grade. It appeared that the zinc circuit should be optimized with respect to pH, collector additions and recirculating load in the zinc cleaning. It was found that the zinc cleaning was stable when pH and collector additions in the cleaning were varied. The conditioning of the pulp with $CuSO_4$ at lower pH would be necesary to lower zinc losses in the tailing.

Test No. PP-27 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	3.92	Ball Mill Feed
NaCN	0.18	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	1.00	Ball Mill Feed
R-242	0.02	Pb Rougher Conditioner
Z-11	0.02	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.076	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
Na_2CO_3	0.56	Pb Regrind Mill
$ZnSO_4$	0.56	Pb Regrind Mill
NaCN	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
Z-11	0.01	Pb Cyclone Feed Pump
MIBC	0.040	Pb 1st Cleaner Feed
Z-11	0.02	Pb 1st Cleaner 4th Cell
NaCN	0.09	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	2.05	Zn Rougher Conditioner No. 1
$Ca(OH)_2$	2.62	Zn Rougher Conditioner No. 2
DF-250	0.076	Zn Rougher Feed Pump
Z-11	0.20	Zn Rougher Feed Pump
Z-200	0.160	Zn Rougher Feed Pump
DF-250	0.074	Zn Rougher Feed
Z-11	0.06	Zn Scavenger Feed
DF-250	0.032	Zn Scavenger Feed
Z-11	0.06	Zn Scavenger 2nd Cell
$Ca(OH)_2$	0.75	Zn Regrind Mill
$CuSO_4$	0.32	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
DF-250	0.015	Zn 1st Cleaner Feed
Z-200	0.018	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.30	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.12	Zn 4th Cleaner Feed

Test No. PP-27 - Continued

2.4. Results

2.4.1. pH

Product	pH
Cyclone Overflow	9.3
Pb Rougher Feed	9.2
Pb Scavenger Tailing	8.9
Pb Regrinding Mill Discharge	9.2
Pb 1st Cleaner Feed	9.4
Pb 2nd Cleaner Feed	9.5
Pb 3rd Cleaner Feed	9.5
Pb 4th Cleaner Feed	9.4
Zn Rougher Feed	10.1
Zn Scavenger Tailing	9.6
Zn 1st Cleaner Scavenger Tail	10.2
Zn 1st Cleaner Feed	10.5
Zn 2nd Cleaner Feed	10.6
Zn 3rd Cleaner Feed	10.6
Zn 4th Cleaner Feed	10.6

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1245
Pb Scavenger Tailing	1197
Pb 1st Cleaner Feed	1117
Zn Rougher Feed	1227
Zn Scavenger Tailing	1075
Zn 1st Cleaner Feed	1147

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	24
Pb Regrind Mill Discharge	29
Zn Rougher Feed	24
Zn Regrind Mill Discharge	24

Test No. PP-27 - Continued

2.4. Results

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	6.03	10.1
Pb Rougher Feed	5.72	10.7
Pb Rougher Concentrate	20.3	15.2
Pb Rougher Tailing	1.92	10.4
Pb Scavenger Concentrate	5.76	14.9
Pb Scavenger Tailing	1.50	10.1
Pb 1st Cleaner Concentrate	29.8	19.4
Pb 1st Cleaner Tailing	4.37	17.4
Pb Regrind Cyclone Overflow	19.7	18.3
Pb Regrind Cyclone Underflow	20.0	15.1
Pb Cleaner Concentrate	58.4	12.4
Zn Rougher Concentrate	1.46	17.1
Zn Scavenger Concentrate	1.13	2.47
Zn Scavenger Tailing	1.39	1.59
Zn 1st Cleaner Scavenger Tail	0.94	0.88
Zn Combined Tail	1.24	1.39
Zn Cleaner Concentrate	58.4	12.4

Test No. PP-27 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	22.36	20.3	15.2	75.3	29.6
Pb Rougher Tailing	77.64	1.92	10.4	24.7	70.4
Regrind Overflow (meas)	100.00	6.03	10.1	100.0	100.0
(calc)		6.03	11.5		
Pb Scavenger Concentrate	7.65	5.76	14.9	7.3	9.9
Pb Scavenger Tailing	69.99	1.50	10.1	17.4	61.6
Pb Rougher Tailing (meas)	77.64	1.92	10.4	24.7	79.9
(calc)		1.92	10.6	24.7	71.5
Pb 1st Cleaner Conc.	14.01	29.8	19.4	69.2	23.7
Pb 1st Cleaner Tailing	8.35	4.37	17.4	6.1	12.7
Pb Rougher Conc. (meas)	22.36	20.3	15.2	75.3	33.7
(calc)		20.3	18.7	75.3	36.4

Three-Product Formula

Pb 4th Cleaner Conc.	8.02	58.4	12.4	77.7	9.8
Zn 4th Cleaner Conc.	16.69	2.47	48.3	6.8	79.8
Zn Combined Tailing	75.29	1.24	1.39	15.5	10.4
Cyclone Overflow	100.00	6.03	10.1	100.0	100.0

2.4.6. Water Assays

Product	ppm $S_2O_3^=$	pH	CN mg/l	Zn*	Pb*	Cu*
Hendy Cyclone Overflow	63.9	8.90	-	1.12	0.97	6.34
Pb Scavenger Tailing	53.0	8.65	-	-	-	-
Zn Combined Tailing	61.2	9.05	-	0.97	0.21	2.78
Tailing Pond H_2O	63.4	8.75	0.143	-	-	-

	Fe*	Ag*	Na_2CO_3**	$NaHCO_3$**
Hendy Cyclone Overflow	0.57	0.026	0.086	0.150
Zn Combined Tailing	0.20	0.005	-	-
Pb Scavenger Tailing	-	-	0.028	0.327

* ppm
** g/l

Test No. PP28

1. Grinding

1.1. Purpose: To repeat conditions of test PP26.

1.2. Method: As for test PP26 and 27. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 701 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.21. Classification Equipment

Hendy Mill; P-50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1 4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was stable during the test run. Net power consumption in the Hendy mill was 9.46 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 82.4 % minus 200 mesh.

Test No. PP28 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	701 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	700 pounds	
	1½ inch balls	500 pounds	
		239 pounds	
	Total	1439 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5433 pounds, test period 1402 pounds		
Circulating Load:	Cyclone underflow 640 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2080	67.5
	Cyclone Overflow	1356	35.2
	Cyclone Underflow	2532	74.8
Average Power:	Gross	5.23 kilowatts	
	No Load	1.92 kilowatts	
	Net	3.31 kilowatts	
Net Power Consumption:	9.46 kilowatt-hours per ton of ½ inch feed.		
Work Index:	8.16		

Test No. PP28 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate		
Feed Rate:	140.2 pounds per hour 20.0 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	350 pounds	
	Total	400 pounds	
Operating Time:	Total 7.75 hours. test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2530	74.0
	Cyclone Feed	1217	22.3
	Cyclone Overflow	1093	10.4
	Cyclone Underflow	2530	74.0
Average Power:	Gross	3.80 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.88 kilowatts	
Net Power Consumption:	8.23 kilowatt-hours per ton of feed.		

Test No. PP28 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc., Zinc 2nd Cl. Tail. and Zinc 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2624	80.5
	Cyclone Overflow	1152	17.5
	Cyclone Underflow	2624	80.5
Average Power:	Gross	1.90 kilowatts	
	No Load	0.92 kilowatts	
	Net	0.98 kilowatts	
Net Power Consumption:	2.80 kilowatt-hours per ton of feed.		

Test No. PP28 - Continued

1.4.4. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	5.8	5.8	94.2
3	15.9	21.7	78.3
4	14.2	35.9	64.1
6	9.7	45.6	54.4
8	8.6	54.2	45.8
10	6.3	60.5	39.5
14	4.8	65.3	34.7
20	3.8	69.1	30.9
28	3.2	72.3	27.7
35	2.9	75.2	24.8
48	3.1	78.3	21.7
65	3.1	81.4	18.6
100	2.6	84.0	16.0
150	2.6	86.6	13.4
200	2.8	89.4	10.6
- 200	10.6	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.4	0.7	99.3
28	0.9	1.6	98.4
35	1.5	3.1	96.9
48	3.6	6.7	93.3
65	6.8	13.5	86.5
100	10.1	23.6	76.4
150	15.3	38.9	61.1
200	20.6	59.5	40.5
270	11.4	70.9	29.1
400	10.7	81.6	18.4
- 400	18.4	100.0	-
Total	100.0	-	-

Test No. PP28 - Continued

1.4.4. Screen Analysis

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.3	0.3	99.7
14	0.3	0.6	99.4
20	0.6	1.2	98.8
28	1.1	2.3	97.7
35	2.0	4.3	95.7
48	4.5	8.8	91.2
65	8.1	16.9	83.1
100	11.7	28.6	71.4
150	17.6	46.2	53.8
200	22.9	69.1	30.9
270	11.7	80.8	19.2
400	9.6	90.4	9.6
- 400	9.6	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	1.1	1.1	98.9
100	2.3	3.4	96.6
150	4.7	8.1	91.9
200	9.5	17.6	82.4
270	9.1	26.7	73.3
400	15.4	42.1	57.9
- 400	57.9	100.0	-
Total	100.0	-	-

Test No. PP28 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 150 mesh	3.6	3.6	96.4
200	7.3	10.9	89.1
270	9.1	20.0	80.0
27.6 µm	9.2	29.2	70.8
21.4	18.0	47.2	52.8
14.9	11.4	58.6	41.4
10.3	10.2	68.8	31.2
7.9	6.4	75.2	24.8
- 7.9	24.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.71

Pb Regrind Cyclone Underflow

+ 200 mesh	7.5	7.5	92.5
270	9.2	16.7	83.3
27.0 µm	13.5	30.2	69.8
21.0	36.4	66.6	33.4
14.6	19.3	85.9	14.1
10.1	7.0	92.9	7.1
7.8	2.0	94.9	5.1
- 7.8	5.1	100.0	-
Total	100.0	-	-

Specific Gravity 4.95

Pb Regrind Discharge

+ 27.6 µm	11.6	11.6	88.4
21.4	43.4	55.0	45.0
14.9	21.0	76.0	24.0
10.3	7.4	83.4	16.6
7.9	3.6	87.0	13.0
- 7.9	13.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.82

Test No. PP28 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 29.3 µm	0.6	0.6	99.4
22.7	1.4	2.0	98.0
15.8	10.2	12.2	87.8
10.9	19.2	31.4	68.6
8.4	14.2	45.6	54.4
- 8.4	54.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.40

Pb 4th Cleaner Concentrate

+ 19.8 µm	3.3	3.3	96.7
13.8	15.6	18.9	81.1
9.5	23.2	42.1	57.9
7.3	14.2	56.3	43.7
- 7.3	43.7	100.0	-
Total	100.0	-	-

Specific Gravity 5.53

Zn Regrind Cyclone Underflow

+ 150 mesh	4.6	4.6	95.4
200	19.8	24.4	75.6
270	28.0	52.4	47.6
28.3 µm	8.3	60.7	39.3
21.9	32.2	92.9	7.1
15.3	3.0	95.9	4.1
10.5	0.8	96.7	3.3
8.1	0.4	97.1	2.9
- 8.1	2.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.61

Test No. PP28 - Continued

1.4.4. Screen Analysis

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 150 mesh	4.2	4.2	95.8
200	20.0	24.2	75.8
270	28.6	52.8	47.2
27.2 µm	8.8	61.6	38.4
21.1	30.8	92.4	7.6
14.7	2.4	94.8	5.2
10.1	1.0	95.8	4.2
7.8	0.5	96.3	3.7
- 7.8	3.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.86

Zn Regrind Cyclone Overflow

+ 200 mesh	4.4	4.4	95.6
270	8.9	13.3	86.7
29.7 µm	23.8	37.1	62.9
23.0	11.0	48.1	51.9
16.1	13.6	61.7	38.3
11.0	9.8	71.5	28.5
8.5	5.4	76.9	23.1
- 8.5	23.1	100.0	-
Total	100.0	-	-

Specific Gravity 4.26

Test No. PP28 - Continued

1.4.4. Screen Analysis

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	1.2	1.2	98.8
270	5.2	6.4	93.6
30.5 µm	16.1	22.5	77.5
23.7	11.2	33.7	66.3
16.5	15.4	49.1	50.9
11.4	12.2	61.3	38.7
8.8	7.4	68.7	31.3
- 8.8	31.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.08

Zn Scavenger Tailing

+ 65 mesh	2.4	2.4	97.6
100	5.3	7.7	92.3
150	8.1	15.8	84.2
200	9.0	24.8	75.2
38.0 µm	3.4	28.2	71.8
29.5	17.9	46.1	53.9
20.6	10.3	56.4	43.6
14.2	8.3	64.7	35.3
10.9	5.1	69.8	30.2
- 10.9	30.2	100.0	-
Total	100.0	-	-

Specific Gravity 2.98

Test No. PP28 - Continued

2. Flotation

2.1. Purpose: To repeat conditions of test PP27 at a coarser lead rougher concentrate regrind.

2.2. Method: About 850 pounds of steel balls were removed from the Sala mill. Collector Z-11 additions to the lead circuit were decreased by 0.04 lb/ton. The pH in the zinc cleaning increased slightly.

2.2.1. Flotation Equipment

As for test PP22

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet: As for test PP24.

2.4. Results: Coarser lead rougher concentrate regrinding resulted in a lower lead concentrate grade. The lead 4th cleaner concentrate assayed51.9 % lead at 78.0 % Pb recovery. Zinc flotation results remain poor. The zinc concentrate assayed 46.8 % Zn at 75.6 % Zn recovery.

Test No. PP28 - Continued

2.4. Results:

2.2.2. Reagent Additions

Type	Pounds of Reagent per ton of Feed	Point of Addition
Na_2CO_3	3.60	Ball Mill Feed
NaCN	0.18	Ball Mill Feed
Z-11	0.06	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.075	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
NaCN	0.30	Pb Regrind Mill
$ZnSO_4$	0.50	Pb Regrind Mill
Na_2CO_3	0.30	Pb Regrind Mill
R-242	0.01	Pb Regr. Cyclone Feed Pump
Z-11	0.01	Pb Regr. Cyclone Feed Pump
MIBC	0.043	Pb 1st Cleaner Feed
Z-11	0.01	Pb 1st Cleaner 4th Cell
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.08	Pb 3rd Cleaner Feed
$CuSO_4$	2.05	Zn Ro. Conditioner No. 2
$Ca(OH)_2$	2.62	Zn Ro. Conditioner No. 1
DF-250	0.075	Zn Rougher Feed Pump
Z-11	0.20	Zn Rougher Feed Pump
Z-200	0.156	Zn Rougher Feed Pump
DF-250	0.05	Zn Rougher Feed
Z-11	0.05	Zn Scavenger Feed
DF-250	0.032	Zn Scavenger Feed
Z-11	0.05	Zn Scavenger 2nd Cell
$Ca(OH)_2$	1.30	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
DF-250	0.03	Zn 1st Cleaner Feed
Z-200	0.018	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca_8OH)_2$	0.30	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.20	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.10	Zn 4th Cleaner Feed

Test No. PP28 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	8.8
Pb Rougher Feed	8.9
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	9.1
Pb 1st Cleaner Feed	9.1
Pb 2nd Cleaner Feed	9.2
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.3
Zn Rougher Feed	9.8
Zn Scavenger Tailing	9.4
Zn 1st Cl. Scav.Tail.	10.6
Zn 1st Cleaner Feed	11.0
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	11.1
Zn 4th Cleaner Feed	10.9

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1213
Pb Scavenger Tailing	1170
Pb 1st Cleaner Feed	1093
Zn Rougher Feed	1143
Zn Scavenger Tailing	1060
Zn 1st Cleaner Feed	1152

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	24
Pb Regr. Mill Discharge	27
Zn Rougher Feed	24
Zn Regr. Mill Discharge	26

Test No. PP28 - Continued

2.4. Results:

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	6.20	10.5
Pb Rougher Feed	5.84	11.7
Pb Rougher Concentrate	22.6	15.9
Pb Rougher Tailing	2.10	10.5
Pb Scavenger Concentrate	6.28	15.6
Pb Scavenger Tailing	1.54	9.59
Pb 1st Cl. Concentrate	24.0	20.6
Pb 1st Cleaner Tailing	3.99	18.1
Pb Regr. Cyclone Overflow	17.0	20.3
Pb Regr. Cyclone Underflow	18.3	13.7
Pb Cleaner Concentrate	51.9	15.2
Zn Rougher Concentrate	1.52	14.8
Zn Scavenger Concentrate	1.55	4.42
Zn Scavenger Tailing	1.49	1.94
Zn 1st Cl. Scav. Tailing	0.95	0.98
Zn Combined Tailing	1.25	1.55
Zn Cleaner Concentrate	2.61	46.8

Test No. PP28 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	20.00	22.6	15.9	72.9	27.5
Pb Rougher Tailing	80.00	2.10	10.5	27.1	72.5
Cyclone Overflow (meas)	100.00	6.20	10.5	100.0	100.0
(Calc.)	-	6.20	11.6	-	-
Pb Scavenger Concentrate	9.45	6.28	15.6	9.6	12.7
Pb Scavenger Tailing	70.55	1.54	9.59	17.5	58.4
Pb Rougher Tailing (meas)	80.00	2.10	10.5	27.1	80.0
(Calc.)	-	2.10	10.3	27.1	71.1
Pb 1st Cl. Conc.	18.60	24.0	20.6	72.0	33.1
Pb 1st Cl. Tail.	1.40	3.99	18.1	0.9	2.2
Pb Ro. Conc. (meas)	20.00	22.6	15.9	72.9	30.3
(Calc.)	-	22.6	20.4	72.9	35.3

Three-Product Formula

Pb 4th Cl. Concentrate	9.30	51.9	15.2	78.0	13.5
Zn 4th Cl. Concentrate	16.97	2.61	46.8	7.2	75.6
Zn Combined Tailing	73.73	1.35	1.55	14.8	10.9
Cyclone Overflow (meas)	100.00	6.20	10.5	100.0	100.0
(Calc.)	-	6.20	10.5	-	-

Test No. PP-29

1. Grinding

1.1. Purpose: To optain a finer cyclone overflow product.

1.2. Method: The Hendy mill load was increased from 1439 pounds to 1589 pounds steel balls. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 702 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill: P-50 Dorr Cyclone:	1½ inch diameter 5/8 inch vortex ½ inch apex
Pb Regrind	
Sala Mill: Krebs Cyclone:	1 inch diameter 1/4 inch vortex 1/8 inch apex
Zn Regrind	
Conical Mill: Krebs Cyclone:	1½ inch diameter ½ inch vortex 1/4 inch apex

1.3. Flowsheet: As for Test PP-1.

1.4. Results: The grinding circuit was stable during the test run. Net Power Consumption in the Hendy Mill was 11.63 kilowatt-hours per ton of 1/2 inch feed. The cyclone overflow was 82.7 % passing 200 mesh.

Test No. PP-29 - Continued

1.4. Results

1.4.1. Ball Mill Report

Feed:	Minus 1/2 inch ore at 0.4 percent moisture content		
Feed Rate:	702 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	750 pounds	
	1½ inch balls	600 pounds	
	1 inch balls	239 pounds	
	Total	1589 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Mill Feed:	Total 5441 pounds, test period 1404 pounds		
Circulating Load:	Cyclone Underflow	465 percent	
Pulp Densities:		gpl	% Solids
	Mill Discharge	2086	68
	Cyclone Overflow	1350	34
	Cyclone Underflow	2555	79
Average Power:	Gross	6.06 kilowatts	
	No Load	1.92 kilowatts	
	Net	4.14 kilowatts	
Net Power Consumption:	1163 kilowatt-hours per ton of 1/2 inch feed		
Work Index:	10.15		

Test No. PP-29 - Continued

1.4. Results

1.4.2. Lead Regrind Mill Report

Regrind Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate		
Feed Rate:	129.0 pounds per hour 18.36 percent of the mill feed		
Mill Speed:	31 r.p.m., 72 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	350 pounds	
	Total	400 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densites:		gpl	% Solids
	Mill Discharge	2552	76
	Cyclone Feed	1213	22
	Cyclone Overflow	1102	11.5
	Cyclone Underflow	2552	76
Average Power:	Gross	3.43 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.51 kilowatts	
Net Power Consumption:	7.17 kilowatt-hours per ton of feed		

Test No. PP-29 - Continued

1.4. Results

1.4.3. Zinc Regrind Mill Report

Regrind Mill:	Conical Mill		
Feed:	Zn Ro. Conc. Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2618	77
	Cyclone Overflow	1132	15
	Cyclone Underflow	2618	77
Average Power:	Gross	2.13 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.21 kilowatts	
Net Power Consumption:	3.45 kilowatt-hours per ton of feed		

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.2	4.2	95.8
3	13.8	18.0	82.0
4	14.6	32.6	67.4
6	11.1	43.7	56.3
8	9.5	53.2	46.8
10	7.4	60.6	39.4
14	5.9	66.5	33.5
20	4.3	70.8	29.2
28	3.4	74.2	25.8
35	2.9	77.1	22.9
48	3.0	80.1	19.9
65	2.9	83.0	17.0
100	2.4	85.4	14.6
150	2.4	87.8	12.2
200	2.5	90.3	9.7
- 200	9.7	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.3	0.4	99.6
20	0.4	0.8	99.2
28	0.7	1.5	98.5
35	1.3	2.8	97.2
48	3.0	5.8	94.2
65	5.7	11.5	88.5
100	9.1	20.6	79.4
150	14.8	35.4	64.6
200	21.6	57.0	43.0
270	12.6	69.6	30.4
400	11.7	81.3	18.7
- 400	18.7	100.0	-
Total	100.0	-	-

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.5	0.9	99.1
28	0.8	1.7	98.3
35	1.5	3.2	96.8
48	3.7	6.9	93.1
65	7.1	14.0	86.0
100	10.7	24.7	75.3
150	17.3	42.0	58.0
200	24.1	66.1	33.9
270	13.1	79.2	20.8
400	10.5	89.7	10.3
- 400	10.3	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.9	0.9	99.1
100	2.2	3.1	96.9
150	4.6	7.7	92.3
200	9.6	17.3	82.7
270	9.5	26.8	73.2
400	16.1	42.9	57.1
- 400	57.1	100.0	-
Total	100.0	-	-

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	7.8	7.8	92.2
270	9.4	17.2	82.8
27.3 µm	18.2	35.4	64.6
20.6	7.7	43.1	56.9
14.8	12.6	55.7	44.3
10.2	11.4	67.1	32.9
7.9	7.0	74.1	25.9
- 7.9	25.9	100.0	-
Total	100.0	-	-

Specific Gravity = 4.96

Pb Regrind Cyclone Underflow

+ 200 mesh	4.6	4.6	95.4
270 mesh	8.6	13.2	86.8
27.3 µm	12.5	25.7	74.3
20.6	20.6	46.3	53.7
14.8	21.0	67.3	32.7
10.2	6.1	73.4	26.6
7.9	1.6	75.0	25.0
- 7.9	25.0	100.0	-
Total	100.0	-	-

Specific Gravity = 4.97

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Pb Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.0	2.0	98.0
270	5.4	7.4	92.6
27.5 µm	12.6	20.0	80.0
21.3	35.1	55.1	44.9
14.9	21.0	76.1	23.9
10.2	8.6	84.7	15.3
7.9	3.2	87.9	12.1
- 7.9	12.1	100.0	-
Total	100.0	-	-

Specific Gravity = 4.92

Pb Regrind Cyclone Overflow

+ 29.0 µm	0.8	0.8	99.2
22.5	1.4	2.2	97.8
15.7	10.6	12.8	87.2
10.8	19.4	32.2	67.8
8.3	14.0	46.2	53.8
- 8.3	53.8	100.0	-
Total	100.0	-	-

Specific Gravity = 4.52

Pb 4th Cleaner Concentrate

+ 25.0	1.8	1.8	98.2
19.4	2.8	4.6	95.4
13.5	17.0	21.6	78.4
9.3	22.4	44.0	56.0
7.1	13.0	57.0	43.0
- 7.1	43.0	100.0	-
Total	100.0	-	-

Specific Gravity = 5.77

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 34.2 µm	7.4	7.4	92.6
26.5	8.6	16.0	84.0
18.5	16.8	32.8	67.2
12.7	15.0	47.8	52.2
9.8	9.6	57.4	42.6
- 9.8	42.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.05

Zn Regrind Discharge

+ 200 mesh	23.7	23.7	76.4
270	29.6	53.3	46.7
28.8 µm	8.2	61.5	38.5
22.3	31.2	92.7	7.3
15.6	2.5	95.2	4.8
10.7	0.9	96.1	3.9
8.3	0.4	96.5	3.5
- 8.3	3.5	100.0	-
Total	100.0	-	-

Specific Gravity = 4.56

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Zn Scavenger Tailing

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 65 mesh	2.5	2.5	97.5
100	5.0	7.5	92.5
150	7.6	15.1	84.9
200	8.8	23.9	76.1
37.3 µm	5.2	29.1	70.9
28.9	18.0	47.1	52.9
20.2	10.1	57.2	42.8
13.9	8.2	65.4	34.6
10.7	5.2	70.6	29.4
- 10.7	29.4	100.0	-
Total	100.0	-	-

Specific Gravity = 3.13

Zn Regrind Cyclone Underflow

+ 150 mesh	3.7	3.7	96.3
200	20.4	24.1	75.9
270	28.3	52.4	47.6
28.4 µm	7.4	59.8	40.2
22.0	33.0	92.8	7.2
15.4	3.2	96.0	4.0
10.6	1.0	97.0	3.0
8.2	0.3	97.3	2.7
- 8.2	2.7	100.0	-
Total	100.0	-	-

Test No. PP-29 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Overflow

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 200 mesh	1.6	1.6	98.4
270	4.4	6.0	94.0
30.1 µm	17.1	23.1	76.9
23.3	11.8	34.9	65.1
16.3	16.8	51.7	48.3
11.2	12.4	64.1	35.9
8.7	6.8	70.9	29.1
- 8.7	29.1	100.0	-
Total	100.0	-	-

Specific Gravity = 4.28

Test No. PP-29 - Continued

2. Flotation

2.1. Purpose: To investigate the effect of a coarser lead concentrate regrind on lead and zinc flotation.

2.2. Method: Similar to Test PP-28, except that several slight modifications in the lead cleaning were made. These modifications were:

1) Omitted collector Z-11 from the lead regrind cyclone feed pump.

2) Diluted pulp to the Pb 4th cleaner

2.2.1. Flotation Equipment

As for Test PP-26

2.2.2. Flotation Reagent

See following page

2.3. Flowsheet: As for Test PP-26

2.4. Results: Lower additions of collector to the lead 1st cleaner improved lead concentrate grade, with no losses in recovery. The lead 4th cleaner concentrate assayed 56.4 % Pb at 77.6 % recovery. Higher pH in the zinc cleaning resulted in improved zinc concentrate grade.

Test No. PP-29 - Continued

2.2.2. Flotation Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	3.60	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.06	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed
MIBC	0.075	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.022	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
$ZnSO_4$	0.58	Pb Regrind Mill
Na_2CO_3	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.041	Pb 1st Cleaner Feed
Z-11	0.01	Pb 1st Cleaner 4th Cell
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.08	Pb 3rd Cleaner Feed
$CuSO_4$	2.04	Zn Rougher Conditioner No. 1
$Ca(OH)_2$	2.10	Zn Rougher Conditioner No. 2
Z-11	0.20	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
Z-200	0.16	Zn Rougher Feed Pump
DF-250	0.054	Zn Rougher Feed
Z-11	0.06	Zn Scavenger Feed
DF-250	0.029	Zn Scavenger Feed
$Ca(OH)_2$	1.60	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.084	Zn Regrind Mill
DF-250	0.030	Zn 1st Cleaner Feed
Z-200	0.005	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.29	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.15	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.20	Zn 4th Cleaner Feed

Test No. PP-29 - Continued

2.4. Results

2.4.1. pH

Product	pH
Cyclone Overflow	9.1
Pb Rougher Feed	9.1
Pb Scavenger Tailing	8.9
Pb Regrinding Mill Discharge	9.3
Pb 1st Cleaner Feed	9.2
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.3
Zn Rougher Feed	9.9
Zn Scavenger Tailing	9.4
Zn 1st Cleaner Scavenger Tailing	11.2
Zn 1st Cleaner Feed	11.3
Zn 2nd Cleaner Feed	11.3
Zn 3rd Cleaner Feed	11.3
Zn 4th Cleaner Feed	11.3

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1218
Pb Scavenger Tailing	1177
Pb 1st Cleaner Feed	1102
Pb Cleaner Concentrate	-
Zn Rougher Feed	1203
Zn Scavenger Tailing	1082
Zn 1st Cleaner Feed	1132
Zn Cleaner Concentrate	-

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	24
Pb Regrind Mill Discharge	25
Zn Rougher Feed	24
Zn Regrind Mill Discharge	24

Test No. PP-29 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.77	10.3
Pb Rougher Feed	5.50	11.3
Pb Rougher Concentrate	22.4	15.9
Pb Rougher Tailing	2.03	10.2
Pb Scavenger Concentrate	6.27	16.1
Pb Scavenger Tailing	1.46	9.47
Pb 1st Cleaner Concentrate	26.5	20.3
Pb 1st Cleaner Tailing	4.92	18.5
Pb Regrind Cyclone Overflow	19.3	20.0
Pb Regrind Cyclone Underflow	18.9	13.2
Pb Cleaner Concentrate	56.4	12.9
Zn Rougher Concentrate	1.53	17.9
Zn Scavenger Concentrate	1.24	4.09
Zn Scavenger Tailing	1.39	1.89
Zn Regrind Cyclone Overflow	2.15	18.9
Zn 1st Cleaner Scavenger Tailing	1.09	2.35
Zn Combined Tail	1.23	2.10
Zn Cleaner Concentrate	2.39	54.5

Test No. PP-29 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	18.36	22.4	15.9	71.3	26.0
Pb Rougher Tailing	81.64	2.03	10.2	28.7	74.0
Cyclone Overflow (meas)	100.00	5.77	10.3	100.0	100.0
(calc)		5.77	11.2		
Pb Scavenger Concentrate	9.67	6.27	16.1	10.5	13.8
Pb Scavenger Tailing	71.97	1.46	9.47	18.2	60.6
Pb Rougher Tailing (meas)	81.64	2.03	10.2	28.7	80.8
(calc)		2.03	10.3	28.7	74.4
Pb 1st Cleaner Conc.	14.87	26.5	20.3	68.3	26.8
Pb 1st Cleaner Tailing	3.49	4.92	18.5	3.0	5.7
Pb Rougher Concentrate (meas)	18.36	22.4	15.9	71.3	28.3
(calc)		22.4	20.0	71.3	32.5

Three-Product Formula

Pb 4th Cleaner Concentrate	7.95	56.4	12.9	77.6	9.9
Zn 4th Cleaner Concentrate	14.04	2.39	54.5	5.8	74.2
Zn Combined Tailing	78.01	1.23	2.10	16.6	15.9
Cyclone Overflow (meas)	100.00	5.77	10.3	100.0	100.0
(calc)		5.76	10.3		

Test No.PP-30

1. Grinding

1.1. Purpose: To repeat the conditions of Test PP-29.

1.2. Method: As for Test PP-26 to 29. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 701 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill: P-50 Dorr Cyclone - 1½ inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill: Krebs Cyclone - 1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill: Krebs Cyclone - 1½ inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for Test PP-1.

1.4. Results: The grinding circuit was stable during the test run. Net power consumption in the Hendy mill was 11.83 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 82.0 % minus 200 mesh

Test No. PP-30 - Continued

1.4. Results

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	701 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	750 pounds	
	1½ inch balls	600 pounds	
	1 inch balls	239 pounds	
	Total	1589 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5433 pounds, test period 1402 pounds		
Circulating Load:	Cyclone underflow 433 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2086	68
	Cyclone Overflow	1358	37
	Cyclone Underflow	2556	78
Average Power:	Gross	6.06 kilowatts	
	No Load	1.92 kilowatts	
	Net	4.14 kilowatts	
Net Power Consumption:	11.83 kilowatt-hours per ton of 1/2 inch feed		
Work Index:	10.8		

Test No. PP-30 - Continued

1.4. Results

1.4.2. Lead Regrind Mill Report

Regrind Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	103.0 pounds per hour 14.69 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	350 pounds	
	Total	400 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2280	70
	Cyclone Feed	1175	18.5
	Cyclone Overflow	1065	7.5
	Cyclone Underflow	2280	70
Average Power:	Gross	3.33 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.41 kilowatts	
Net Power Consumption:	6.89 kilowatt-hours per ton of feed		

Test No. PP-30 - Continued

1.4. Results

1.4.3. Zinc Regrind Mill Report

Regrind Mill:	Conical Mill		
Feed:	Zn Ro. Conc., Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Pulp Densites:		gpl	% Solids
	Mill Discharge	2536	77
	Cyclone Overflow	1125	12
	Cyclone Underflow	2536	77
Average Power:	Gross	1.90 kilowatts	
	No Load	0.92 kilowatts	
	Net	0.98 kilowatts	
Net Power Consumption:	2.80 kilowatt-hours per ton of feed		

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.2	4.2	95.8
3	15.4	19.6	80.4
4	12.7	32.3	67.7
6	10.8	43.1	56.9
8	10.0	53.1	46.9
10	7.4	60.5	39.5
14	5.7	66.2	33.8
20	4.2	70.4	29.6
28	3.5	73.9	26.1
35	2.9	76.8	23.2
48	3.1	79.9	20.1
65	3.0	82.9	17.1
100	2.4	85.3	14.7
150	2.4	87.7	12.3
200	2.6	90.3	9.7
- 200	9.7	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.4	0.8	99.2
28	0.7	1.5	98.5
35	1.2	2.7	97.3
48	3.0	5.7	94.3
65	5.8	11.5	88.5
100	9.0	20.5	79.5
150	14.3	34.8	65.2
200	20.9	55.7	44.3
270	12.3	68.0	32.0
400	11.8	79.8	20.2
- 400	20.2	100.0	-
Total	100.0	-	-

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.3	0.5	99.5
20	0.5	1.0	99.0
28	0.9	1.9	98.1
35	1.6	3.5	96.5
48	3.9	7.4	92.6
65	7.0	14.4	85.6
100	10.4	24.8	75.2
150	16.2	41.0	59.0
200	23.5	64.5	35.5
270	12.9	77.4	22.6
400	10.8	88.2	11.8
- 400	11.8	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.9	0.9	99.1
100	2.3	3.2	96.8
150	5.0	8.2	91.8
200	9.8	18.0	82.0
270	9.4	27.4	72.6
400	16.2	43.6	56.4
- 400	56.4	100.0	-
Total	100.0	-	-

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	6.6	6.6	93.4
270	8.7	15.3	84.7
28.1 µm	18.2	33.5	66.5
21.8	8.0	41.5	58.5
15.2	13.0	54.5	45.5
10.5	11.5	66.0	34.0
8.1	7.2	73.2	26.8
- 8.1	26.8	100.0	-
Total	100.0	-	-

Specific Gravity = 4.78

Pb Regrind Discharge

+ 270 mesh	5.4	5.4	94.6
37.3 µm	12.3	17.7	82.3
28.9	34.8	52.5	47.5
20.2	20.5	73.0	27.0
13.9	8.1	81.1	18.9
10.7	3.6	84.7	15.3
- 10.7	15.3	100.0	-
Total	100.0	-	-

Specific Gravity = 5.14

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Pb Regrind Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.5	4.5	95.5
270	9.6	14.1	85.9
29.1 µm	14.0	28.1	71.9
22.5	35.9	64.0	36.0
15.7	26.3	90.3	9.7
10.8	3.8	94.1	5.9
8.4	1.2	95.3	4.7
- 8.4	4.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.62

Pb Regrind Cyclone Overflow

+ 28.2 µm	0.8	0.8	99.2
21.9	2.0	2.8	97.2
15.3	13.5	16.3	83.7
10.5	19.3	35.6	64.4
8.1	12.8	48.4	51.6
- 8.1	51.6	100.0	-
Total	100.0	-	-

Specific Gravity = 4.67

Pb 4th Cleaner Concentrate

+ 25.0 µm	2.6	2.6	97.4
19.4	4.3	6.9	93.1
13.5	16.4	23.3	76.7
9.3	22.8	46.1	53.9
7.1	14.0	60.1	39.9
- 7.1	39.9	100.0	-
Total	100.0	-	-

Specific Gravity = 5.73

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Zinc Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 150 mesh	3.2	3.2	96.8
200	17.8	21.0	79.0
270	27.8	48.8	51.2
28.2 µm	9.0	57.8	42.2
21.9	32.5	90.3	9.7
15.3	3.4	93.7	6.3
10.5	1.4	95.1	4.9
8.1	0.6	95.7	4.3
- 8.1	4.3	100.0	-
Total	100.0	-	-

Specific Gravity = 4.68

Zinc Regrind Cyclone Underflow

+ 150 mesh	4.9	4.9	95.1
200	18.3	23.2	76.8
270	23.0	46.2	53.8
29.1 µm	7.5	53.7	46.3
22.5	34.4	88.1	11.9
15.7	6.6	94.7	5.3
10.8	2.0	96.7	3.3
8.4	0.4	97.1	2.9
- 8.4	2.9	100.0	-
Total	100.0	-	-

Specific Gravity = 4.56

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Zinc Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.4	4.4	95.6
270	8.8	13.2	86.8
28.8 µm	10.8	24.0	76.0
22.3	28.4	52.4	47.6
15.6	13.8	66.2	33.8
10.7	9.2	75.4	24.6
8.3	4.8	80.2	19.8
- 8.3	19.8	100.0	-
Total	100.0	-	-

Specific Gravity = 4.54

Zinc 4th Cleaner Concentrate

+ 200 mesh	1.4	1.4	98.6
270	6.2	7.6	92.4
30.5 µm	16.1	23.7	76.3
23.7	11.0	34.7	65.3
16.5	15.0	49.7	50.3
11.3	13.4	63.1	36.9
8.8	7.2	70.3	29.7
- 8.8	29.7	100.0	-
Total	100.0	-	-

Specific Gravity = 4.16

Test No. PP-30 - Continued

1.4.4. Screen Analyses

Zinc Scavenger Tailing

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 65 mesh	1.6	1.6	98.4
100	4.5	6.1	93.9
150	7.4	13.5	86.5
200	8.5	22.0	78.0
37.3 µm	4.6	26.6	73.4
28.9	18.6	45.2	54.8
20.2	10.1	55.3	44.7
13.9	8.0	63.3	36.7
10.7	5.2	68.5	31.5
- 10.7	31.5	100.0	-
Total	100.0	-	-

Specific Gravity = 3.12

Test No. PP-30 - Continued

2. Flotation

2.1. Purpose: To improve Pb concentrate grade.

2.2. Method: The following changes in the circuit were made:

1. Decreased lead first cleaner time by approximately 6 minutes.
2. Omitted collector Z-11 additions to the lead 1st cleaner, cell No. 4 feed.

2.2.1. Flotation Equipment

As for Test PP-26

2.2.2. Flotation Reagents

See Following Page

2.3. Flowsheet: As for Test PP-26

2.4. Results: The lead and zinc flotation results were poor. The lead 4th cleaner concentrate assayed 54.5 % Pb at 75.4 % Pb recovery, and the zinc 3rd cleaner concentrate assayed 50.0 % Zn at 78.0 % Zn recovery. It appeared that a coarser primary grind and coarser lead concentrate regrind resulted in deterioration of Pb and zinc flotation.

Test No. PP-30 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagents per Ton of Feed	Point of Addition
Na_2CO_3	3.90	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.06	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.074	Pb Rougher 3rd Cell
Z-11	0.05	Pb Scavenger Feed
MIBC	0.022	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
$ZnSO_4$	0.54	Pb Regrind Mill
Na_2CO_3	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.043	Pb 1st Cleaner Feed
NaCN	0.09	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	2.06	Zn Rougher Conditioner No. 1
$Ca(OH)_2$	2.8	Zn Rougher Conditioner No. 2
Z-11	0.20	Zn Rougher Feed Pump
DF-250	0.077	Zn Rougher Feed Pump
Z-200	0.152	Zn Rougher Feed Pump
DF-250	0.053	Zn Rougher Feed
Z-11	0.05	Zn Scavenger Feed
DF-250	0.03	Zn Scavenger Feed
$Ca(OH)_2$	1.00	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
Z-200	0.005	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.28	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.13	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.18	Zn 4th Cleaner Feed

Test No. PP-30 - Continued

2.4. Results

2.4.1. pH

Product	pH
Cyclone Overflow	9.2
Pb Rougher Feed	9.1
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	9.5
Pb 1st Cleaner Feed	9.1
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.2
Pb 4th Cleaner Feed	9.1
Zn Rougher Feed	9.9
Zn Scavenger Tailing	9.3
Zn 1st Cleaner Scav. Feed	10.4
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	10.9
Zn 3rd Cleaner Feed	11.0
Zn 4th Cleaner Feed	10.9

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1240
Pb Scavenger Tailing	1217
Pb 1st Cleaner Feed	1065
Zn Rougher Feed	1223
Zn Scavenger Tailing	1090
Zn 1st Cleaner Feed	1125

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	23
Pb Regrind Mill Discharge	24
Zn Rougher Feed	24
Zn Regrind Mill Discharge	25

Test No. PP-30 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.98	10.5
Pb Rougher Feed	6.21	11.8
Pb Rougher Concentrate	25.2	16.0
Pb Rougher Tailing	2.67	10.9
Pb Scavenger Concentrate	7.37	15.8
Pb Scavenger Tailing	1.60	9.71
Pb 1st Cleaner Concentrate	37.6	16.8
Pb 1st Cleaner Tailing	8.10	18.2
Pb Regrind Cyclone Overflow	24.0	17.3
Pb Regrind Cyclone Underflow	23.8	13.2
Pb Cleaner Concentrate	54.9	13.1
Zn Rougher Concentrate	1.60	17.4
Zn Scavenger Concentrate	1.22	3.15
Zn Scavenger Tailing	1.48	1.79
Zn Regrind Cyclone Overflow	1.86	13.8
Zn 1st Cleaner Scavenger Tailing	1.08	1.14
Zn Combined Tailing	1.40	1.64
Zn Cleaner Concentrate	2.53	50.0

Test No. PP-30 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	14.69	25.2	16.0	61.9	20.2
Pb Rougher Tailing	85.31	2.67	10.9	38.1	79.8
Cyclone Overflow (meas)	100.00	5.98	10.5	100.0	100.0
(calc)		5.98	11.6		
Pb Scavenger Concentrate	15.82	7.37	15.8	19.5	21.5
Pb Scavenger Tailing	69.49	1.60	9.71	18.6	57.9
Pb Rougher Tailing (meas)	85.31	2.67	10.9	38.1	88.6
(calc)		2.67	10.8	38.1	79.4
Pb 1st Cleaner Concentrate	8.52	37.6	16.8	53.6	12.3
Pb 1st Cleaner Tailing	6.17	8.10	18.2	8.4	9.6
Pb Rougher Conc. (meas)	14.69	25.2	16.0	62.0	21.6
(calc)		25.2	17.4	62.0	21.9

Three-Product Formula

Pb 4th Cleaner Concentrate	8.21	54.9	13.1	75.4	10.2
Zn 4th Cleaner Concentrate	16.37	2.53	50.0	6.9	78.0
Zn Combined Tailing	75.42	1.40	1.64	17.7	11.8
Cyclone Overflow (meas)	100.00	5.98	10.5	100.0	100.0

Test No. PP31

1. Grinding

1.1. Purpose: To produce finer cyclone overflow product.

1.2. Method: The Hendy mill load was increased from 1439 pounds to 2011 pounds, and ball size ratio was adjusted as for test PP1 to PP25. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 698 pounds per hour. The samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Goodwin Cyclone:

1 1/2 inch diameter
1/2 inch vortex
3/16 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1

1.4. Results: The grinding circuit was very stable throughout the test run. Net power consumption in the Hendy mill was 16.91 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 89.8 % minus 200 mesh.

Test No. PP31 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	698 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	761 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.00 hours, test period 2.00 hours		
Mill Feed:	Total 4886 pounds, test period 1396 pounds		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2072	68
	Cyclone Overflow	1320	32
	Cyclone Underflow	2464	78
Average Power:	Gross	7.84 kilowatts	
	No Load	1.92 kilowatts	
	Net	5.92 kilowatts	
Net Power Consumption:	16.91 kilowatt-hours per ton of ½ inch feed.		
Work Index:	12.94		

Test No. PP31 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	126.8 pounds per hour, 18.16 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent od critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	250 pounds	
	Total	300 pounds	
Operating Time:	Total 7.0 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2034	64
	Cyclone Feed	1208	21
	Cyclone Overflow	1142	15.5
	Cyclone Underflow	2034	64
Average Power	Gross	3.33 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.41 kilowatts	
Net Power Consumption:	6.89 kilowatt-hours per ton of feed		

Test No. PP31 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc., Zinc 2nd Cl. Tail. and Zinc 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.0 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2512	77
	Cyclone Overflow	1097	11.3
	Cyclone Underflow	2512	77
Average Power:	Gross	2.14 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.22 kilowatts	
Net Power Consumption:	3.49 kilowatt-hours per ton of feed		

Test No. PP31 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	6.5	6.5	93.5
3	17.8	24.3	75.7
4	14.9	39.2	60.8
6	11.0	50.2	49.8
8	8.5	58.7	41.3
10	6.6	65.3	34.7
14	5.4	70.7	29.3
20	3.6	74.3	25.7
28	3.2	77.5	22.5
35	2.5	80.0	20.0
48	2.6	82.6	17.4
65	2.5	85.1	14.9
100	2.0	87.1	21.9
150	2.0	89.1	10.9
200	2.1	91.2	8.8
- 200	8.8	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.2	0.4	99.6
28	0.3	0.7	99.3
35	0.6	1.3	98.7
48	1.4	2.7	97.3
65	2.8	5.5	94.5
100	5.0	10.5	89.5
150	9.3	19.8	80.2
200	17.1	36.9	63.1
270	14.0	50.9	49.1
400	19.3	70.2	29.8
- 400	29.8	100.0	-
Total	100.0	-	-

Test No. PP31 - Continued

1.4.4. Screen Analysis

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.3	0.6	99.4
28	0.5	1.1	98.9
35	0.8	1.9	98.1
48	1.9	3.8	96.2
65	3.7	7.5	92.5
100	6.1	13.6	86.4
150	11.3	24.9	75.1
200	19.6	44.5	55.5
270	15.4	59.9	40.1
400	20.4	80.3	19.7
- 400	19.7	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.3	0.3	99.7
100	0.7	1.0	99.0
150	2.4	3.4	96.6
200	6.8	10.2	89.8
270	7.4	17.6	82.4
400	15.4	33.0	67.0
- 400	67.0	100.0	-
Total	100.0	-	-

Test No. PP31 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.8	2.8	97.2
270	4.4	7.2	92.8
29.2 µm	14.4	21.6	78.4
22.6	10.9	32.5	67.5
15.8	19.6	52.1	47.9
10.9	14.6	66.7	33.3
8.4	7.8	74.5	25.5
- 8.4	25.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.57

Pb Regrind Discharge

+ 270 mesh	8.2	8.2	91.8
27.4 µm	12.9	21.1	78.9
21.2	41.7	62.8	37.2
14.8	16.3	79.1	20.9
10.2	6.2	85.3	14.7
7.9	2.9	88.2	11.8
- 7.9	11.8	100.0	-
Total	100.0	-	-

Specific Gravity 5.00

Pb Regrind Cyclone Underflow

+ 200 mesh	4.0	4.0	96.0
270	8.7	12.7	87.3
27.9 µm	13.5	26.2	73.8
21.6	35.7	61.9	38.1
15.1	26.4	88.3	11.7
10.4	4.0	92.3	7.7
8.0	1.5	93.8	6.2
- 8.0	6.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.93

Test No. PP31 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 29.1 µm	4.0	4.0	96.0
22.5	8.4	12.4	87.6
15.7	23.8	36.2	63.8
10.8	19.0	55.2	44.8
8.4	10.6	65.8	34.2
- 8.4	34.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.59

Pb 4th Cleaner Concentrate

+ 25.2 µm	3.2	3.2	96.8
19.5	6.6	9.8	90.2
13.6	21.4	31.2	68.8
9.4	20.8	52.0	48.0
7.2	12.0	64.0	36.0
- 7.2	36.0	100.0	-
Total	100.0	-	-

Specific Gravity 5.68

Zn Regrind Cyclone Underflow

+ 200 mesh	12.2	12.2	87.8
270	23.5	35.7	64.3
29.2 µm	9.6	45.3	54.7
22.6	41.0	86.3	13.7
15.8	10.3	96.6	3.4
10.9	0.8	97.4	2.6
8.4	0.2	97.6	2.4
- 8.4	2.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.56

Test No. PP31 - Continued

1.4.4. Screen Analysis

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	9.9	9.9	90.1
270	23.0	32.9	67.1
29.2 µm	11.1	44.0	56.0
22.6	41.4	85.4	14.6
15.8	8.8	94.2	5.8
10.9	1.4	95.6	4.4
8.4	0.5	96.1	3.9
- 8.4	3.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.54

Zn Regrind Cyclone Overflow

+ 270 mesh	4.5	4.5	95.5
29.9 µm	17.1	21.6	78.4
32.2	13.9	35.5	64.5
16.2	18.4	53.9	46.1
11.1	11.8	65.7	34.3
8.6	6.0	71.7	28.3
- 8.6	28.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.41

Test No. PP31 - Continued

1.4.4. Screen Analysis

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 30.8 µm	6.5	6.5	93.5
23.9	9.4	15.9	84.1
16.7	19.5	35.4	64.6
11.5	16.4	51.8	48.2
8.9	10.0	61.8	38.2
- 8.9	38.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.17

Zn Scavenger Tailings

+ 100 mesh	1.5	1.5	98.5
150	3.0	4.5	95.5
200	8.7	13.2	86.8
34.7 µm	19.7	32.9	67.1
26.9	10.4	43.3	56.7
18.7	13.3	56.6	43.4
12.9	10.0	66.6	33.4
10.0	5.9	72.5	27.5
- 10.0	27.5	100.0	-
Total	100.0	-	-

Specific Gravity 3.51

Test No. PP31 - Continued

2. Flotation

2.1. Purpose: To repeat conditions of test PP30 but with a finer Primary grind and coarser lead regrind.

2.2. Method: The fineness of the primary grind was adjusted to 90 % passing minus 200 mesh. In the lead regrinding circuit the 1 inch Krebs cyclone was replaced by the 1½ inch Goodwin cyclone, and 100 lb of balls were removed from the Sala mill.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet: As for test PP26.

2.4. Results: The finer primary grinding and coarser lead rougher concentrate regrinding did not result in any changes in the Pb and Zinc grade and recovery over that of test PP30. The final lead concentrate assayed 53.7 % Pb at 76.3 % Pb recovery. The zinc final concentrate assayed 55.0 % Zn at 75.4 % Zn recovery.

Test No. PP31 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent per Ton of Feed	Point of Addition
Na_2CO_3	3.80	Ball Mill Feed
NaCN	0.18	Ball Mill Feed
Z-11	0.06	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.113	Pb Rougher Feed Pump
MIBC	0.074	Pb Rougher 3rd Cell
Z-11	0.05	Pb Scavenger Feed
MIBC	0.021	Pb Scavenger Feed
NaCN	0.30	Pb Regrind Mill
$ZnSO_4$	0.52	Pb Regrind Mill
Na_2CO_3	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.030	Pb 1st Cleaner Feed
NaCN	0.09	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	2.06	Zn Rougher Cond. No. 2
$Ca(OH)_2$	2.80	Zn Rougher Cond. No. 1
Z-11	0.20	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
Z-200	0.156	Zn Rougher Feed Pump
DF-250	0.052	Zn Rougher Feed
Z-11	0.05	Zn Scavenger Feed
DF-250	0.029	Zn Scavenger Feed
$Ca(OH)_2$	1.40	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
Z-11	0.03	Zn 1st Cl. Scav.
Z-200	0.015	Zn 1st Cl. Scav.
$Ca(OH)_2$	0.28	Zn 2nd Cl. Feed
$Ca(OH)_2$	0.14	Zn 3rd Cl. Feed
$Ca(OH)_2$	0.22	Zn 4th Cl. Feed

Test No. PP31 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.1
Pb Rougher Feed	9.0
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	9.6
Pb 1st Cleaner Feed	9.2
Pb 2nd Cleaner Feed	9.2
Pb 3rd Cleaner Feed	9.2
Pb 4th Cleaner Feed	9.2
Zn Rougher Feed	10.5
Zn Scavenger Tailing	9.4
Zn 1st Cl. Scav. Feed	11.0
Zn 1st Cleaner Feed	11.1
Zn 2nd Cleaner Feed	11.1
Zn 3rd Cleaner Feed	11.0
Zn 4th Cleaner Feed	11.0

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1213
Pb Scavenger Tailing	1175
Pb 1st Cleaner Feed	1142
Zn Rougher Feed	1188
Zn Scavenger Tailing	1120
Zn 1st Cleaner Feed	1097

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	24
Pb Regrinding Mill Discharge	23
Zn Rougher Feed	24
Zn Regr. Mill Discharge	23

Test No. PP31 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.96	10.4
Pb Rougher Feed	6.01	12.2
Pb Rougher Concentrate	21.6	17.2
Pb Rougher Tailing	2.49	10.9
Pb Scavenger Concentrate	6.50	16.3
Pb Scavenger Tailing	1.49	9.59
Pb 1st Cleaner Concentrate	25.9	19.9
Pb 1st Cleaner Tailing	6.59	18.7
Pb Regrind Cyclone Underflow	19.8	15.3
Pb Regrind Cyclone Overflow	18.3	19.8
Pb Cleaner Concentrate	53.7	13.3
Zn Rougher Concentrate	2.19	27.4
Zn Scavenger Concentrate	1.29	4.13
Zn Scavenger Tailing	1.17	1.57
Zn Regrinding Cyclone Overflow	2.96	26.3
Zn 1st Cl. Scav. Tailing	2.15	3.55
Zn Combined Tailing	1.38	1.86
Zn Cleaner Concentrate	2.41	55.0

Test No. PP31 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	18.16	21.6	17.2	65.8	25.9
Pb Rougher Tailing	81.84	2.49	10.9	34.2	74.1
Cyclone Overflow (meas)	100.00	5.96	10.4	100.0	100.0
(Calc.)	-	5.96	12.0	-	-
Pb Scavenger Concentrate	16.34	6.50	16.3	17.8	22.1
Pb Scavenger Tailing	65.50	1.49	9.59	16.4	52.2
Pb Rougher Tailing (meas)	81.84	2.49	10.9	34.2	85.8
(Calc.)	-	2.49	10.9	34.2	74.3
Pb 1st Cleaner Conc.	14.12	25.9	19.9	61.4	23.3
Pb 1st Cleaner Tail.	4.04	6.59	18.7	4.5	6.3
Pb Ro. Concentrate (meas)	18.16	21.6	17.2	65.8	30.0
(Calc.)	-	21.6	19.6	65.9	29.6

Three-Product Formula

Product	Weight %	Assays, %					% Distribution			
		Pb	Zn	Ag*	Au*	Hg	Pb	Zn	Ag	Hg
Pb 4th Cl. Conc.	8.47	53.7	13.3	25.01	0.110	0.128	76.3	10.8	74.4	8.3
Zn 4th Cl. Conc.	14.25	2.41	55.0	2.13	0.005	0.057	5.8	75.4	10.7	62.2
Zn Comb. Tail.	77.28	1.38	1.86	0.55	0.005	0.005	17.9	13.8	14.9	29.5
Cyclone O/F	100.00	5.96	10.4	2.58	0.010	0.01	100.0	100.0	100.0	100.0

* oz/ton

Test No. PP31 - Continued

2.4.6. Water Analyses

Product	Assays, ppm				
	Zn	Pb	Cu	Fe	Ag
Hendy Cyclone Overflow	0.93	0.44	1.61	0.088	0.029
Zn Combined Tailing	0.22	0.25	5.18	0.41	<0.0009

Product	Assays CN mg/l
Pb Scavenger Tailing	10.13
Tailing Pond H_2O	<1.0

Test No. PP32

1. Grinding

1.1. Purpose: To repeat conditions of test PP31.

1.2. Method: As for test PP31. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 697 pounds per hour. Samples were taken every 20 minutes during the last 2 hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Goodwin Cyclone:

1 1/2 inch diameter
1/2 inch vortex
3/16 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1 1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was stable throughout the test run. Net power consumption in the Hendy mill was 17.91 kilowatt hours per ton of ½ inch feed. The cyclone overflow was 90 % minus 200 mesh.

Test No. PP32 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	697 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	761 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Mill Feed:	Total 5402 pounds, test period 1394 pounds		
Circulating Load:	Cyclone underflow 532 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2074	69
	Cyclone Overflow	1318	32
	Cyclone Underflow	2480	77
Average Power:	Gross	8.19 kilowatts	
	No Load	1.92 kilowatts	
	Net	6.27 kilowatts	
Net Power Consumption:	17.91 kilowatt-hours per ton of ½ inch feed.		
Work Index:	13.7		

Test No. PP32 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Ro. Conc. and Lead 2nd Cl. Tail.		
Feed Rate:	175.0 pounds per hour, 25.10 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	250 pounds	
	Total	300 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2180	68
	Cyclone Feed	1250	26
	Cyclone Overflow	1175	19
	Cyclone Underflow	2180	68
Average Power:	Gross	2.85 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.93 kilowatts	
Net Power Consumption:	5.51 kilowatt-hours per ton of feed		

Test No. PP32 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc. and Zn 2nd Cl. Tail. and Zn 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75hours, test period 2.00 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2560	75
	Cyclone Overflow	1083	10.0
	Cyclone Underflow	2560	75
Average Power:	Gross	1.90 kilowatts	
	No Load	0.92 kilowatts	
	Net	0.98 kilowatts	
Net Power Consumption:	2.80 kilowatt-hours per ton of feed.		

Test No. PP32 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	5.1	5.1	94.9
3	17.8	22.9	77.1
4	14.8	37.7	62.3
6	10.3	48.0	52.0
8	8.9	56.9	43.1
10	7.2	64.1	35.9
14	5.7	69.8	30.2
20	4.2	74.0	26.0
28	3.2	77.2	22.8
35	2.5	79.7	20.3
48	2.7	82.4	17.6
65	2.5	84.9	15.1
100	2.1	87.0	13.0
150	2.1	89.1	10.9
300	2.2	91.3	8.7
- 200	8.7	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.2	0.5	99.5
28	0.3	0.8	99.2
35	0.5	1.3	98.7
48	1.3	2.6	97.4
65	2.6	5.2	94.8
100	4.7	9.9	90.1
150	8.9	18.8	81.2
200	16.9	35.7	64.3
270	13.9	49.6	50.4
400	19.1	68.7	31.3
- 400	31.3	100.0	-
Total	100.0	-	-

Test No. PP32 - Continued

1.4.4. Screen Analysis

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.2	0.5	99.5
28	0.4	0.9	99.1
35	0.7	1.6	98.4
47	1.7	3.3	96.7
65	3.5	6.8	93.2
100	5.8	12.6	87.4
150	10.8	23.4	76.6
200	19.4	42.8	57.2
270	15.6	58.4	41.6
400	20.6	79.0	21.0
- 400	21.0	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.3	0.3	99.7
100	0.7	1.0	99.0
150	2.1	3.1	96.9
200	6.6	9.7	90.3
270	7.6	17.3	82.7
400	14.5	31.8	68.2
- 400	68.2	100.0	-
Total	100.0	-	-

Test No. PP32 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.6	2.6	97.4
270	3.8	6.4	93.6
29.8 µm	12.0	18.4	81.6
23.1	11.8	30.2	69.8
16.1	23.5	53.7	46.3
11.1	17.7	71.4	28.6
8.6	9.4	80.8	19.2
- 8.6	19.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.50

Pb Regrind Cyclone Underflow

+ 200 mesh	4.1	4.1	95.9
270	9.0	13.1	86.9
27.6 µm	12.6	25.7	74.3
21.4	35.8	61.5	38.5
14.9	25.6	87.1	12.9
10.3	4.3	91.4	8.6
7.9	1.7	93.1	6.9
- 7.9	6.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.98

Pb Regrind Discharge

+ 200 mesh	2.7	2.7	97.3
270	7.2	9.9	90.1
27.6 µm	12.3	22.2	77.8
21.4	34.2	56.4	43.6
14.9	25.5	81.9	18.1
10.3	5.5	87.4	12.6
7.9	2.4	89.8	10.2
- 7.9	10.2	100.0	-
Total	100.0	-	-

Specific Gravity 5.05

Test No. PP32 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 28.6 µm	2.3	2.3	97.7
22.2	6.4	8.7	91.3
15.5	23.3	32.0	68.0
10.7	20.6	52.6	47.4
8.2	11.4	64.0	36.0
- 8.2	36.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.63

Pb 4th Cleaner Concentrate

+ 24.1 µm	3.2	3.2	96.8
18.7	6.0	9.2	90.8
13.0	20.9	30.1	69.9
8.9	21.2	51.3	48.7
6.9	12.2	63.5	36.5
- 6.9	36.5	100.0	-
Total	100.0	-	-

Specific Gravity 6.21

Zn Regrind Discharge

+ 200 mesh	8.8	8.8	91.2
270	20.4	29.2	70.8
28.9 µm	11.5	40.7	59.3
22.4	41.8	82.5	17.5
15.6	12.1	94.6	5.4
10.7	1.2	95.8	4.2
8.3	0.4	96.2	3.8
- 8.3	3.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.65

Test No. PP32 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	7.4	7.4	92.6
270	16.6	24.0	76.0
29.4 µm	11.1	35.1	64.9
22.8	40.3	75.4	24.6
15.9	19.2	94.6	5.4
10.9	2.2	96.8	3.2
8.4	0.4	97.2	2.8
- 8.4	2.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.58

Zn Regrind Cyclone Overflow

+ 270 mesh	2.4	2.4	97.6
30.2 µm	12.8	15.2	84.8
23.4	14.7	29.9	70.1
16.3	21.6	51.5	48.5
11.2	13.4	64.9	35.1
8.7	6.8	71.7	28.3
- 8.7	28.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.35

Test No. PP32 - Continued

1.4.4. Screen Analysis

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 31.3 µm	8.2	8.2	91.8
24.3	11.4	19.6	80.4
17.0	19.4	39.0	61.0
11.7	15.4	54.4	45.6
9.0	9.3	63.7	36.3
- 9.0	36.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.12

Zn Scavenger Tailing

+ 100 mesh	1.5	1.5	98.5
150	3.0	4.5	95.5
200	9.0	13.5	86.5
36.7 µm	14.5	28.0	72.0
28.4	9.4	37.4	62.6
19.8	12.8	50.2	49.8
13.6	9.9	60.1	39.9
10.5	6.5	66.6	33.4
- 10.5	33.4	100.0	-
Total	100.0	-	-

Specific Gravity 3.30

Test No. PP32 - Continued

2. Flotation

2.1. Purpose:

1) To improve lead grade.
2) To improve zinc Grade and recovery.

2.2. Method:

Mechanically the circuit was similar to test PP30 except that collector additions to the Pb and Zn circuit were adjusted as follows:

1) Increased collector additions to the Hendy mill feed from 0.07 lb/ton to 0.09 lb/ton.
2) Decreased collector additions to the Zn rougher feed from 0.20 lb/ton to 0.1 lb/ton.
3) Collector Z-11 to the Zn scavenger feed decreased from 0.1 to 0.03 and Z-200 was added at a rate of 0.05 lb/ton.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet:

As for test PP26.

2.4. Results:

The lead cleaning circuit was unstable throughout the test run. Attempts were made to produce a high-grade lead concentrate. Therefore the froth discharge in the Pb 4th was decreased by additions of high amounts of water. The circulating load increased to high levels during the test period in the Pb 1st, 2nd and 3rd cleaner. This resulted in plugging of the pump and concentrate launders during the sampling period. The zinc flotation circuit was stable. The zinc cleaner concentrate assayed 54.5 % Zn at 79.8 % recovery.

Test No. PP32 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	4.20	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.075	Pb Rougher 3rd Cell
Z-11	0.05	Pb Scavenger Feed
MIBC	0.021	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
$ZnSO_4$	0.58	Pb Regrind Mill
Na_2CO_3	0.32	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.043	Pb 1st Cleaner Feed
NaCN	0.09	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	2.04	Zn Ro. Conditioner No. 2
$Ca(OH)_2$	2.30	Zn Ro. Conditioner No. 1
Z-200	0.16	Zn Ro. Conditioner No. 1
Z-11	0.15	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
DF-250	0.054	Zn Rougher Feed
Z-11	0.03	Zn Scavenger Feed
DF-250	0.03	Zn Scavenger Feed
Z-200	0.053	Zn Scavenger Feed
$Ca(OH)_2$	1.22	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.083	Zn Regrind Mill
Z-200	0.019	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.31	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.10	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.25	Zn 4th Cleaner Feed

Test No. PP32 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.2
Pb Rougher Feed	9.2
Pb Scavenger Tailing	9.0
Pb Regrinding Mill Discharge	9.6
Pb 1st Cleaner Feed	9.2
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.2
Zn Rougher Feed	10.0
Zn Scavenger Tailing	9.3
Zn 1st Cl. Scavenger	10.8
Zn 1st Cleaner Feed	11.0
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	10.9
Zn 4th Cleaner Feed	11.0

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1190
Pb Scavenger Tailing	1167
Pb 1st Cleaner Feed	1175
Zn Rougher Feed	1187
Zn Scavenger Tailing	1085
Zn 1st Cleaner Feed	1083

2.4.3. Temperature

Product	^{o}C
Pb Rougher Feed	23
Pb Regrinding Mill Discharge	23
Zn Rougher Feed	24
Zn Regrinding Mill Discharge	23

Test No. PP32 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.84	10.0
Pb Rougher Feed	5.99	13.1
Pb Rougher Concentrate	17.3	18.4
Pb Rougher Tailing	2.00	11.0
Pb Scavenger Concentrate	4.94	16.4
Pb Scavenger Tailing	1.29	9.53
Pb 1st Cleaner Concentrate	27.4	21.3
Pb 1st Cleaner Tailing	7.54	20.9
Pb Regrind Cyclone Overflow	20.6	21.3
Pb Regrind Cyclone Underflow	19.8	14.2
Pb Cleaner Concentrate	65.4	9.45
Zn Rougher Concentrate	1.45	18.8
Zn Scavenger Concentrate	0.94	2.84
Zn Scavenger Tailing	1.21	1.70
Zn Regrinding Cyclone Overflow	2.08	19.5
Zn 1st Cl. Scavenger Tailing	1.24	1.65
Zn Combined Tailing	1.23	1.73
Zn Cleaner Concentrate	2.16	54.5

Test No. PP32 - Continued

2.4.5. Metallurgical Results

Two-Product Forumula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	25.10	17.3	18.4	74.4	35.9
Pb Rougher Tailing	74.90	2.00	11.0	25.6	64.1
Cyclone Overflow (meas)	100.00	5.84	10.0	100.0	100.0
(Calc.)	-	5.84	12.9	-	-
Pb Scavenger Concentrate	14.57	4.94	16.4	12.3	18.6
Pb Scavenger Tailing	60.33	1.29	9.53	13.3	44.7
Pb Ro. Tailing (meas)	74.90	2.00	11.0	25.6	82.4
(Calc.)	-	2.00	10.9	25.6	63.3
Pb 1st Cl. Concentrate	12.33	27.4	21.3	57.9	20.4
Pb 1st Cl. Tailing	12.77	7.54	20.9	16.5	20.8
Pb Ro. Concentrate (meas)	25.10	17.3	18.4	74.4	46.2
(Calc.)	-	17.3	21.1	74.4	41.2

Three-Product Formula

Pb 4th Cl. Concentrate	6.97	65.4	9.45	78.1	6.6
Zn 4th Cl. Concentrate	14.65	2.16	54.5	5.4	79.8
Zn Combined Tailing	78.38	1.23	1.73	16.5	13.6
Cyclone Overflow (meas)	100.00	5.84	10.0	100.0	100.0
(Calc.)	-	5.84	10.0	-	-

Test No. PP33

1. Grinding

1.1. Purpose: To repeat conditions of test PP31.

1.2. Method: As for test PP31 to 32. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 696 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Goodwin Cyclone:

1 1/2 inch diameter
1/2 inch vortex
3/16 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was quite stable during the test run. Net power consumption in the Hendy mill was 17.6 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 91.6 % minus 200 mesh.

Test No. PP33 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	MInsu ½ inch ore at 0.4 percent moisture content		
Feed Rate:	696 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	761 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Mill Feed:	Total 5394 pounds, test period 1392 pounds		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2058	68
	Cyclone Overflow	1310	31
	Cyclone Underflow	2404	78
Average Power:	Gross	8.08 kilowatts	
	No Load	1.92 kilowatts	
	Net	6.16 kilowatts	
Net Power Consumption:	17.60 kilowatt-hours per ton of ½ inch feed.		
Work Index:	12.78		

Test No. PP3 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Ro. Conc. and Lead 2nd Cleaner Tailing		
Feed Rate:	200.6 pounds per hour, 28.57 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	250 pounds	
	Total	300 pounds	
Operating Time:	Total 7.75 hours, test period 2.00 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2236	69.5
	Cyclone Feed	1327	31
	Cyclone Overflow	1173	19
	Cyclone Underflow	2236	69.5
Average Power:	Gross	3.09 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.17 kilowatts	
Net Power Consumption:	6.20 kilowatt-hours per ton of feed.		

Test No. PP33 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc., Zinc 2nd Cl. Tail. and Zinc 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	320 pounds	
	½ inch balls	220 pounds	
	Total	540 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2542	76
	Cyclone Overflow	1083	10
	Cyclone Underflow	2542	76
Average Power:	Gross	2.26 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.34 kilowatts	
Net Power Consumption:	3.83 kilowatt-hours per ton of feed.		

Test No. PP33 - Continued

1.4.4. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	6.0	6.0	94.0
3	19.5	25.5	74.5
4	13.3	38.8	61.2
6	10.9	49.7	50.3
8	8.8	58.5	41.5
10	6.9	65.4	34.6
14	5.0	70.4	29.6
20	3.7	74.1	25.9
28	3.1	77.2	22.8
35	2.5	79.7	20.3
48	2.6	82.3	17.7
65	2.5	84.8	15.2
100	2.1	86.9	13.1
150	2.1	89.0	11.0
200	2.2	91.2	8.8
- 200	8.8	100.0	-
Total	100.0	-	-

Mill Discharge

+ 14	0.2	0.2	99.8
20	0.2	0.4	99.6
28	0.2	0.6	99.4
35	0.5	1.1	98.9
48	1.3	2.4	97.6
65	2.4	4.8	95.2
1-0	4.4	9.2	90.8
150	8.2	17.4	82.6
200	15.3	32.7	67.3
270	13.1	45.8	54.2
400	18.7	64.5	35.5
- 400	35.5	100.0	-
Total	100.0	-	-

Test No. PP33 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.3	0.5	99.5
28	0.4	0.9	99.1
35	0.8	1.7	98.3
48	1.8	3.5	96.5
65	3.4	6.9	93.1
100	5.7	12.6	87.4
150	10.2	22.8	77.2
200	18.1	40.9	59.1
270	14.6	55.5	44.5
400	19.4	74.9	25.1
- 400	25.1	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.2	0.2	99.8
100	0.6	0.8	99.2
150	1.8	2.6	97.4
200	5.8	8.4	91.6
270	6.4	14.8	85.2
400	13.7	28.5	71.5
- 400	71.5	100.0	-
Total	100.0	-	-

Test No. PP33 - Continued

1.4.4. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 150 mesh	2.2	2.2	97.8
200	5.2	7.4	92.6
270	7.1	14.5	85.5
28.0 µm	13.3	27.8	72.2
21.7	9.6	37.4	62.6
15.1	18.2	55.6	44.4
10.4	14.0	69.6	30.4
8.0	7.6	77.2	22.8
- 8.0	22.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.91

Pb Regrind Cyclone Underflow

+ 150 mesh	2.7	2.7	97.3
200	8.8	11.5	88.5
270	16.2	27.7	72.3
28.0 µm	12.3	40.0	60.0
21.7	41.4	81.4	18.6
15.1	7.6	89.0	11.0
10.4	3.0	92.0	8.0
8.0	1.3	93.3	6.7
- 8.0	6.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.93

Pb Regrind Discharge

+ 200 mesh	6.2	6.2	93.8
270	13.0	19.2	80.8
27.8 µm	14.0	33.2	66.8
21.5	38.8	72.0	28.0
15.0	10.5	82.5	17.5
10.3	4.8	87.3	12.7
7.9	2.3	89.6	10.4
- 7.9	10.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.98

Test No. PP33 - Continued

1.4.4. Screen Analyses

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 29.1 µm	4.2	4.2	95.8
22.5	7.6	11.8	88.2
15.7	22.1	33.9	66.1
10.8	19.6	53.5	46.5
8.4	11.1	64.6	35.4
- 8.4	35.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.61

Pb 4th Cleaner Concentrate

+ 24.8 µm	3.4	3.4	96.6
19.2	7.2	10.6	89.4
13.4	21.6	32.2	67.8
9.2	20.4	52.6	47.4
7.1	11.4	64.0	36.0
- 7.1	36.0	100.0	-
Total	100.0	-	-

Specific Gravity 5.90

Zn Regrind Cyclone Underflow

+ 200 mesh	8.5	8.5	91.5
270	19.3	27.8	72.2
29.5 µm	11.7	39.5	48.8
22.8	42.2	81.7	18.3
15.9	14.1	95.8	4.2
10.9	1.0	96.8	3.2
8.4	0.3	97.1	2.9
- 8.4	2.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.59

Test No. PP33 - Continued

1.4.4. Screen Analyses

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	6.6	6.6	93.4
270	17.7	24.3	75.7
29.2 µm	12.7	37.0	63.0
22.6	42.4	79.4	20.6
15.8	14.6	94.0	6.0
10.8	1.6	95.6	4.4
8.4	0.5	96.1	3.9
- 8.4	3.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.60

Zn Regrind Cyclone Overflow

+ 270 mesh	1.8	1.8	98.2
30.1 µm	10.8	12.6	87.4
23.3	12.6	25.6	74.8
16.3	22.8	48.0	52.0
11.2	15.2	63.2	36.8
8.6	7.4	70.6	29.4
- 8.6	29.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.36

Test No. PP33 - Continued

1.4.4. Screen Analyses

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 31.2 µm	10.6	10.6	89.4
24.2	12.2	22.8	77.2
16.9	19.2	42.0	58.0
11.6	14.4	56.4	43.6
9.0	8.6	65.0	35.0
- 9.0	35.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.08

Zn Scavenger Tailing

+ 100 mesh	1.6	1.6	98.4
150	4.2	5.8	94.2
200	10.1	15.9	84.1
270	-	15.9	84.1
33.7 µm	14.9	30.8	69.2
26.1	9.1	39.9	60.1
18.2	12.3	52.2	47.8
12.5	9.8	62.0	38.0
9.7	6.2	68.2	31.8
- 9.7	31.8	100.0	-
Total	100.0	-	-

Specific Gravity 3.87

Test No. PP33 - Continued

2. Flotation

2.1. Purpose:

1) To repeat conditions of test PP32 lead circuit.
2) To investigate the effect of point of lime and $CuSO_4$ additions to the Zn rougher conditioning.

2.2. Method:

The lead circuit was operated under the conditions of test PP32. In the zinc circuit the lime was added to the conditioner No. 1 instead to the conditioner No. 2 and $CuSO_4$ was added to the conditioner No. 2 instead to the conditioner No. 1. The Z-11 addition to the Zn scavenger feed was omitted.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet:

As for test PP26.

2.4. Results:

Decreased rate of Pb flotation in the cleaning appeared to improve lead grade. However the amount of zinc recirculated to the lead rougher and scavenger circuit was two times higher as compared to tests in which finer lead rougher concentrate regrinding was applied (PP27-28). The zinc cricuit was unstable during the test run. The zinc final concentrate assayed 51.8 % Zn at 79.0 % Zn recovery. It would appear to require long run test period in order to confirm the effect of coarser lead rougher concentrate regrinding.

Test No. PP33 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	3.92	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.073	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
Na_2CO_3	0.30	Pb Regrind Mill
$ZnSO_4$	0.56	Pb Regrind Mill
NaCN	0.31	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.043	Pb 1st Cleaner Feed
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	1.72	Zn Rougher Cond. No. 2
$Ca(OH)_2$	2.80	Zn Rougher Cond. No. 1
Z-200	0.09	Zn Rougher Cond. No. 1
Z-11	0.15	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
DF-250	0.053	Zn Rougher Feed
Z-11	0.03	Zn Scavenger Feed
DF-250	0.03	Zn Scavenger Feed
Z-200	0.054	Zn Scavenger Feed
$Ca(OH)_2$	1.00	Zn Regrind Mill
$CuSO_4$	0.30	Zn Regrind Mill
Z-200	0.082	Zn Regrind Mill
Z-200	0.02	Zn 1st Cleaner Scavenger
Z-11	0.03	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.33	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.10	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.25	Zn 4th Cleaner Feed

Test No. PP33 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.1
Pb Rougher Feed	9.1
Pb Scavenger Tailing	9.0
Pb Regrinding Mill Dsicharge	9.6
Pb 1st Cleaner Feed	9.3
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.2
Zn Rougher Feed	9.8
Zn Scavenger Tailing	9.2
Zn 1st Cl. Scav. Feed	10.7
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	11.0
Zn 4th Cleaner Feed	11.0

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1175
Pb Scavenger Tailing	1145
Pb 1st Cleaner Feed	1173
Zn Rougher Feed	1183
Zn Scavenger Tailing	1093
Zn 1st Cleaner Feed	1083

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	22
Pb Regrinding Mill Discharge	23
Zn Rougher Feed	23
Zn Regrinding Mill Discharge	23

Test No. PP33 - Continued

2.4. Results:

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.95	10.2
Pb Rougher Feed	5.67	12.7
Pb Rougher Concentrate	16.0	17.7
Pb Rougher Tailing	1.93	10.1
Pb Scavenger Concentrate	4.68	15.7
Pb Scavenger Tailing	1.14	9.28
Pb 1st Cleaner Concentrate	25.4	21.4
Pb 1st Cleaner Tailing	6.63	20.1
Pb Regrind Cyclone Overflow	16.9	20.9
Pb Regrind Cyclone Underflow	17.5	12.7
Pb Cleaner Concentrate	59.2	11.9
Zn Rougher Concentrate	1.30	18.6
Zn Scavenger Concentrate	0.94	3.10
Zn Scavenger Tailing	1.07	1.65
Zn Regrinding Cyclone Overflow	1.90	16.7
Zn 1st Cl. Scav. Tailing	1.06	1.32
Zn Combined Tailing	1.08	1.55
Zn Cleaner Concentrate	2.16	51.8

Test No. PP33 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	28.57	16.0	17.7	76.8	41.2
Pb Rougher Tailing	71.43	1.93	10.1	23.2	58.8
Cyclone Overflow (meas)	100.00	5.95	10.2	100.0	100.0
(Calc.)	-	5.95	12.3	-	-
Pb Scavenger Concentrate	15.94	4.68	15.7	12.6	20.4
Pb Scavenger Tailing	55.49	1.14	9.28	10.6	42.0
Pb Rougher Tailing (meas)	71.43	1.93	10.1	23.2	70.7
(Calc.)	-	1.93	16.7	23.2	62.4
Pb 1st Cleaner Conc.	14.26	25.4	21.4	60.9	24.9
Pb 1st Cleaner Tail.	14.31	6.63	20.1	15.9	23.4
Pb Ro. Conc. (meas)	28.57	16.0	17.7	76.8	41.1
(Calc.)	-	16.0	20.7	76.8	48.3

Three-Product Formula

Pb Concentrate	8.05	59.2	11.9	80.4	9.4
Zn Concentrate	15.55	2.16	51.8	5.7	79.0
Zn Combined Tailing	76.40	1.08	1.55	13.9	11.6
Cyclone Overflow	100.00	5.95	10.2	100.0	100.0

Test No. PP34

1. Grinding

1.1. Purpose: To repeat conditions of test PP31.

1.2. Method: As for test PP31 - 33. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 702 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Goodwin Cyclone:

1 1/2 inch diameter
1/2 inch vortex
3/16 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was stable during the test period. Net power consumption in the Hendy mill was 17.6 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 90.3 % minus 200 mesh.

Test No. PP34 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percnet moisture content		
Feed Rate:	702 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	761 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5441 pounds, test period 1404 pounds		
Circulating Load:	Cyclone underflow 567 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2078	69
	Cyclone Overflow	1322	33
	Cyclone Underflow	2462	79
Average Power:	Gross	8.08 kilowatts	
	No Load	1.92 kilowatts	
	Net	6.16 kilowatts	
Net Power Consumption:	17.6 kilowatt-hours per ton of ½ inch feed.		
Work Index:	13.5		

Test No. PP34 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	184.0 pounds per hour, 26.22 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	250 pounds	
	Total	300 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2182	67
	Cyclone Feed	1235	25
	Cyclone Overflow	1142	16
	Cyclone Underflow	2182	67
Average Power:	Gross	3.09 kilowatts	
	No Load	0.92 kilowatts	
	Net	2.17 kilowatts	
Net Power Consumption:	6.20 kilowatt-hours per ton of feed.		

Test No. PP34 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc., Zinc 2nd Cl. Tailing and Zinc 1st Cl. Scavenger Concentrate		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	680 pounds	
	½ inch balls	220 pounds	
	Total	900 pounds	
Operating Time:	Total 7.75 hours, test peirod 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2456	75
	Cyclone Overflow	1055	7.0
	Cyclone Underflow	2456	75
Average Power:	Gross	1.90 kilowatts	
	No Load	0.92 kilowatts	
	Net	0.98 kilowatts	
Net Power Consumption:	2.80 kilowatt-hours per ton of feed.		

Test No. PP34 - Continued

1.4.4. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	6.6	6.6	93.4
3	15.6	22.2	77.8
4	14.2	36.4	63.6
6	12.1	48.5	51.5
8	8.5	57.0	43.0
10	6.8	63.8	36.2
14	5.5	69.3	30.7
20	4.0	73.3	26.7
28	3.3	76.6	23.4
35	2.4	79.0	21.0
48	3.0	82.0	18.0
65	2.6	84.6	15.4
100	2.2	86.8	13.2
150	2.2	89.0	11.0
200	2.2	91.2	8.8
- 200	8.8	100.0	-
Total	100.0	-	-

Mill Discharge

+ 14	0.2	0.2	99.8
20	0.2	0.4	99.6
28	0.3	0.7	99.3
35	0.5	1.2	98.8
48	1.4	2.6	97.4
65	2.6	5.2	94.8
100	4.9	10.1	89.9
150	9.1	19.2	80.8
200	17.0	36.2	63.8
270	13.9	50.1	49.9
400	20.0	70.1	29.9
- 400	29.9	100.0	-
Total	100.0	-	-

Test No. PP34 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.2	0.6	99.4
28	0.4	1.0	99.0
35	0.6	1.6	98.4
38	1.8	3.4	96.6
65	3.5	6.9	93.1
100	5.9	12.8	87.2
150	10.9	23.7	76.3
200	19.5	43.2	56.8
270	15.6	58.8	41.2
400	20.7	79.5	20.5
- 400	20.5	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.3	0.3	99.7
100	0.7	1.0	99.0
150	2.1	3.1	96.9
200	6.6	9.7	90.3
270	7.5	17.2	82.8
400	14.9	32.1	67.9
- 400	67.9	100.0	-
Total	100.0	-	-

Test No. PP34 - Continued

1.4.4. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 270 mesh	4.3	4.3	95.7
30.1 µm	9.6	13.9	86.1
23.4	8.8	22.7	77.3
16.3	21.4	44.1	55.9
11.2	17.0	61.1	38.9
8.7	9.5	70.6	29.4
- 8.7	29.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.48

Pb Regrind Cyclone Underflow

+ 200 mesh	2.6	2.6	97.4
270	7.0	9.6	90.4
28.4 µm	12.2	21.8	78.2
22.0	36.0	57.8	42.2
15.4	31.0	88.8	11.2
10.6	3.8	92.6	7.4
8.2	1.4	94.0	6.0
- 8.2	6.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.88

Pb Regrind Discharge

+ 200 mesh	2.0	2.0	98.0
270	5.6	7.6	92.4
28.4 µm	12.5	20.1	79.9
22.0	34.0	54.1	45.9
15.4	29.3	83.4	16.6
10.6	5.1	88.5	11.5
8.2	2.2	90.7	9.3
- 8.2	9.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.88

Test No. PP34 - Continued

1.4.4. Screen Analyses

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 30.1 µm	2.3	2.3	97.7
23.3	6.7	9.0	91.0
16.3	24.2	33.2	66.8
11.2	20.5	53.7	46.3
8.6	11.6	65.3	34.7
- 8.6	34.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.33

Pb 4th Cleaner Concentrate

+ 24.7 µm	2.6	2.6	97.4
19.2	6.4	9.0	91.0
13.4	21.1	30.1	69.9
9.2	19.2	49.3	50.7
7.1	11.3	60.6	39.4
- 7.1	39.4	100.0	-
Total	100.0	-	-

Specific Gravity 6.03

Zn Regrind Cyclone Overflow

+ 270 mesh	3.2	3.2	96.8
30.6 µm	15.7	18.9	81.1
23.7	16.9	35.8	64.2
16.6	21.8	57.6	42.4
11.4	11.9	69.5	30.5
8.8	5.7	75.2	24.8
- 8.8	24.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.33

Test No. PP34 - Continued

1.4.4. Screen Analyses

Zn Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	5.2	5.2	94.8
270	12.7	17.9	69.4
30.1 µm	11.5	29.4	70.6
23.4	41.6	71.0	29.0
16.3	22.8	93.8	6.2
11.2	2.0	95.8	4.2
8.7	0.6	96.4	3.6
- 8.7	3.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.49

Zn 4th Cleaner Concentrate

+ 33.1 µm	7.6	7.6	92.4
25.6	8.4	16.0	84.0
17.9	19.2	35.2	64.8
12.3	17.0	52.2	47.8
9.5	10.0	62.2	37.8
- 9.5	37.8	100.0	-
Total	100.0	-	-

Specific Gravity 3.83

Zn Regrind Cyclone Underflow

+ 200 mesh	5.8	5.8	94.2
270	13.4	19.2	80.8
30.1 µm	10.1	29.3	70.7
23.4	43.0	72.3	27.7
16.3	23.4	95.7	4.3
11.2	1.4	97.1	2.9
8.7	0.3	97.4	2.6
- 8.7	2.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.46

Test No. PP34 - Continued

1.4.4. Screen Analyses

Zn Scavenger Tailing

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 100 mesh	1.2	1.2	98.8
150	2.2	3.4	96.6
200	6.8	10.2	89.8
35.4 µm	17.0	27.2	72.8
27.4	10.6	37.8	62.2
19.2	14.2	52.0	48.0
13.2	10.7	62.7	37.3
10.2	6.2	68.9	31.1
- 10.2	31.1	100.0	-
Total	100.0	-	-

Specific Gravity 3.54

Zn Tailing Cyclone Underflow

+ 100 mesh	1.3	1.3	98.7
150	2.4	3.7	96.3
200	6.0	9.7	90.3
34.9 µm	9.8	19.5	80.5
27.1	32.2	51.7	48.3
18.9	22.7	74.4	25.6
13.0	14.6	89.0	11.0
10.0	3.9	92.9	7.1
- 10.0	7.1	100.0	-
Total	100.0	-	-

Specific Gravity 3.59

Zn Tailing Cyclone Overflow

+ 26.4 µm	2.0	2.0	98.0
18.4	0.6	2.6	97.4
12.7	5.9	8.5	91.5
9.8	10.9	19.4	80.6
- 9.8	80.6	100.0	-
Total	100.0	-	-

Specific Gravity 3.73

Test No. PP34 - Continued

2. Flotation

2.1. Purpose: To repeat conditions of test PP33 while attempting to stabilize the lead cleaning circuit.

2.2. Method: Similar to test PP33 except that MIBC was omitted from the Pb 1st cleaner circuit and decreased collector additions to the Zn rougher and scavenger feed.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet: As for test PP26.

2.4. Results: Lead grade and recovery were similar to those obtained in the previous tests. Zinc grade and recovery were poor.

Test No. PP34 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	4.40	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	0.96	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.074	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
$ZnSO_4$	0.56	Pb Regrind Mill
Na_2CO_3	0.36	Pb Regrind Mill
NaCN	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.07	Pb 3rd Cleaner Feed
$CuSO_4$	2.06	Zn Rougher Cond. No. 2
$Ca(OH)_2$	2.40	Zn Rougher Cond. No. 1
Z-200	0.09	Zn Rougher Cond. No. 1
Z-11	0.15	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
DF-250	0.053	Zn Rougher Feed
Z-11	0.03	Zn Scavenger Feed
DF-250	0.03	Zn Scavenger Feed
Z-200	0.053	Zn Scavenger Feed
$Ca(OH)_2$	1.30	Zn Regrind Mill
$CuSO_4$	0.31	Zn Regrind Mill
Z-200	0.084	Zn Regrind Mill
Z-11	0.03	Zn 1st Cleaner Scavenger
Z-200	0.019	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.31	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.10	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.17	Zn 4th Cleaner Feed

Test No. PP34 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.2
Pb Rougher Feed	9.1
Pb Scavenger Tailing	8.9
Pb Regrinding Mill Discharge	9.5
Pb 1st Cleaner Feed	9.2
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.3
Pb 4th Cleaner Feed	9.2
Zn Rougher Feed	9.9
Zn Scavenger Tailing	9.3
Zn 1st Cl. Scav. Feed	10.6
Zn 1st Cleaner Feed	11.0
Zn 2nd Cleaner Feed	11.1
Zn 3rd Cleaner Feed	11.0
Zn 4th Cleaner Feed	11.1

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1165
Pb Scavenger Tailing	1148
Pb 1st Cleaner Feed	1142
Pb Rougher Concentrate	1235
Zn Rougher Feed	1170
Zn Rougher Concentrate	1335
Zn 1st Cleaner Feed	1055
Zn Scav. Tail. Cyclone O/F	1017
Zn Scav. Tail. Cyclone U/F	1780

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	21
Pb Regrinding Mill Discharge	21
Zn Rougher Feed	22
Zn Regrinding Mill Discharge	22

Test No. PP34 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.88	10.2
Pb Rougher Feed	5.67	12.9
Pb Rougher Concentrate	16.6	19.0
Pb Rougher Tailing	2.07	10.8
Pb Scavenger Concentrate	4.87	16.5
Pb Scavenger Tailing	1.53	10.2
Pb 1st Cleaner Concentrate	25.5	22.1
Pb 1st Cleaner Tailing	7.21	20.9
Pb Regrind Cyclone Overflow	16.7	21.5
Pb Regrind Cyclone Underflow	19.0	14.2
Pb Cleaner Concentrate	64.8	9.35
Zn Rougher Concentrate	2.07	35.6
Zn Scavenger Concentrate	1.39	6.36
Zn Scavenger Tailing	1.20	1.85
Zn Regrinding Cyclone Overflow	2.15	24.3
Zn 1st Cleaner Scavenger Tailing	1.78	3.34
Zn Combined Tailing	1.27	2.08
Zn Cleaner Concentrate	2.20	53.5

Test No. PP34 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	26.22	16.6	19.0	74.0	38.5
Pb Rougher Tailing	73.78	2.07	10.8	26.0	61.5
Cyclone Overflow (meas)	100.00	5.88	10.2	100.0	100.0
(Calc.)	-	5.88	13.0	-	-
Pb Scavenger Concentrate	11.92	4.87	16.5	9.9	15.2
Pb Scavenger Tailing	61.86	1.53	10.2	16.1	48.7
Pb Rougher Tailing (meas)	73.78	2.07	10.8	26.0	78.1
(Calc.)	-	2.07	11.2	26.0	63.9
Pb 1st Cleaner Conc.	13.46	25.5	22.1	58.4	23.0
Pb 1st Cleaner Tail.	12.76	7.21	20.9	15.6	20.6
Pb Ro. Concentrate (meas)	26.22	16.6	19.0	74.0	48.8
(Calc.)	-	16.6	21.5	74.0	43.6

Three-Product Formula

Pb 4th Cleaner Conc.	7.04	64.8	9.35	77.6	6.5
Zn 4th Cleaner Conc.	14.65	2.20	53.5	5.5	77.4
Zn Combined Tailing	78.33	1.27	2.08	16.9	16.1
Cyclone Overflow	100.00	5.88	10.2	100.0	100.0

Test No. PP35

1. Grinding

1.1. Purpose: To repeat conditions of test PP34.

1.2. Method: As for test PP31 - 34. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 700 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The operation of the grinding circuit was unstable during the test period because of several blockages in the cyclone and variation in the mill feed rate. Net power consumption in the Hendy mill was 20.0 kilowatt-hours per ton of ½ inch feed. The cylone overflow was 83.0 % minus 200 mesh.

Test No. PP35 - Continued

1.4. Results:

1.4.1.Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	700 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	761 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.50 hours, test period 2.0 hours		
Mill Feed:	Total 5250 pounds, test period 1400 pounds		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2060	68
	Cyclone Overflow	1310	31
	Cyclone Underflow	2422	78
Average Power:	Gross	8.91 kilowatts	
	No Load	1.92 kilowatts	
	Net	6.99 kilowatts	
Net Power Consumption:	20.0 kilowatt-hours per ton of ½ inch feed.		
Work Index:	17.2		

Test No. PP35 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	157.0 pounds per hour, 22.14 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	650 pounds	
	Total	700 pounds	
Operating Time:	Total 7.50 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2072	65
	Cyclone Feed	1230	24
	Cyclone Overflow	1112	12.5
	Cyclone Underflow	2072	65
Average Power:	Gross	5.58 kilowatts	
	No Load	0.92 kilowatts	
	Net	4.66 kilowatts	
Net Power Consumption:	13.3 kilowatt-hours per ton of feed.		

Test No. PP35 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Rougher Concentrate, 2nd Cleaner Tailing		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	660 pounds	
	½ inch balls	220 pounds	
	Total	880 pounds	
Operating Time:	Total 7.5 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2248	72
	Cyclone Overflow	1043	5.5
	Cyclone Underflow	2248	72
Average Power:	Gross	2.85 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.93 kilowatts	
Net Power Consumption:	5.51 kilowatt-hours per ton of feed.		

Test No. PP35 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	5.1	5.1	94.9
3	15.0	20.1	79.9
4	12.6	32.7	67.3
6	11.7	44.4	55.6
8	8.8	53.2	46.8
10	7.6	60.8	39.2
14	6.2	67.0	33.0
20	4.4	71.4	28.6
28	3.7	75.1	24.9
35	2.7	77.8	22.2
48	3.3	81.1	18.9
65	2.9	84.0	16.0
100	2.3	86.3	13.7
150	2.3	88.6	11.4
200	2.4	91.0	9.0
- 200	9.0	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.2	0.5	99.5
28	0.4	0.9	99.1
35	0.5	1.4	98.6
48	1.3	2.7	97.3
65	2.4	5.1	94.9
100	4.2	9.3	90.7
150	8.2	17.5	82.5
200	15.7	33.2	66.8
270	13.2	46.4	53.6
300	20.0	66.4	33.6
- 400	33.6	100.0	-
Total	100.0	-	-

Test No. PP35 - Continued

1.4.4. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.2	0.4	99.4
20	0.3	0.7	99.3
28	0.4	1.1	98.9
35	0.5	1.6	98.4
48	1.6	3.2	96.8
65	3.1	6.3	93.7
100	5.2	11.5	88.5
150	9.9	21.4	78.6
200	18.3	39.7	60.3
270	15.0	54.7	45.3
400	21.8	76.5	23.5
- 400	23.5	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	2.0	2.0	98.0
100	1.9	3.9	96.1
150	4.0	7.9	92.1
200	9.1	17.0	83.0
270	9.0	26.0	74.0
400	16.2	42.2	57.8
- 400	57.8	100.0	-
Total	100.0	-	-

Test No. PP35 - Continued

1.4.4. Screen Analysis

Pb Regrind Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 270 mesh	2.0	2.0	98.0
28.8 µm	12.6	14.6	85.4
22.3	13.0	27.6	72.4
15.6	28.4	55.9	44.1
10.7	17.6	73.5	26.5
8.3	7.0	80.5	19.5
- 8.3	19.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.79

Pb Regrind Cyclone Underflow

+ 200 mesh	2.6	2.6	97.4
270	4.2	6.8	93.2
29.1 µm	16.4	23.2	76.8
22.5	15.0	38.2	23.6
15.7	29.0	67.2	32.8
10.8	16.6	83.8	16.2
8.4	5.4	89.2	10.8
- 8.4	10.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.79

Pb Rougher Concentrate

+ 200 mesh	3.6	3.6	96.4
270	4.8	8.4	91.6
30.4 µm	11.8	20.2	79.8
22.5	7.2	27.4	72.6
16.5	13.2	40.6	59.4
11.3	14.2	54.8	45.2
8.7	10.4	65.2	34.8
- 8.7	34.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.52

Test No. PP35 - Continued

1.4.4. Screen Analysis

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 22.6 µm	1.2	1.2	98.8
15.8	6.1	7.3	92.7
10.9	16.4	23.7	76.3
8.4	15.4	39.1	60.9
- 8.4	60.9	100.0	-
Total	100.0	-	-

Specific Gravity 4.54

Pb 4th Cleaner Concentrate

+ 24.5 µm	1.6	1.6	98.4
19.0	1.6	3.2	96.8
13.2	10.6	13.8	86.2
9.1	22.0	35.8	64.2
7.0	16.1	51.9	48.1
- 7.0	48.1	100.0	-
Total	100.0	-	-

Specific Gravity 6.05

Zn Regrind Discharge

+ 200 mesh	1.6	1.6	98.4
270	3.3	4.9	95.1
30.8 µm	7.1	12.0	88.0
23.9	19.2	31.2	68.8
16.7	33.6	64.8	35.2
11.5	7.5	72.3	27.7
8.9	1.6	73.9	26.1
- 8.9	26.1	100.0	-
Total	100.0	-	-

Specific Gravity 4.34

Test No. PP35 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Underflow

Particle Size	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 200 mesh	3.0	3.0	97.0
270	4.2	7.2	92.8
31.3 µm	6.3	13.5	86.5
24.3	29.0	42.5	57.5
16.9	43.6	86.1	13.9
11.6	8.7	94.8	5.2
9.0	1.6	96.4	3.6
- 9.0	3.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.29

Zn 4th Cleaner Concentrate

+ 31.3 µm	1.4	1.4	98.6
24.3	2.7	4.1	95.9
17.0	9.9	14.0	86.0
11.7	20.6	34.6	65.4
9.0	14.6	49.2	50.8
- 9.0	50.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.06

Test No. PP35 - Continued

1.4.4. Screen Analysis

Zn Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 31.5 µm	3.3	3.3	96.7
24.4	2.9	6.2	93.8
17.0	10.4	16.6	83.4
11.7	17.8	34.4	65.6
9.0	10.9	45.3	54.7
- 9.0	54.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.14

Zn Scavenger Tailing

+ 150 mesh	2.2	2.2	97.8
200	5.4	7.6	92.4
35.0 µm	15.2	22.8	77.2
27.1	9.8	32.6	67.4
18.9	14.9	47.5	52.5
13.0	12.0	59.5	40.5
10.1	7.2	66.7	33.3
- 10.1	33.3	100.0	-
Total	100.0	-	-

Specific Gravity 3.64

Test No. PP35 - Continued

2. Flotation

2.1. Purpose:

1) To investigate the effect of finer lead rougher concentrate regrind.
2) To improve zinc concentrate grade and recovery.

2.2. Method:

The following reagent and circuit changes were made:

1) Pb Circuit

a) Increased fineness of lead concentrate regrind from 85 % minus 20 µm to 95 % minus 20 µm.
b) The level of reagent additions was as for test PP9; except that 0.005 lb/ton of MIBC was added to the Pb 2nd cleaner.

2) Zinc Circuit

a) The Zn 1st cleaner scavenger concentrate was recycled to the Zn 1st conditioner instead of the Zn regrinding mill.
b) The H_2SO_4 was added to the Zn 1st conditioner together with $CuSO_4$.
c) Collector Z-11 was replaced with collector Z-6.
d) Collector Z-200 was added to the Zn 2nd and 3rd cleaner.
e) Increased pH in the Zn 2nd, 3rd, and 4th cleaner.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.4. Results:

Improvements in the Pb and zinc concentrate grade were obtained with the above changes. However, recoveries were lower.

Test No. PP35 - Continued

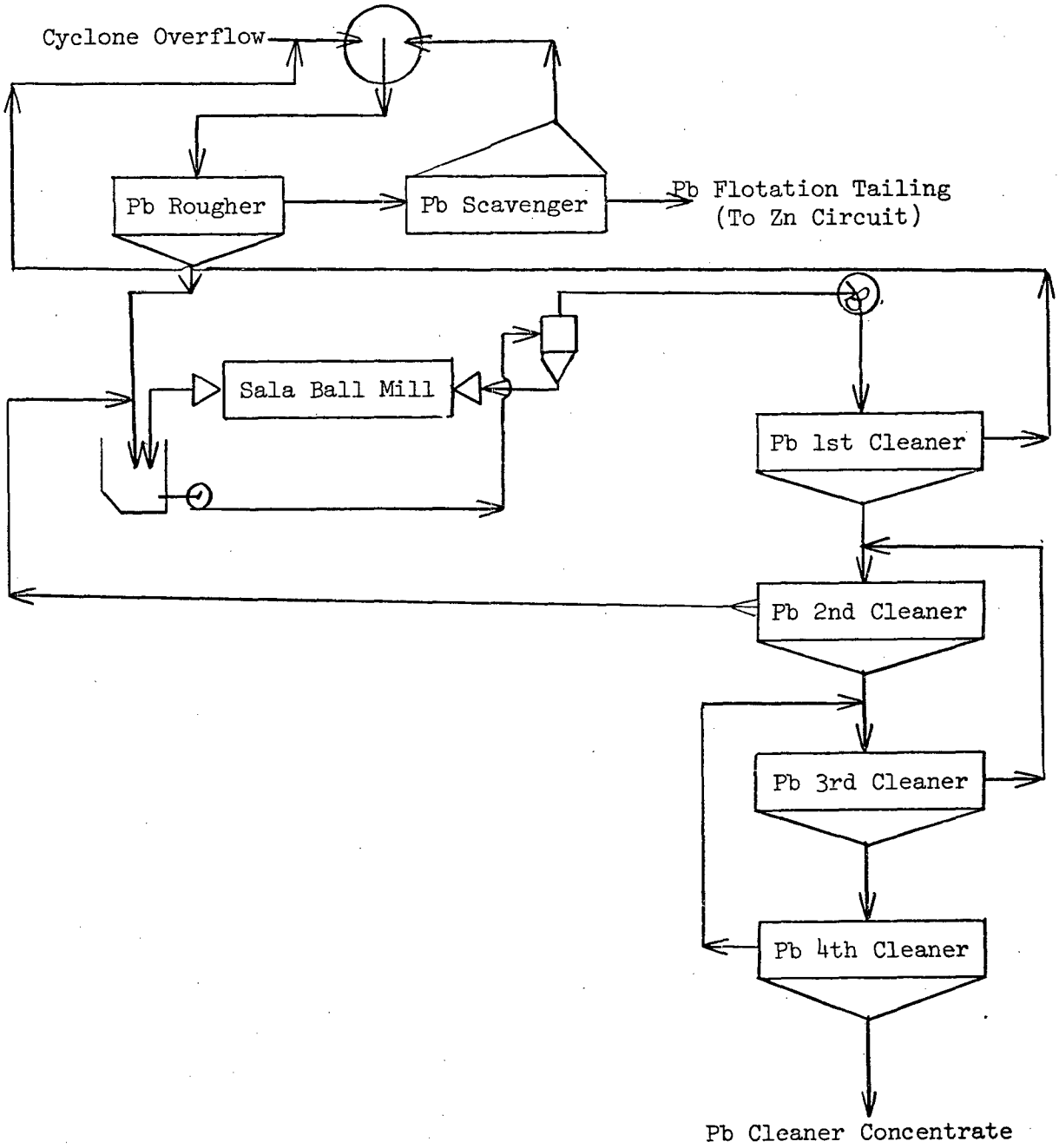
2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	4.24	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.073	Pb Rougher 3rd Cell
Z-11	0.05	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
$ZnSO_4$	0.56	Pb Regrind Mill
Na_2CO_3	0.30	Pb Regrind Mill
NaCN	0.30	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
MIBC	0.015	Pb 1st Cleaner Feed
NaCN	0.005	Pb 2nd Cleaner Feed
MIBC	0.008	Pb 2nd Cleaner Feed
$CuSO_4$	1.90	Zn Rougher Cond. No. 1
H_2SO_4	0.77	Zn Rougher Cond. No. 1
$Ca(OH)_2$	2.56	Zn Rougher Cond. No. 2
Z-6	0.105	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
Z-200	0.09	Zn Rougher Feed Pump
DF-250	0.055	Zn Rougher Feed
Z-6	0.02	Zn Scavenger Feed
DF-250	0.03	Zn Scavenger Feed
Z-200	0.018	Zn Scavenger Feed
$Ca(OH)_2$	1.36	Zn Regrind Mill
$CuSO_4$	0.40	Zn Regrind Mill
Z-200	0.105	Zn Regrind Mill
Z-6	0.03	Zn 1st Cleaner Feed
Z-200	0.055	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.24	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.17	Zn 3rd Cleaner Feed
Z-200	0.018	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.16	Zn 4th Cleaner Feed

Test No. PP35 - Continued

2.3. Flowsheet

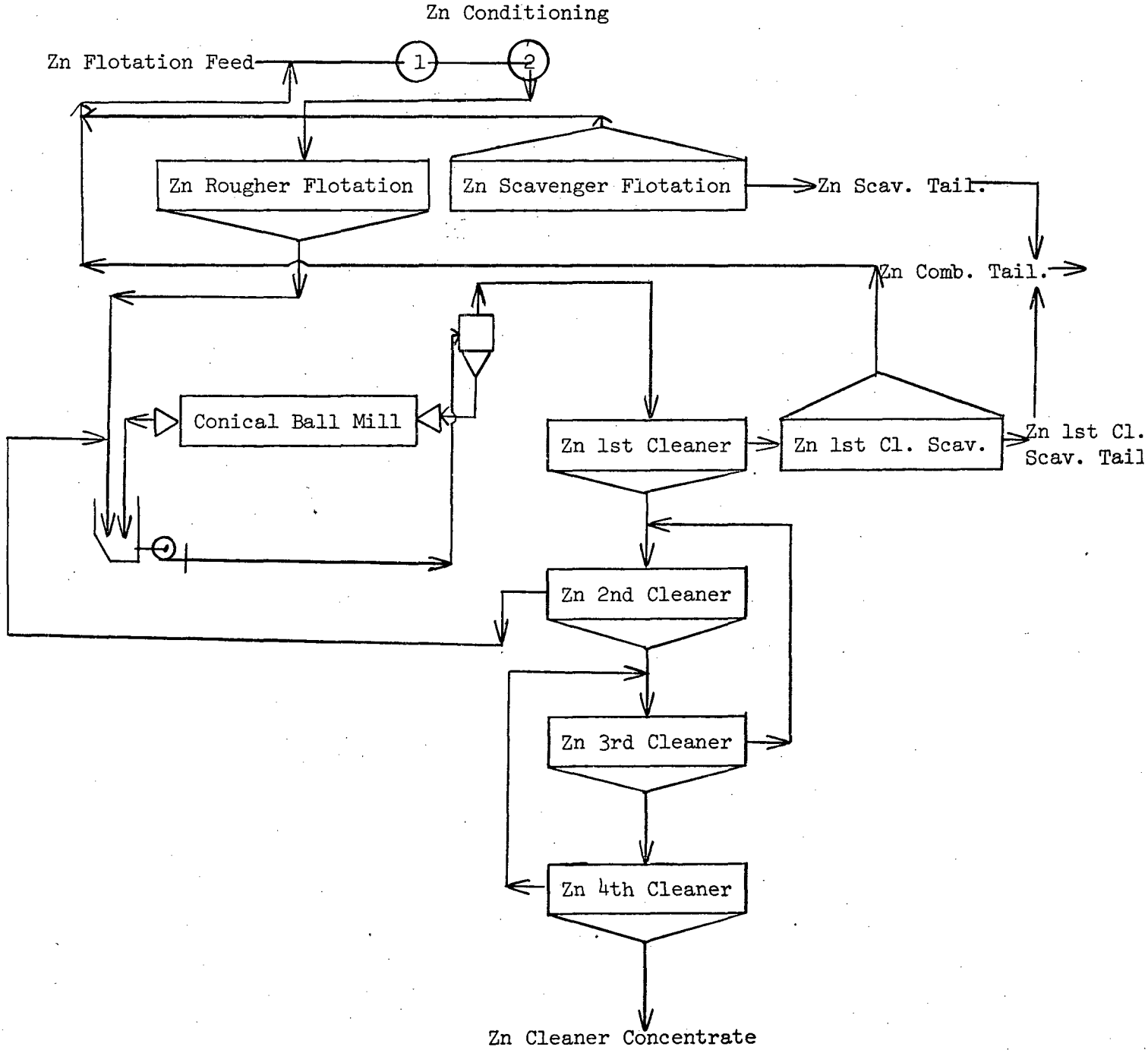
a) Lead Circuit



Test No. PP35 - Continued

2.3. Flowsheet

b) Zinc Circuit



Test No. PP35 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.0
Pb Rougher Feed	8.9
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	8.8
Pb 1st Cleaner Feed	8.9
Pb 2nd Cleaner Feed	9.0
Pb 3rd Cleaner Feed	9.0
Pb 4th Cleaner Feed	8.9
Zn Rougher Feed	9.8
Zn Scavenger Tailing	9.1
Zn 1st Cl. Scav. Feed	10.7
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	11.7
Zn 4th Cleaner Feed	11.3
Zn 1st Cond. Overflow	7.8

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1180
Pb Scavenger Tailing	1177
Pb 1st Cleaner Feed	1112
Zn Rougher Feed	1122
Zn 1st Cleaner Feed	1043
Zn Comb. Tail. Cyclone O/F	1017
Zn Comb. Tail. Cyclone U/F	1742

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	23
Pb Regrinding Mill Discharge	29
Zn Rougher Feed	22
Zn Regrinding Mill Discharge	27

Test No. PP35 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.95	9.80
Pb Rougher Feed	5.76	11.9
Pb Rougher Concentrate	19.7	16.4
Pb Rougher Tailing	2.04	10.4
Pb Scavenger Concentrate	5.21	15.1
Pb Scavenger Tailing	1.52	9.80
Pb 1st Cleaner Concentrate	31.7	18.4
Zn 1st Cleaner Tailing	6.66	18.2
Pb Regrind Cyclone Overflow	21.7	18.7
Pb Regrind Cyclone Underflow	20.7	14.6
Pb Cleaner Concentrate	66.6	8.33
Zn Rougher Feed	1.92	11.2
Zn Rougher Concentrate	2.46	40.3
Zn Rougher Tailing	1.71	4.27
Zn Scavenger Concentrate	2.75	13.3
Zn Scavenger Tailing	1.43	2.30
Zn 1st Cleaner Tailing	3.11	20.7
Zn 1st Cleaner Concentrate	2.61	51.9
Zn Regr. Cyclone Overflow	2.82	37.8
Zn Regr. Cyclone Underflow	20.7	14.6
Zn 1st Cl. Scav. Tailing	2.69	9.63
Zn 1st Cl. Scav. Concentrate	3.45	30.7
Zn Combined Tailing	1.47	2.69
Zn Cleaner Concentrate	2.06	57.4

Test No. PP35 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	22.14	19.7	16.4	73.3	31.0
Pb Rougher Tailing	77.86	2.04	10.4	26.7	69.0
Cyclone Overflow (meas)	100.00	5.95	9.80	100.0	100.0
(Calc.)	-	5.95	11.7	-	-
Pb Scavenger Concentrate	10.97	5.21	15.1	9.6	14.1
Pb Scavenger Tailing	66.89	1.52	9.80	17.1	55.9
Pb Rougher Tailing (meas)	77.86	2.04	10.4	26.7	82.6
(Calc.)	-	2.04	10.5	26.7	70.0
Pb 1st Cl. Concentrate	11.53	31.7	18.4	61.4	18.1
Pb 1st Cl. Tailing	10.61	6.66	18.2	11.9	16.5
Pb Ro. Concentrate (meas)	22.14	19.7	16.4	73.3	37.1
(Calc.)	-	19.7	18.3	73.3	34.6
Zn Rougher Concentrate	11.95	2.46	40.3	4.9	41.1
Zn Rougher Tailing	65.91	1.71	4.27	19.0	24.0
Pb Scav. Tailing (meas)	77.86	1.52	9.80	19.9	77.9
(Calc.)	-	1.83	9.80	23.9	65.1
Zn Scav. Concentrate	13.94	2.75	13.3	6.4	15.8
Zn Scav. Tailing	63.92	1.43	2.30	15.4	12.5
Zn Ro. Tailing (meas)	77.86	1.71	4.27	22.4	33.9
(Calc.)	-	1.67	4.27	21.8	28.3
Zn 1st Cleaner Conc.	7.51	2.61	51.9	3.3	33.2
Zn 1st Cleaner Tail.	4.44	3.11	20.7	2.3	7.8
Zn Ro. Concentrate (meas)	11.95	2.46	40.3	4.9	49.1
(Calc.)	-	2.80	40.3	5.6	41.0
Zn 1st Cl. Scav. Conc.	2.33	3.45	30.7	1.4	6.1
Zn 1st Cl. Scav. Tail.	2.11	2.69	9.63	1.0	1.7
Zn 1st Cl. Tail. (meas)	4.44	3.11	20.7	2.3	7.8
(Calc.)	-	3.09	20.7	2.4	7.8

Test No. PP35 - Continued

1.4.5. Metallurgical Results

Three-Product Formula

Product	Weight	Assays, %				% Distribution		
	%	Pb	Zn	Ag*	Au*	Pb	Zn	Ag
Pb 4th Cl. Conc.	6.77	66.6	8.33	27.82	0.130	75.7	5.8	71.3
Zn 4th Cl. Conc.	12.30	2.06	57.4	1.82	0.010	4.3	72.0	8.5
Zn Combined Tail.	80.93	1.47	2.69	0.66	0.010	20.0	22.2	20.2
Cyclone Overflow	100.00	5.95	9.80	2.52	0.040	100.0	100.0	100.0

* oz/ton

Test No. PP36

1. Grinding

1.1. Purpose: To repeat conditions of test PP35.

1.2. Method: As for test PP31 - 35. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 704 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/8 inch apex

2.3. Flowsheet: As for test PP1.

2.4. Results: The operation of the grinding circuit was stable during the test run. Net power consumption in the Hendy mill was 20.31 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 92.4 % minus 200 mesh.

Test No. PP36 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	704 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	961 pounds	
	1 inch balls	400 pounds	
	Total	2361 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5456 pounds, test period 1408 pounds		
Circulating Load:	Cyclone underflow 520 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2139	70
	Cyclone Overflow	1322	32
	Cyclone Underflow	2420	78
Average Power:	Gross	9.03 kilowatts	
	No Load	1.92 kilowatts	
	Net	7.11 kilowatts	
Net Power Consumption:	20.31 kilowatt-hours per ton of ½ inch feed.		
Work Index:	14.74		

Test No. PP36 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Tailing		
Feed Rate:	162.5 pounds per hour, 23.0 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	650 pounds	
	Total	700 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2044	64
	Cyclone Feed	1207	22
	Cyclone Overflow	1100	12
	Cyclone Underflow	2044	64
Average Power:	Gross	5.11 kilowatts	
	No Load	0.92 kilowatts	
	Net	4.19 kilowatts	
Net Power Consumption:	11.97 kilowatt-hours per ton of feed.		

Test No. PP36 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Rougher Concentrate and Zinc 2nd Cleaner Tailing		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	660 pounds	
	½ inch balls	220 pounds	
	Total	880 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2504	75
	Cyclone Overflow	1113	15
	Cyclone Underflow	2504	75
Average Power:	Gross	2.85 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.93 kilowatts	
Net Power Consumption:	5.51 kilowatt-hours per ton of feed.		

Test No. PP36 - Continued

1.4.4. Screen Analysis - Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.3	4.3	95.7
3	16.0	20.3	79.7
4	15.0	35.3	64.7
6	10.9	46.2	53.8
8	9.3	55.5	44.5
10	7.3	62.8	37.2
14	5.7	68.5	31.5
20	4.2	72.7	27.3
28	3.5	76.2	23.8
35	2.6	78.8	21.2
48	3.1	81.9	18.1
65	2.7	84.6	15.4
100	2.2	86.8	13.2
150	2.2	89.0	11.0
200	2.3	91.3	8.7
- 200	8.7	100.0	-
Total	100.0	-	-

Cyclone Underflow

+ 10	0.2	0.2	99.8
14	0.3	0.5	99.5
20	0.3	0.8	99.2
28	0.5	1.3	98.7
35	0.6	1.9	98.1
48	1.7	3.6	96.4
65	3.1	6.7	93.3
100	5.3	12.0	88.0
150	9.6	21.6	78.4
200	17.8	39.4	60.6
270	14.5	53.9	46.1
400	21.2	75.1	24.9
- 400	24.9	100.0	-
Total	100.0	-	-

Test No. PP36 - Continued

1.4.4. Screen Analysis

Mill Discharge

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.3	0.7	99.3
28	0.4	1.1	98.9
35	0.5	1.6	98.4
48	1.4	3.0	97.0
65	2.5	5.5	94.5
100	4.1	9.6	90.4
150	7.8	17.4	82.6
200	15.3	32.7	67.3
270	13.0	45.7	54.3
400	19.6	65.3	34.7
- 400	34.7	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.1	0.1	99.9
100	0.5	0.6	99.4
150	1.6	2.2	97.8
200	5.4	7.6	92.4
270	6.7	14.3	85.7
400	14.3	28.6	71.4
- 400	71.4	100.0	-
Total	100.0	-	-

Test No. PP36 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.4	4.4	95.6
270	5.4	9.8	90.2
29.8 µm	12.6	22.4	77.6
23.1	7.8	30.2	69.8
16.1	14.2	44.4	55.6
11.1	13.0	57.4	42.6
8.6	9.1	66.5	33.5
- 8.6	33.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.74

Pb Regrind Cyclone Underflow

+ 200 mesh	3.0	3.0	97.0
270	4.5	7.5	92.5
29.4 µm	14.6	22.1	77.9
22.8	12.3	34.4	65.6
15.9	26.0	60.4	39.6
10.9	19.6	80.0	20.0
8.4	7.6	87.6	12.4
- 8.4	12.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.78

Pb Regrind Cyclone Overflow

+ 30.2 µm	0.6	0.6	99.4
23.4	0.6	1.2	98.8
16.3	4.3	5.5	94.5
11.2	12.5	18.0	82.0
8.7	14.8	32.8	67.2
- 8.7	67.2	100.0	-

Specific Gravity 4.42

Test No. PP36 - Continued

1.4.4. Screen Analysis

Pb 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 25.3 µm	5.6	5.6	94.4
19.6	4.6	10.2	89.8
13.7	15.0	25.2	74.8
9.4	19.0	44.2	55.8
7.3	12.7	56.9	43.1
- 7.3	43.1	100.0	-
Total	100.0	-	-

Specific Gravity 5.86

Zn Regrind Mill Discharge

+ 200 mesh	2.6	2.6	97.4
270	9.2	11.8	88.2
28.9 µm	16.2	28.0	72.0
22.4	37.8	65.8	34.2
15.6	22.0	87.8	12.2
10.7	3.6	91.4	8.6
8.3	1.4	92.8	7.2
- 8.3	7.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.86

Zn Regrind Cyclone Underflow

+ 200 mesh	4.6	4.6	95.4
270	10.4	15.0	85.0
29.2 µm	10.0	25.0	75.0
22.7	39.1	64.1	35.9
15.8	27.6	91.7	8.3
10.9	4.0	95.7	4.3
8.4	1.0	96.7	3.3
- 8.4	3.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.78

Test No. PP36 - Continued

1.4.4. Screen Analysis

Zn Scavenger Tailing

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 100 mesh	1.8	1.8	98.2
150	2.2	4.0	96.0
200	6.3	10.3	89.7
37.8 µm	9.2	19.5	80.5
29.3	8.2	27.7	72.3
20.5	13.0	40.7	59.3
14.1	10.8	51.5	48.5
10.9	7.0	58.5	41.5
- 10.9	41.5	100.0	-
Total	100.0	-	-

Specific Gravity 3.28

Zn 4th Cleaner Concentrate

+ 31.2 µm	6.7	6.7	93.3
24.2	8.2	14.9	85.1
16.9	16.8	31.7	68.3
11.6	15.0	46.7	53.3
9.0	9.8	56.5	43.5
- 9.0	43.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.31

Zn Tailing Cyclone Underflow

+ 100 mesh	2.2	2.2	97.8
150	2.8	5.0	95.0
200	7.8	12.8	87.2
36.0 µm	15.2	28.0	72.0
27.9	16.7	44.7	55.3
19.5	25.4	70.1	29.9
13.4	17.0	87.1	12.9
10.4	5.4	92.5	7.5
- 10.4	7.5	100.0	-
Total	100.0	-	-

Specific Gravity 3.51

Test No. PP36 - Continued

2. Flotation

2.1. Purpose:

1) To improve lead recovery.
2) To improve zinc recovery.

2.2. Method:

The following reagent changes were made:
1) Slightly increased collector additions to the Pb rougher and scavenger feed.
2) Increased collectors Z-6 and Z-200 to the zinc rougher and scavenger feed.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet:

As for test PP35.

2.4. Results:

The circuit was not stable during the test period. It was observed that the rejection of pyrite and zinc, in the lead cleaning stages was slow. In the zinc circuit larger amounts of collector addition to the zinc rougher and scavenger circuits resulted in a poor rougher concentrate grade. However, excellent pyrite rejection in the cleaning was achieved.

Test No. PP36 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	4.64	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.10	Ball Mill Feed
$ZnSO_4$	0.95	Ball Mill Feed
R-242	0.04	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.074	Pb Rougher 3rd Cell
Z-11	0.08	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
$ZnSO_4$	0.52	Pb Regrind Mill
Na_2CO_3	0.58	Pb Regrind Mill
NaCN	0.31	Pb Regrind Mill
R-242	0.02	Pb Cyclone Feed Pump
MIBC	0.030	Pb 1st Cleaner Feed
NaCN	0.005	Pb 2nd Cleaner Feed
MIBC	0.008	Pb 2nd Cleaner Feed
$CuSO_4$	2.02	Zn Rougher Cond. No. 1
H_2SO_4	0.37	Zn Rougher Cond. No. 1
$Ca(OH)_2$	2.60	Zn Rougher Cond. No. 2
Z-200	0.118	Zn Rougher Cond. No. 2
Z-6	0.26	Zn Rougher Feed Pump
DF-250	0.074	Zn Rougher Feed Pump
DF-250	0.060	Zn Rougher Feed
Z-6	0.04	Zn Scavenger Feed
DF-250	0.032	Zn Scavenger Feed
Z-200	0.03	Zn Scavenger Feed
$Ca(OH)_2$	1.10	Zn Regrind Mill
$CuSO_4$	0.40	Zn Regrind Mill
Z-200	0.105	Zn Regrind Mill
Z-6	0.04	Zn 1st Cleaner Feed
Z-200	0.051	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.35	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.23	Zn 3rd Cleaner Feed
Z-200	0.023	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.27	Zn 4th Cleaner Feed

Test No. PP36 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.0
Pb Rougher Feed	9.0
Pb Scavenger Tailing	8.8
Pb Regrinding Mill Discharge	9.5
Pb 1st Cleaner Feed	9.2
Pb 2nd Cleaner Feed	9.1
Pb 3rd Cleaner Feed	9.0
Pb 4th Cleaner Feed	9.0
Zn Rougher Feed	9.9
Zn Scavenger Tailing	9.3
Zn 1st Cl. Scav. Tail.	10.4
Zn 1st Cleaner Feed	10.8
Zn 2nd Cleaner Feed	11.1
Zn 3rd Cleaner Feed	11.4
Zn 4th Cleaner Feed	11.4
Zn 1st Cond. Overflow	8.4

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1170
Pb Scavenger Tailing	1163
Pb 1st Cleaner Feed	1100
Zn Rougher Feed	1160
Zn 1st Cleaner Feed	1113
Zn Comb. Tail. Cyclone O/F	1018
Zn Comb. Tail. Cyclone U/F	1593

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	23
Pb Regrinding Mill Discharge	29
Zn Rougher Feed	22
Zn Regrinding Mill Discharge	26

Test No. PP36 - Continued

2.4. Results:

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.77	10.1
Pb Rougher Feed	5.38	11.7
Pb Rougher Concentrate	19.4	15.3
Pb Rougher Tailing	1.68	10.2
Pb Scavenger Concentrate	3.91	14.1
Pb Scavenger Tailing	1.35	9.67
Pb 1st Cleaner Concentrate	24.5	18.6
Pb 1st Cleaner Tailing	4.12	16.3
Pb Regrind Cyclone Overflow	15.9	18.2
Pb Regrind Cyclone Underflow	16.9	15.5
Pb Cleaner Concentrate	54.1	12.8
Zn Rougher Feed	1.36	6.91
Zn Rougher Concentrate	1.29	13.1
Zn Rougher Tailing	1.29	2.24
Zn Scavenger Concentrate	1.18	2.91
Zn Scavenger Tailing	1.45	1.77
Zn 1st Cleaner Tailing	0.97	1.28
Zn 1st Cleaner Concentrate	2.12	31.9
Zn Regrinding Cyclone Overflow	1.51	13.5
Zn Regrinding Cyclone Underflow	0.83	7.01
Zn 1st Cleaner Scavenger Concentrate	1.24	1.91
Zn 1st Cleaner Scavenger Tailing	0.71	0.66
Zn Combined Tailing	1.28	1.51
Zn Cleaner Concentrate	2.10	52.6

Test No. PP36 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	23.08	19.4	15.3	77.6	31.0
Pb Rougher Tailing	76.92	1.68	10.2	22.4	69.0
Cyclone Overflow (meas)	100.00	5.77	10.1	100.0	100.0
(Calc.)	-	5.77	11.4	-	-
Pb Scavenger Concentrate	9.92	3.91	14.1	6.7	12.3
Pb Scavenger Tailing	67.00	1.35	9.67	15.7	56.9
Pb Rougher Tailing (meas)	76.92	1.68	10.2	22.4	77.7
(Calc.)	-	1.68	10.2	22.4	69.2
Pb 1st Cleaner Conc.	17.30	24.5	18.6	73.5	28.3
Pb 1st Cleaner Tail.	5.78	4.12	16.3	4.1	8.3
Pb Rougher Conc. (meas)	23.08	19.4	15.3	77.6	35.0
(Calc.)	-	19.4	18.0	77.6	36.6
Zn Rougher Concentrate	45.84	1.29	13.1	10.2	52.8
Zn Rougher Tailing	21.16	1.29	2.24	4.7	4.2
Pb Scavenger Tailing (meas)	67.00	1.35	9.67	15.7	64.1
(Calc.)	-	1.29	9.67	14.9	57.0
Zn Scavenger Concentrate	8.72	1.18	2.91	1.8	2.2
Zn Scavenger Tailing	12.44	1.45	1.77	3.1	1.9
Zn Rougher Tailing (meas)	21.16	1.29	2.24	4.7	4.7
(Calc.)	-	1.34	2.24	4.9	4.1
Zn 1st Cleaner Conc.	17.70	2.12	31.9	6.5	49.6
Zn 1st Cleaner Tail.	28.14	0.97	1.28	4.7	3.2
Zn Ro. Concentrate (meas)	45.84	1.29	13.1	10.2	59.5
(Calc.)	-	1.41	13.1	11.2	52.8
Zn 1st Cl. Scav. Conc.	13.96	1.24	1.91	3.0	2.34
Zn 1st Cl. Scav. Tail.	14.18	0.71	0.66	1.7	0.82
Zn 1st Cl. Tail. (meas)	28.14	0.97	1.28	4.7	3.17
(Calc.)	-	0.97	1.28	4.7	3.16

Test No. PP36 - Continued

1.4.5. Metallurgical Results

Three-Product Formula

Product	Weight	Assays, %				% Distribution		
	%	Pb	Zn	Ag*	Au*	Pb	Zn	Ag
Pb 4th Cl. Conc.	8.27	54.1	12.8	22.65	0.150	77.5	10.5	73.7
Zn 4th Cl. Conc.	14.99	2.10	52.6	20.1	0.005	5.5	78.0	11.8
Zn Comb. Tail.	76.74	1.28	1.51	0.48	0.010	17.0	11.5	14.5
Cyclone O/F	100.00	5.77	10.1	2.59	0.040	100.0	100.0	100.0

* oz/ton

Test No. PP37

1. Grinding

1.1. Purpose: To repeat conditions of test PP36.

1.2. Method: As for test PP36. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 700 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Sala Mill; Krebs Cyclone:

1 inch diameter
1/4 inch vortex
1/8 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diameter
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1

1.4. Results: The grinding circuit was stable during the test period. Net power consumption in the Hendy mill was 19.63 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 91.6 % minus 200 mesh.

Test No. PP37 - Continued

1.4. Results:

1.4.1. Ball Mill Report

Feed:	Minus ½ inch ore at 0.4 percent moisture content		
Feed Rate:	700 dry pounds per hour		
Mill Speed:	32 r.p.m., 80.5 percent of critical speed		
Mill Load:	3 inch balls	1000 pounds	
	1½ inch balls	961 pounds	
	1 inch balls	400 pounds	
	Total	2161 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Mill Feed:	Total 5433 pounds, test period 1400 pounds		
Circulating Load:	Cyclone underflow 510 percent		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2144	71
	Cyclone Overflow	1312	31
	Cyclone Underflow	2326	76
Average Power:	Gross	8.79 kilowatts	
	No Load	1.92 kilowatts	
	Net	6.87 kilowatts	
Net Power Consumption:	19.63 kilowatt-hours per ton of ½ inch feed.		
Work Index:	13.75		

Test No. PP37 - Continued

1.4. Results:

1.4.2. Lead Regrinding Mill Report

Regrinding Mill:	Sala Mill		
Feed:	Lead Rougher Concentrate and Lead 2nd Cleaner Concentrate		
Feed Rate:	153.3 pounds per hour, 21.9 percent of the mill feed		
Mill Speed:	31 r.p.m., 73 percent of critical speed		
Mill Load:	2 inch balls	50 pounds	
	1 inch balls	650 pounds	
	Total	700 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2152	68
	Cyclone Feed	1265	27
	Cyclone Overflow	1117	13
	Cyclone Underflow	2152	68
Average Power:	Gross	4.99 kilowatts	
	No Load	0.92 kilowatts	
	Net	4.07 kilowatts	
Net Power Consumption:	11.63 kilowatt-hours per ton of feed.		

Test No. PP37 - Continued

1.4. Results:

1.4.3. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Rougher Concentrate and Zinc 2nd Cleaner Tailing		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	660 pounds	
	½ inch balls	220 pounds	
	Total	880 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2560	76
	Cyclone Overflow	1118	14
	Cyclone Underflow	2560	76
Average Power:	Gross	2.49 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.57 kilowatts	
Net Power Consumption:	4.49 kilowatt-hours per ton of feed.		

Test No. PP37 - Continued

1.4.4. Screen Analysis

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.4	4.4	95.6
3	16.9	21.3	78.7
4	13.7	35.0	65.0
6	10.1	45.1	54.9
8	8.5	53.6	46.4
10	6.9	60.5	39.5
14	5.7	66.2	33.8
20	4.0	70.2	29.8
28	3.5	73.7	26.3
35	2.6	76.3	23.7
48	3.3	79.6	20.4
65	2.9	82.5	17.5
100	2.4	84.9	15.1
150	2.4	87.3	12.7
200	2.6	89.9	10.1
- 200	10.1	100.0	-
Total	100.0	-	-

Cyclone Underflow

+ 10	0.2	0.2	99.8
14	0.2	0.4	99.6
20	0.2	0.6	99.4
28	0.4	1.0	99.0
35	0.7	1.7	98.3
48	1.7	3.4	96.6
65	3.1	6.5	93.5
100	4.9	11.4	88.6
150	9.2	20.6	79.4
200	17.6	38.2	61.8
270	14.6	52.8	47.2
400	20.0	72.8	27.2
- 400	27.2	100.0	-
Total	100.0	-	-

Test No. PP37 - Continued

1.4.4. Screen Analysis

Mill Discharge

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.2	0.4	99.6
28	0.4	0.8	99.2
35	0.5	1.3	98.7
48	1.4	2.7	97.3
65	2.4	5.1	94.9
100	4.3	9.4	90.6
150	8.0	17.4	82.6
200	15.5	32.9	67.1
270	13.2	46.1	53.9
400	19.0	65.1	34.9
- 400	34.9	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.2	0.2	99.8
100	0.7	0.9	99.1
150	1.9	2.8	97.2
200	5.6	8.4	91.6
270	6.8	15.2	84.8
400	14.5	29.7	70.3
- 400	70.3	100.0	-
Total	100.0	-	-

Test No. PP37 - Continued

1.4.4. Screen Analysis

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.0	4.0	96.0
270	4.7	8.7	91.3
30.5 µm	11.3	20.0	80.0
23.6	6.8	26.8	73.2
16.5	12.8	39.6	60.4
11.3	13.2	52.8	47.2
8.8	9.8	62.2	37.4
- 8.8	37.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.57

Pb Regrind Cyclone Underflow

+ 200 mesh	1.8	1.8	98.2
270	3.3	5.1	94.9
29.6 µm	14.9	20.0	80.0
23.0	13.1	33.1	66.9
16.0	27.7	60.8	39.2
11.0	19.6	80.4	19.6
8.5	7.2	87.6	12.4
- 8.5	12.4	100.0	-
Total	100.0	-	-

Specific Gravity 4.76

Zn Regrind Cyclone Underflow

+ 200 mesh	3.8	3.8	96.2
270	9.4	13.2	86.8
30.1 µm	10.0	23.2	76.8
23.2	44.6	67.8	32.2
16.3	25.6	93.4	6.6
11.1	2.4	95.8	4.2
8.6	0.6	96.4	3.6
- 8.6	3.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.64

Test No. PP37 - Continued

1.4.4. Screen Analyses

Pb Regrind Mill Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 270 mesh	2.0	2.0	98.0
29.2 µm	11.8	13.8	86.2
22.7	11.1	24.9	75.1
15.8	25.4	50.3	49.7
10.9	20.0	70.3	29.7
8.4	8.5	78.8	21.2
- 8.4	21.2	100.0	-
Total	100.0	-	-

Specific Gravity 4.77

Pb Regrind Cyclone Overflow

+ 30.1 µm	0.5	0.5	99.5
23.4	0.6	1-1	98.9
16.3	4.6	5.7	94.3
11.2	13.0	18.7	81.3
8.7	14.7	33.4	66.6
- 8.7	66.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.52

Pb 4th Cleaner Concentrate

+ 25.3 µm	3.9	3.9	96.1
19.6	2.0	5.9	94.1
12.7	9.8	15.7	84.3
9.4	18.3	34.0	66.0
7.3	14.7	48.7	51.3
- 7.3	51.3	100.0	-
Total	100.0	-	-

Specific Gravity 6.02

Test No. PP37 - Continued

1.4.4. Screen Analysis

Zn Regrind Mill Discharge

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.8	2.8	97.2
270	8.9	11.7	88.3
29.6 µm	11.8	23.5	76.5
22.9	45.4	68.9	31.1
16.0	23.4	92.3	7.7
11.0	2.2	94.5	5.5
8.5	0.8	95.3	4.7
- 8.5	4.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.72

Zn Regrind Cyclone Overflow

+ 31.0 µm	5.3	5.3	94.7
24.0	11.0	16.3	83.7
16.8	21.0	37.3	62.7
11.5	16.0	53.3	46.7
8.9	9.1	62.4	37.6
- 8.9	37.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.40

Zn Scavenger Tailing

+ 100 mesh	1.2	1.2	98.8
150	2.6	3.8	96.2
200	7.4	11.2	88.8
38.5 µm	12.2	23.4	76.6
29.9	8.9	32.3	67.7
20.9	13.4	45.7	54.3
14.3	10.6	56.3	43.7
11.1	6.6	62.9	37.1
- 11.1	37.1	100.0	-
Total	100.0	-	-

Specific Gravity 3.24

Test No. PP37 - Continued

1.4.4. Screen Analysis

Zn 4th Cleaner Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 31.5 µm	2.1	2.1	97.9
24.4	5.9	8.0	92.0
17.0	16.6	24.6	75.4
11.7	15.4	40.0	60.0
9.0	10.2	50.2	49.8
- 9.0	49.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.17

Test No. PP37 - Continued

2. Flotation

2.1. Purpose: To investigate the effect of collector R-404 on zinc flotation.

2.2. Method: The circuit was similar to test PP36 except that collector Z-6 additions to the Zn rougher and scavenger feed were replaced with collector R-404. In the Pb cleaning circuit collector R-242 was increased from 0.02 to 0.03 lb/ton.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagents

See following page.

2.3. Flowsheet: As for test PP35.

2.4. Results: High additions of frother in the lead 1st cleaner resulted in unstable conditions in the lead cleaners during the sampling period. The lead cleaner concentrate assayed 63.1 % Pb at 78.3 % lead recovery. The zinc cleaner concentrate assayed 50.2 % zinc at 82.3 % recovery.

Test No. PP37 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent per Ton of Feed	Point of Additions
Na_2CO_3	4.80	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
Z-11	0.10	Ball Mill Feed
$ZnSO_4$	1.00	Ball Mill Feed
R-242	0.04	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.074	Pb Rougher 3rd Cell
Z-11	0.08	Pb Scavenger Feed
MIBC	0.023	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
$ZnSO_4$	0.56	Pb Regrind Mill
Na_2CO_3	0.70	Pb Regrind Mill
R-242	0.03	Pb Cyclone Feed Pump
MIBC	0.030	Pb 1st Cleaner Feed
NaCN	0.005	Pb 2nd Cleaner Feed
MIBC	0.006	Pb 2nd Cleaner Feed
$CuSO_4$	2.04	Zn Rougher Cond. No. 1
H_2SO_4	0.37	Zn Rougher Cond. No. 1
Z-200	0.080	Zn Rougher Cond. No. 2
$Ca(OH)_2$	2.44	Zn Rougher Cond. No. 2
R-404	0.25	Zn Rougher Feed Pump
DF-250	0.076	Zn Rougher Feed Pump
DF-250	0.004	Zn Rougher Feed
DF-250	0.030	Zn Scavenger Feed
R-404	0.04	Zn Scavenger Feed
Z-200	0.053	Zn Scavenger Feed
$Ca(OH)_2$	1.32	Zn Regrind Mill
$CuSO_4$	0.42	Zn Regrind Mill
Z-200	0.105	Zn Regrind Mill
Z-6	0.04	Zn 1st Cleaner Feed
Z-200	0.053	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.40	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.23	Zn 3rd Cleaner Feed
Z-200	0.023	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.29	Zn 4th Cleaner Feed

Test No. PP37 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.0
Pb Rougher Feed	9.1
Pb Scavenger Tailing	8.9
Pb Regrinding Mill Discharge	9.6
Pb 1st Cleaner Feed	9.3
Pb 2nd Cleaner Feed	9.2
Pb 3rd Cleaner Feed	9.2
Pb 4th Cleaner Feed	9.1
Zn Rougher Feed	9.8
Zn Scavenger Tailing	9.2
Zn 1st Cl. Scav. Feed	10.6
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	11.1
Zn 3rd Cleaner Feed	11.3
Zn 4th Cleaner Feed	11.6
Zn 1st Cond. Overflow	8.2

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1193
Pb Scavenger Tailing	1167
Pb 1st Cleaner Feed	1117
Zn Rougher Feed	1150
Zn 1st Cleaner Feed	1118
Zn Comb. Tail. Cyclone O/F	1023
Zn Comb. Tail. Cyclone U/F	1630

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	23
Pb Regrinding Mill Discharge	29
Zn Rougher Feed	23
Zn Regrinding Mill Discharge	26

Test No. PP37 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.90	10.2
Pb Rougher Feed	5.12	11.5
Pb Rougher Concentrate	20.8	15.8
Pb Rougher Tailing	1.72	10.2
Pb Scavenger Concentrate	4.04	14.4
Pb Scavenger Tailing	1.35	9.93
Pb 1st Cleaner Concentrate	27.1	20.5
Pb 1st Cleaner Tailing	4.36	17.9
Pb Regrind Cyclone Overflow	19.6	19.7
Pb Regrind Cyclone Underflow	18.3	15.6
Pb Cleaner Concentrate	63.1	9.86
Zn Rougher Feed	1.48	8.12
Zn Rougher Concentrate	1.54	17.4
Zn Rougher Tailing	1.36	2.38
Zn Scavenger Concentrate	1.33	3.54
Zn Scavenger Tailing	1.40	1.75
Zn 1st Cleaner Tailing	1.12	2.06
Zn 1st Cleaner Concentrate	2.40	35.9
Zn Regrinding Cyclone Overflow	1.77	15.4
Zn REgrinding Cyclone Underflow	0.91	8.36
Zn 1st Cleaner Scavenger Concentrate	2.03	5.90
Zn 1st Cleaner Scavenger Tailing	0.83	0.77
Zn Combined Tailing	1.17	1.43
Zn Cleaner Concentrate	2.33	50.2

Test No. PP37 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight	Assays, %		% Distribution	
	%	Pb	Zn	Pb	Zn
Pb Rougher Concentrate	21.91	20.8	15.8	77.2	30.3
Pb Rougher Tailing	78.09	1.72	10.2	22.8	69.7
Cyclone Overflow (meas)	100.00	5.90	10.2	100.0	100.0
(Calc.)	-	5.90	11.4	-	-
Pb Scavenger Concentrate	10.74	4.04	14.4	7.4	13.5
Pb Scavenger Tailing	67.35	1.35	9.93	15.4	58.5
Pb Rougher Tailing (meas)	78.09	1.72	10.2	22.8	78.1
(Calc.)	-	1.72	11.5	22.8	72.0
Pb 1st Cleaner Conc.	15.84	27.1	20.5	72.8	28.4
Pb 1st Cleaner Tail.	6.07	4.36	17.9	4.5	9.5
Pb Rougher Conc. (meas)	21.91	20.8	15.8	77.3	33.9
(Calc.)		20.8	19.8	77.3	37.9
Zn Rougher Concentrate	33.85	1.54	17.4	8.8	51.5
Zn Rougher Tailing	33.50	1.36	2.38	7.7	7.0
Zn Scavenger Tail. (meas)	67.35	9.93	15.4	65.6	
(Calc.)	-	1.45	9.93	16.5	58.5
Zn Scavenger Concentrate	11.79	1.33	3.54	2.6	3.7
Zn Scavenger Tailing	21.71	1.40	1.75	5.2	3.3
Zn Rougher Tailing (meas)	33.50	1.36	2.38	7.7	7.8
(Calc.)	-	1.38	2.38	7.8	7.0
Zn 1st Cleaner Conc.	15.34	2.40	35.9	6.2	48.2
Zn 1st Cleaner Tail.	18.51	1.12	2.06	3.5	3.3
Zn Rougher Conc. (meas)	33.85	1.54	17.4	8.8	57.7
(Calc.)	-	1.70	17.4	9.7	51.5
Zn 1st Cl. Scav. Conc.	4.65	2.03	5.90	1.6	2.4
Zn 1st Cl. Scav. Tail.	13.86	0.83	0.77	1.9	0.9
Zn 1st Cl. Tail. (meas)	18.51	1.12	2.06	3.5	3.7
(Calc.)	-	1.13	2.06	3.5	3.3

Test No. PP37 - Continued

2.4.5. Metallurgical Results

Three-Product Formula

Product	Weight %	Assays, %					% Distribution			
		Pb	Zn	Ag*	Au*	Hg	Pb	Zn	Ag	Hg
Pb 4th Cl. Conc.	7.32	63.1	9.86	27.75	0.110	0.015	78.3	7.1	77.2	38.8
Zn 4th Cl. Conc.	16.72	2.33	50.2	2.17	0.010	0.076	6.6	82.3	13.8	59.1
Zn Comb. Tail.	75.96	1.17	1.43	0.31	0.010	0.006	15.1	10.6	9.0	2.1
Cyclone O/F	100.00	5.90	10.2	2.43	0.040	0.015	100.0	100.0	100.0	100.0

* oz/ton

2.4.6. Water Analyses

Product	pH	S_2O_3 ppm
Hendy Cyclone Overflow	8.60	53.8
Pb Scavenger Tailing	8.45	49.4
Zn Combined Tailing	9.00	57.4
Tailing Pond H_2O	8.55	34.7

Product	CN mg/l	Na_2CO_3 g/l	$NaHCO_3$ g/l
Hendy Cyclone Overflow	< 1	0.033	0.60
Pb Scavenger Tailing	-	0.022	0.38

Test No. PP38

1. Grinding

1.1. Purpose: To repeat conditions of test PP37.

1.2. Method: As for test PP31 to 37. The grinding circuit was operated for a period of 7.75 hours at a feed rate of 698 pounds per hour. Samples were taken every 20 minutes during the last two hours of operation.

1.2.1. Classification Equipment

Hendy Mill; P50 Dorr Cyclone:

1 1/2 inch diameter
5/8 inch vortex
1/2 inch apex

Pb Regrind

Denver Mill; Goodwin Cyclone:

1 1/2 inch diameter
1/2 inch vortex
3/16 inch apex

Zn Regrind

Conical Mill; Krebs Cyclone:

1 1/2 inch diamerer
1/2 inch vortex
1/4 inch apex

1.3. Flowsheet: As for test PP1.

1.4. Results: The grinding circuit was quite stable throughout the test run. Net power consumption in the Hendy mill was 19.29 kilowatt-hours per ton of ½ inch feed. The cyclone overflow was 91.6 % minus 200 mesh. The power in the Denver mill was not calculated.

Test No. PP38 - Continued

1.4. Results: 1.4.1. Ball Mill Report

Feed: Minus ½ inch ore at 0.4 percent moisture content

Feed Rate: 698 dry pounds per hour

Mill Speed: 32 r.p.m., 80.5 percent of critical speed

Mill Load:

3 inch balls	1000 pounds
1½ inch balls	961 pounds
1 inch balls	400 pounds
Total	2361 pounds

Operating Time: Total 7.75 hours, test period 2.0 hours

Mill Feed: Total 5410 pounds, test period 1396 pounds

Circulating Load: Cyclone underflow 537 percent

Pulp Densities:

	gpl	% Solids
Mill Discharge	2108	70
Cyclone Overflow	1308	31
Cyclone Underflow	2388	77

Average Power:

Gross	8.67 kilowatts
No Load	1.92 kilowatts
Net	6.75 kilowatts

Net Power Consumption: 19.29 kilowatt-hours per ton of ½ inch feed.

Work Index: 14.28

Test No. PP38 - Continued

1.4. Results:

1.4.2. Zinc Regrinding Mill Report

Regrinding Mill:	Conical Mill		
Feed:	Zinc Ro. Conc., Zinc 2nd Cl. Tail. and Zinc 1st Cl. Scav. Conc.		
Mill Speed:	32 r.p.m., 75 percent of critical speed		
Mill Load:	1 inch balls	660 pounds	
	½ inch balls	220 pounds	
	Total	880 pounds	
Operating Time:	Total 7.75 hours, test period 2.0 hours		
Pulp Densities:		gpl	% Solids
	Mill Discharge	2446	75
	Cyclone Overflow	1082	9.5
	Cyclone Underflow	2446	75
Average Power:	Gross	2.61 kilowatts	
	No Load	0.92 kilowatts	
	Net	1.69 kilowatts	
Net Power Consumption:	4.83 kilowatt-hours per ton of feed.		

Test No. PP38 - Continued

1.4.3. Screen Analyses

Mill Feed

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 3/8	4.9	4.9	95.1
3	15.7	20.6	79.4
4	13.5	34.1	65.9
6	11.4	45.5	54.5
8	9.5	55.0	45.0
10	7.6	62.6	37.4
14	5.6	68.2	31.8
20	4.1	72.3	27.7
28	3.3	75.6	24.4
35	2.5	78.1	21.9
48	3.1	81.2	18.8
65	2.8	84.0	16.0
100	2.2	86.2	13.8
150	2.2	88.4	11.6
200	2.3	90.7	9.3
- 200	9.3	100.0	-
Total	100.0	-	-

Mill Discharge

+ 10	0.1	0.1	99.9
14	0.1	0.2	99.8
20	0.2	0.4	99.6
28	0.3	0.7	99.3
35	0.4	1.1	98.9
48	1.2	2.3	97.7
65	2.2	4.5	95.5
100	4.0	8.5	91.5
150	7.7	16.2	83.8
200	15.5	31.7	68.3
270	13.4	45.1	54.9
400	20.2	65.3	34.7
- 400	34.7	100.0	-
Total	100.0	-	-

Test No. PP38 - Continued

1.4.3. Screen Analyses

Cyclone Underflow

Mesh Size (Tyler)	% Retained		% Passing
	Individual	Cumulative	Cumulative
+ 10	0.1	0.1	99.9
14	0.2	0.3	99.7
20	0.3	0.6	99.4
28	0.3	0.9	99.1
35	0.5	1.4	98.6
48	1.5	2.9	97.1
65	2.7	5.6	94.4
100	4.7	10.3	89.7
150	8.9	19.2	80.8
200	17.5	36.7	63.3
270	14.6	51.3	48.7
400	20.7	72.0	28.0
- 400	28.0	100.0	-
Total	100.0	-	-

Cyclone Overflow

+ 65	0.3	0.3	99.7
100	0.6	0.9	99.1
150	1.9	2.8	97.2
200	5.6	8.4	91.6
270	6.6	15.0	85.0
400	14.7	29.7	70.3
- 400	70.3	100.0	-
Total	100.0	-	-

Test No. PP38 - Continued

1.4.3. Screen Analyses

Pb Rougher Concentrate

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	2.8	2.8	97.2
270	3.6	6.4	93.6
31.1 µm	10.2	16.6	83.4
24.1	8.9	25.5	74.5
16.8	19.6	45.1	54.9
11.6	16.2	61.3	38.7
8.9	9.4	70.7	29.3
- 8.9	29.3	100.0	-
Total	100.0	-	-

Specific Gravity 4.48

Pb Regrind Cyclone Underflow

+ 150 mesh	2.2	2.2	97.8
200	2.7	4.9	95.1
270	7.3	12.2	87.8
29.3 µm	10.2	22.4	77.6
22.7	33.2	55.6	44.4
15.8	28.6	84.2	15.8
10.9	5.6	89.8	10.2
8.4	2.2	92.0	8.0
- 8.4	8.0	100.0	-
Total	100.0	-	-

Specific Gravity 4.92

Pb Regrind Mill Discharge

+ 200 mesh	2.0	2.0	98.0
270	5.2	7.2	92.8
29.6 µm	10.8	18.0	82.0
22.9	12.9	30.9	69.1
16.0	10.6	41.5	58.5
11.0	6.2	47.7	52.3
8.5	2.5	50.2	49.8
- 8.5	49.8	100.0	-
Total	100.0	-	-

Specific Gravity 4.82

Test No. PP38 - Continued

1.4.3. Screen Analyses

Pb Regrind Cyclone Overflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 30.3 µm	5.4	5.4	94.6
23.3	9.4	14.8	85.2
16.2	25.9	40.7	59.3
11.2	19.5	60.2	39.8
8.6	10.3	70.5	29.5
- 8.6	29.5	100.0	-
Total	100.0	-	-

Specific Gravity 4.47

Pb 4th Cleaner Concentrate

+ 25.3	3.9	3.9	96.1
19.6	6.0	9.9	90.1
13.7	20.0	29.9	70.1
9.4	20.6	50.5	49.5
7.3	12.2	62.7	37.3
- 7.3	37.3	100.0	-
Total	100.0	-	-

Specific Gravity 5.91

Zn Regrind Mill Discharge

+ 200 mesh	3.0	3.0	97.0
270	6.9	9.9	90.1
30.1 µm	11.2	21.1	78.9
23.3	44.2	65.3	34.7
16.3	27.8	93.1	6.9
11.2	2.3	95.4	4.6
8.7	0.9	96.3	3.7
- 8.7	3.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.57

Test No. PP38 - Continued

1.4.3. Screen Analyses

Zn Regrind Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 200 mesh	4.5	4.5	95.5
270	7.6	12.1	87.9
30.6 µm	8.1	20.2	79.8
23.7	39.3	59.5	40.5
16.6	32.8	92.3	7.7
11.4	3.4	95.7	4.3
8.8	0.6	96.3	3.7
- 8.8	3.7	100.0	-
Total	100.0	-	-

Specific Gravity 4.61

Zn Scavenger Tailing

+ 100 mesh	1.2	1.2	98.8
150	2.2	3.4	96.6
200	6.4	9.8	90.2
36.9 µm	13.4	23.2	76.8
28.6	9.2	32.4	67.6
20.0	14.1	46.5	53.5
13.7	11.2	57.7	42.3
10.6	6.9	64.6	35.4
- 10.6	35.4	100.0	-
Total	100.0	-	-

Specific Gravity 3.45 .

Zn Regrind Cyclone Overflow

+ 32.3 µm	8.6	8.6	91.4
25.0	17.3	25.9	74.1
17.5	26.6	52.5	47.5
12.0	14.2	66.7	33.3
9.3	6.7	73.4	26.6
- 9.3	26.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.22

Test No. PP38 - Continued

1.4.3. Screen Analyses

Zn Tailing Cyclone Underflow

Particle Size	% Retained Individual	% Retained Cumulative	% Passing Cumulative
+ 100 mesh	1.4	1.4	98.6
150	2.8	4.2	95.8
200	5.8	10.0	90.0
36.0 µm	9.0	19.0	81.0
27.9	29.3	48.3	51.7
19.5	25.6	73.9	26.1
13.4	14.4	88.3	11.7
10.4	3.8	92.1	7.9
- 10.4	7.9	100.0	-
Total	100.0	-	-

Specific Gravity 3.59

Zn 4th Cleaner Concentrate

+ 31.9 µm	1.4	1.4	98.6
24.7	6.6	8.0	92.0
17.3	18.3	26.3	73.7
11.9	17.1	43.4	56.6
9.2	10.0	53.4	46.6
- 9.2	46.6	100.0	-
Total	100.0	-	-

Specific Gravity 4.07

Zn Tailing Cyclone Overflow

+ 35.4 µm	0.5	0.5	99.5
27.4	0.4	0.9	99.1
19.2	1.3	2.2	97.8
13.2	7.5	9.7	90.3
10.2	14.1	23.8	76.2
- 10.2	76.2	100.0	-
Total	100.0	-	-

Specific Gravity 3.65

Test No. PP38 - Continued

2. Flotation

2.1. Purpose: To investigate the effect of decreasing lead regrinding time on the grade and recovery of lead.

2.2. Method: The Sala mill in the lead regrinding stage was replaced by a small Denver ball mill. The reagent additions in the lead and zinc circuit were similar to that of test PP34.

2.2.1. Flotation Equipment

As for test PP26.

2.2.2. Flotation Reagent

See following page.

2.3. Flowsheet: As for test PP26.

2.4. Results: The lead and zinc circuits were stable during the test period. The lead 4th cleaner concentrate assayed 60.6 % Pb at 77.0 % Pb recovery, and the zinc 4th cleaner concentrate assayed 53.3 % Zn at 80 % Zn recovery.

Test No. PP38 - Continued

2.2.2. Reagent Additions

Type	Pounds of Reagent Per Ton of Feed	Point of Addition
Na_2CO_3	5.20	Ball Mill Feed
NaCN	0.20	Ball Mill Feed
$ZnSO_4$	1.00	Ball Mill Feed
Z-11	0.09	Ball Mill Feed
R-242	0.03	Pb Rougher Conditioner
MIBC	0.105	Pb Rougher Feed Pump
MIBC	0.075	Pb Rougher 3rd Cell
Z-11	0.04	Pb Scavenger Feed
MIBC	0.020	Pb Scavenger Feed
NaCN	0.31	Pb Regrind Mill
$ZnSO_4$	0.56	Pb Regrind Mill
Na_2CO_3	0.70	Pb Regrind Mill
R-242	0.01	Pb Cyclone Feed Pump
NaCN	0.10	Pb 2nd Cleaner Feed
NaCN	0.08	Pb 3rd Cleaner Feed
$Ca(OH)_2$	2.74	Zn Rougher Conc. No. 1
$CuSO_4$	2.05	Zn Rougher Cond. No. 1
Z-200	0.097	Zn Rougher Cond. No. 2
Z-11	0.15	Zn Rougher Feed Pump
DF-250	0.075	Zn Rougher Feed Pump
DF-250	0.054	Zn Rougher Feed
DF-250	0.03	Zn Scavenger Feed
Z-11	0.03	Zn Scavenger Feed
Z-200	0.053	Zn Scavenger Feed
$Ca(OH)_2$	1.10	Zn Regrind Mill
$CuSO_4$	0.32	Zn Regrind Mill
Z-200	0.055	Zn Regrind Mill
Z-11	0.03	Zn 1st Cleaner Scavenger
Z-200	0.055	Zn 1st Cleaner Scavenger
$Ca(OH)_2$	0.30	Zn 2nd Cleaner Feed
$Ca(OH)_2$	0.15	Zn 3rd Cleaner Feed
$Ca(OH)_2$	0.30	Zn 4th Cleaner Feed

Test No. PP38 - Continued

2.4. Results:

2.4.1. pH

Product	pH
Cyclone Overflow	9.2
Pb Rougher Feed	9.3
Pb Scavenger Tailing	9.0
Pb Regrinding Mill Discharge	9.7
Pb 1st Cleaner Feed	9.4
Pb 2nd Cleaner Feed	9.3
Pb 3rd Cleaner Feed	9.2
Pb 4th Cleaner Feed	9.0
Zn Rougher Feed	10.0
Zn Scavenger Tailing	9.5
Zn 1st Cl. Scav. Feed	10.6
Zn 1st Cleaner Feed	10.9
Zn 2nd Cleaner Feed	11.0
Zn 3rd Cleaner Feed	11.1
Zn 4th Cleaner Feed	11.1

2.4.2. Pulp Densities

Product	Pulp Density gpl
Pb Rougher Feed	1207
Pb Scavenger Tailing	1158
Pb 1st Cleaner Feed	1183
Pb Regrinding Mill Discharge	1780
Zn Rougher Feed	1183
Zn 1st Cleaner Feed	1082
Zn Comb. Tail. Cyclone O/F	1025
Zn Comb. Tail. Cyclone U/F	1715

2.4.3. Pulp Temperature

Product	°C
Pb Rougher Feed	20
Pb Regrinding Mill Discharge	19
Zn Rougher Feed	22
Zn Regrinding Mill Discharge	25

Test No. PP38 - Continued

2.4.4. Chemical Analyses

Product	Assays, %	
	Pb	Zn
Cyclone Overflow	5.85	10.0
Pb Rougher Feed	6.20	13.1
Pb Rougher Concentrate	15.9	18.6
Pb Rougher Tailing	1.99	10.7
Pb Scavenger Concentrate	5.04	16.0
Pb Scavenger Tailing	1.33	9.45
Pb 1st Cleaner Concentrate	21.8	23.1
Pb 1st Cleaner Tailing	7.83	19.4
Pb Regrind Cyclone Overflow	16.4	22.4
Pb Regrind Cyclone Underflow	17.5	15.8
Pb Cleaner Concentrate	60.6	11.3
Zn Rougher Feed	1.33	7.53
Zn Rougher Concentrate	1.81	24.2
Zn Rougher Tailing	1.15	1.72
Zn Scavenger Concentrate	1.09	2.36
Zn Scavenger Tailing	1.27	1.50
Zn 1st Cleaner Tailing	1.89	9.03
Zn 1st Cleaner Concentrate	2.80	44.7
Zn Regrinding Cyclone Overflow	2.14	21.6
Zn Regrinding Cyclone Underflow	1.46	15.0
Zn 1st Cleaner Scavenger Concentrate	2.63	19.1
Zn 1st Cleaner Scavenger Tailing	1.24	1.36
Zn Combined Tailing	1.30	1.51
Zn Cleaner Concentrate	2.24	53.3

Test No. PP38 - Continued

2.4.5. Metallurgical Results

Two-Product Formula

Product	Weight %	Assays, %		% Distribution	
		Pb	Zn	Pb	Zn
Pb Rougher Concentrate	27.75	15.9	18.6	75.4	40.0
Pb Rougher Tailing	72.25	1.99	10.7	24.6	60.0
Cyclone Overflow (meas)	100.00	5.85	10.0	100.0	100.0
(Calc.)	-	5.85	12.9	-	-
Pb Scavenger Concentrate	12.85	5.04	16.0	11.1	15.9
Pb Scavenger Tailing	59.40	1.33	9.45	13.5	43.5
Pb Rougher Tail. (meas)	72.25	1.99	10.7	24.6	77.3
(Calc.)	-	1.99	10.6	24.6	59.4
Pb 1st Cleaner Conc.	16.03	21.8	23.1	59.7	28.7
Pb 1st Cleaner Tail.	11.72	7.83	19.4	15.7	17.6
Pb Rougher Conc. (meas)	27.75	15.9	18.6	75.4	18.6
(Calc.)	-	15.9	21.5	75.4	46.3
Zn Rougher Concentrate	20.43	1.81	24.2	6.3	38.3
Zn Rougher Tailing	38.97	1.15	1.72	7.7	5.2
Pb Scavenger Tail. (meas)	59.40	1.33	9.45	13.5	56.1
(Calc.)	-	1.38	9.45	14.0	43.5
Zn Scavenger Concentrate	9.97	1.09	2.36	1.9	1.8
Zn Scavenger Tailing	29.00	1.27	1.50	6.3	3.4
Zn Rougher Tail. (meas)	38.97	1.15	1.72	7.7	6.7
(Calc.)	-	1.22	1.72	8.2	5.2
Zn 1st Cleaner Conc.	8.69	2.80	44.7	4.16	30.1
Zn 1st Cleaner Tail.	11.74	1.89	9.03	3.79	8.2
Zn Rougher Conc. (meas)	20.43	1.81	24.2	-	-
(Calc.)	-	2.28	24.2	7.95	38.3

Three-Product Formula

Pb 4th Cleaner Conc.	7.44	60.6	11.3	77.0	8.4
Zn 4th Cleaner Conc.	14.99	2.24	53.3	5.7	79.9
Zn Combined Tailing	77.57	1.30	1.51	17.3	11.7
Cyclone Overflow	100.00	5.85	10.0	100.0	100.0