

LAKEFIELD RESEARCH

006527
Vangorda

Test No.: 12 Project No.: 3237 Date: _____ Operator: _____

Purpose: First of the series of continuous batch tests to examine the effect of split lead regrinding on metallurgical results

Procedure: Standard with two stage regrind

Feed: 6 x 2000 grams minus 10 mesh G-3A ore composite

Grind: 40 minutes at 65% solids in a laboratory ball mill

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Caustic 1/2 NaOH	SODAS Na ₂ CO ₃	A317 3418A	MIBC		GRIND	COND.	FROTH	pH
Grind	700	200	8			40			
Pb Roughen (1)			40	25				4	9.0
(2)			12	5				3	
Regrind (1)	150	150	8	10		30			9.0
Pb 1st cleaner (1)								3	
(2)			4	10				3	
Pb 1st clean. succ			2	5				2	
Pb Regrind. 2	50	50	4	10		15			
Pb 2nd clean			2	2				3	9.0
								2	
Pb 3rd cleaner	20			5				3	9.1
Pb 4th cleaner	20							3	9.1
								3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				



LAKEFIELD RESEARCH

Test No.: 12 Project No.: 4237 Date: June 21/92 Operator: D.L.
 Purpose: _____

Procedure: _____

Feed: Pb Rougher Tail + Pb/Lease Tail
 Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
							GRIND	COND.	FROTH	
<u>Spine Circuit</u>	<u>CaOH₂</u>	<u>CuSO₄</u>	<u>A343</u>	<u>DF1012</u>	<u>50200</u>					
<u>Condition</u>	<u>2000</u>							<u>5</u>		
<u>Condition</u>		<u>1000</u>						<u>5</u>		
<u>Sp. Rougher 1</u>			<u>40</u>	<u>2.5</u>				<u>3</u>	<u>3.5</u>	
			<u>20</u>	<u>2.5</u>				<u>1</u>	<u>3</u>	
			<u>10</u>	<u>2.5</u>				<u>1</u>	<u>2</u>	
<u>Sp. Conc. Refiner (C.M.)</u>	<u>1000</u>	<u>100</u>			<u>100</u>		<u>30</u>			
<u>H.T. Condition</u>			<u>25</u>	<u>2.5</u>				<u>15</u>		
<u>Sp. 1st. Cleaner</u>									<u>5</u>	<u>11.8</u>
			<u>10</u>	<u>2.5</u>				<u>1</u>	<u>2</u>	
<u>Sp. 1st. Cleaner Scan</u>			<u>5</u>	<u>2.5</u>				<u>1</u>	<u>1.5</u>	
<u>Sp. 2nd. Cleaner</u>	<u>200</u>							<u>1</u>	<u>4</u>	<u>12.0</u>
<u>Sp. 3rd. Cleaner</u>	<u>200</u>							<u>1</u>	<u>4</u>	<u>12.0</u>
<u>Sp. 4th. Cleaner</u>	<u>500</u>							<u>1</u>	<u>3</u>	<u>12.1</u>

Stage	<u>p.m. Pebble Mill</u>			
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				

Test No. 12

Product	Weight		Assays, %/g/t			% Distribution		
	g	%	Pb	Zn	Ag	Pb	Zn	Ag
1 Pb Cl Conc A	18.5	0.15	56.4	9.21		1.9	0.2	
2 Pb Cl Conc B	122.0	1.02	65.2	8.52		14.4	1.0	
3 Pb Cl Conc C	129.7	1.08	65.6	8.41		15.4	1.0	
4 Pb Cl Conc D	125.5	1.05	66.1	8.28		15.0	1.0	
5 Pb Cl Conc E	129.4	1.08	69.1	9.37		14.8	1.1	
6 Pb Cl Conc F	136.3	1.14	62.5	9.85		15.4	1.3	
7 Pb 4th Cl Tail F	59.8	0.50	29.1	21.9		3.1	1.2	
8 Pb 3rd Cl Tail F	79.2	0.66	15.2	24.4		2.2	1.8	
9 Pb 2nd Cl Tail F	129.5	1.08	7.32	24.1		1.7	2.9	
10 Pb 1st Cl Scav Conc F	52.1	0.43	5.28	21.9		0.5	1.1	
11 Zn Cl Conc A	199.8	1.67	2.26	55.9		0.8	10.4	
12 Zn Cl Conc B	222.0	1.85	2.82	55.7		1.1	11.5	
13 Zn Cl Conc C	240.9	2.01	3	55.2		1.3	12.4	
14 Zn Cl Conc D	227.0	1.89	2.83	55.9		1.2	11.8	
15 Zn Cl Conc E	219.9	1.83	2.36	55.2		0.9	11.3	
16 Zn Cl Conc F	213.8	1.78	2.37	55.6		0.9	11.1	
17 Zn 4th Cl Tail F	50.2	0.42	3.9	39.5		0.4	1.8	
18 Zn 3rd Cl Tail F	97.4	0.81	3.71	34.8		0.7	3.2	
19 Zn 2nd Cl Tail F	129.2	1.08	2.96	24.7		0.7	3.0	
20 Zn 1st Cl Scav Conc F	26.3	0.22	3	11.5		0.1	0.3	
21 Zn 1st Cl Scav Tail A	211.2	1.76	0.53	1.47		0.2	0.3	
22 Zn 1st Cl Scav Tail B	235.2	1.96	0.94	1.88		0.4	0.4	
23 Zn 1st Cl Scav Tail C	258.7	2.16	0.91	2.28		0.4	0.6	
24 Zn 1st Cl Scav Tail D	271.7	2.27	0.99	2.63		0.5	0.7	
25 Zn 1st Cl Scav Tail E	216.5	1.81	1.46	3.66		0.6	0.7	
26 Zn 1st Cl Scav Tail F	197.2	1.65	1.56	3.1		0.6	0.6	
27 Zn Scavenger Tail A	1228.0	10.25	0.25	0.86		0.6	1.0	
28 Zn Scavenger Tail B	1325.5	11.06	0.36	1.04		0.9	1.3	
29 Zn Scavenger Tail C	1314.0	10.96	0.33	0.95		0.8	1.2	
30 Zn Scavenger Tail D	1335.4	11.14	0.35	1.02		0.8	1.3	
31 Zn Scavenger Tail E	1416.1	11.81	0.39	1.04		1.0	1.4	
32 Zn Scavenger Tail F	1368.2	11.41	0.36	1.06		0.9	1.4	
Head (calc)	11986.2	100.00	4.62	8.95		100.0	100.0	

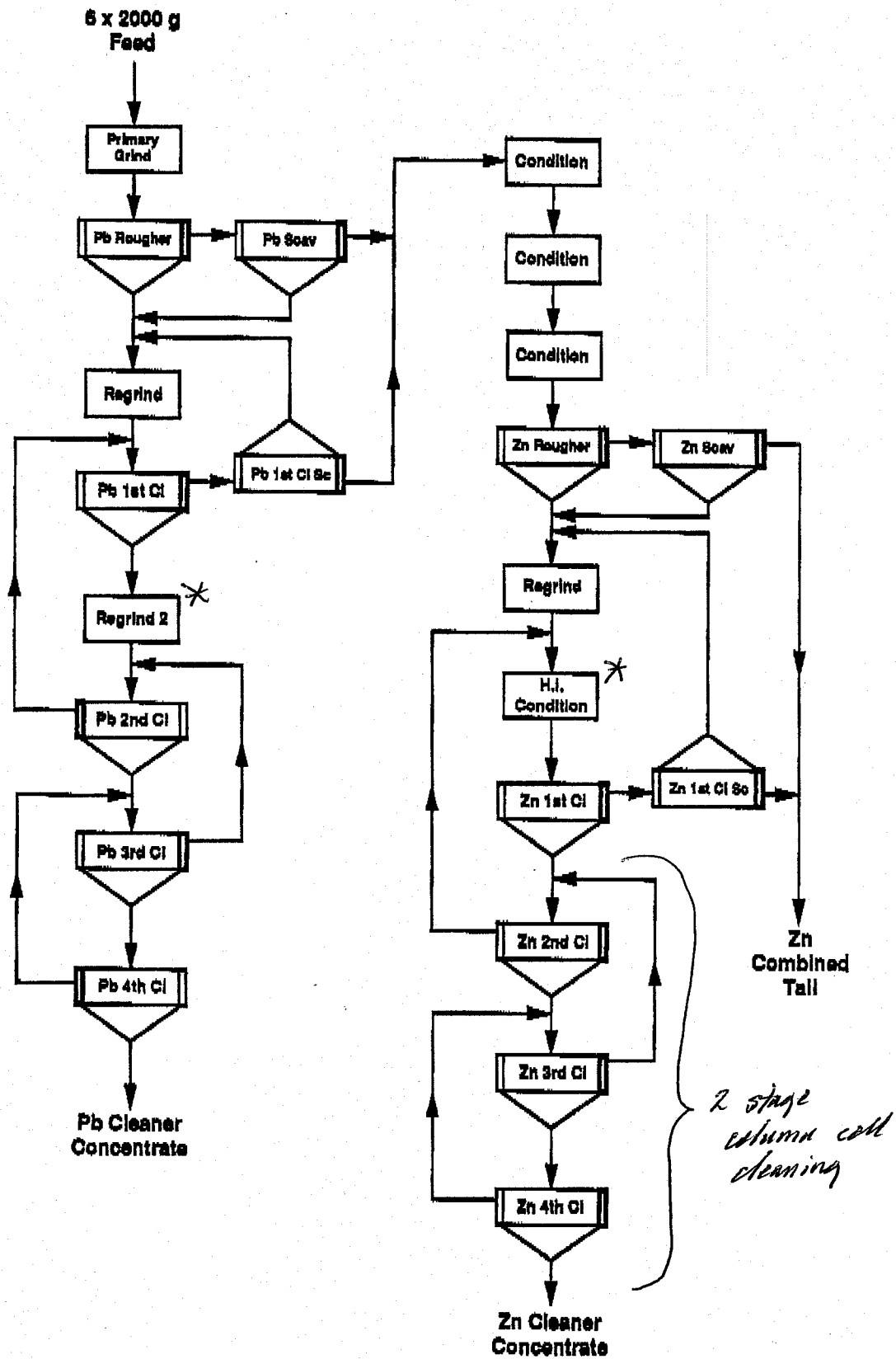
Combined Products

Comb Pb Conc 1 to 6	5.52	64.2	8.91		76.8	5.5	
Comb Pb Cl Tails 7 to 10	2.67	13.0	23.4		7.5	7.0	
Comb Zn Cl Conc 11 to 16	11.04	2.62	55.6		6.3	68.6	
Comb Zn Cl Tails 17 to 20	2.53	3.36	29.3		1.8	8.3	
Comb Zn Cl Scav Tails 21 to 26	11.60	1.05	2.49		2.6	3.2	
Comb Zn Ro Sc Tails 27 to 32	66.64	0.34	1.00		4.9	7.4	

Projected Results Cycles E, F

Pb Cleaner Conc	6.19	62.8	9.62		84.2	6.7	
Zn Cleaner Conc	19.11	2.36	55.4		6.7	81.1	
Overall Tail	80.71	0.52	1.35		9.1	12.2	
Head(calc)	100.00	4.62	8.95		100.0	100.0	

Test No. 12 Flowsheet



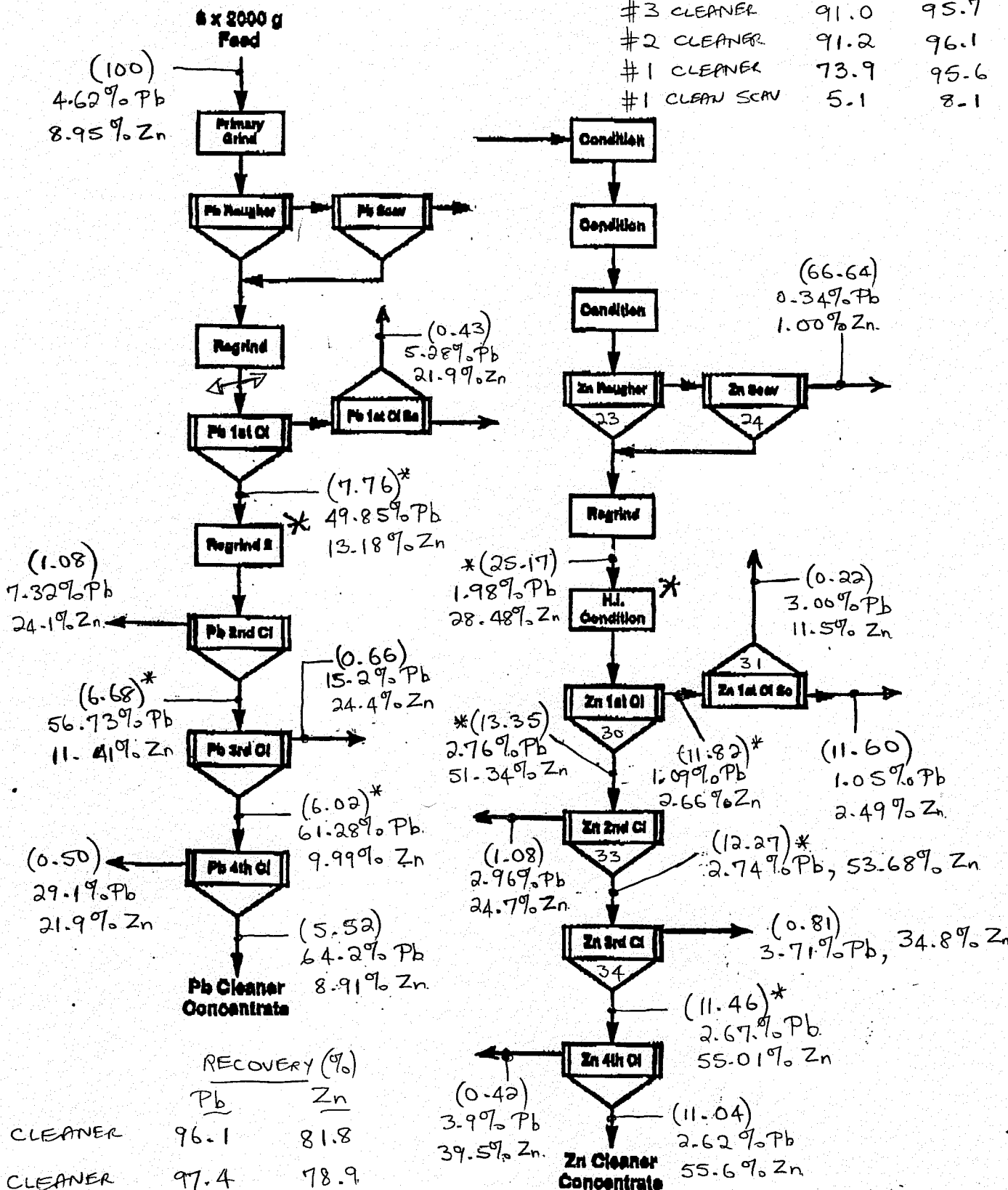
** New Equipment required*

2 stage column cell cleaning

Test No. 12 Flowsheet

RECOVERY (%)

	Pb	Zn
#4 CLEANER	94.5	97.4
#3 CLEANER	91.0	95.7
#2 CLEANER	91.2	96.1
#1 CLEANER	73.9	95.6
#1 CLEAN SCAN	5.1	8.1



* DATA CALCULATED BY MASS BALANCE

LAKEFIELD RESEARCH

Test No.: 13 Project No.: _____ Date: _____ Operator: _____

Purpose: To repeat the conditions of test 13 but omit the lead and regrinding stage

Procedure: Similar to test 12

Feed: 6 x 2000 grams minus 10 mesh composite G-3A

Grind: 40 minutes at 65% solids in a laboratory ball mill

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	SDAO NaCN	A317 3Y18A	MIBC			GRIND	COND.	FROTH	pH
Grinding	700	200					40			
Pb Rougher (1)			40	25				14		9.0
(2)			12	5				13		
Pb Regrind	150	150	8	10			45			
Pb 1st Cleaner (1)								13		9.0
(2)			2	2				13		
Pb 1st Cl. Scav			2	5				12		
Pb 2nd Clean		50		6				24		9.1
Pb 3rd Cleaner		20		4				23		9.1
Pb 4th Cleaner		20						23		9.1

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 13 Project No.: 4237 Date: Jan. 22/92 Operator: J.L.

Purpose: _____

Procedure: _____

Feed: Pb Rougher Tail + Pb 1st Cl Scavenger Tail

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
						GRIND	COND.	FROTH	pH
<u>none Circuit</u>	<u>(60%)</u>	<u>CuSO₄</u>	<u>A343</u>	<u>DF1012</u>	<u>SD200</u>				
<u>Condition</u>	<u>2000</u>						<u>5</u>		
<u>Condition</u>		<u>1000</u>					<u>5</u>		
<u>1st Rougher</u>	<u>1</u>		<u>60</u>	<u>40</u>	<u>2.5</u>		<u>3</u>	<u>4</u>	<u>11.7</u>
<u>2</u>	<u>2</u>		<u>20</u>	<u>2.5</u>			<u>1</u>	<u>3.25</u>	
<u>3</u>	<u>3</u>		<u>10</u>	<u>2.5</u>			<u>1</u>	<u>2.25</u>	
<u>1st Conc. Reg. (P.M.)</u>	<u>1000</u>	<u>100</u>			<u>100</u>	<u>30</u>			
<u>1st H.I. Condition</u>			<u>25</u>	<u>2.5</u>			<u>15</u>		
<u>1st 1st Cleaner</u>								<u>5</u>	
<u>2nd 1st Cleaner</u>			<u>10</u>	<u>2.5</u>			<u>1</u>	<u>2</u>	
<u>2nd 1st Cl. Scav</u>			<u>5</u>	<u>2.5</u>			<u>1</u>	<u>1.5</u>	
<u>2nd 2nd Cleaner</u>	<u>200</u>						<u>1</u>	<u>4</u>	<u>11.8</u>
<u>3rd Cleaner</u>	<u>200</u>						<u>1</u>	<u>4</u>	<u>11.8</u>
<u>4th Cleaner</u>	<u>200</u>						<u>1</u>	<u>3</u>	<u>11.9</u>

Stage	<u>PM Pebble Mill</u>		
Flotation Cell			
Speed: r.p.m.			

Product	Weight		Assays, %/g/t				% Distribution			
	g	%	Pb	Zn	Ag	Au	Pb	Zn	Ag	Au
1 Pb Cl Conc A	95.1	0.79	64.4	9.51			11.1	0.8		-
2 Pb Cl Conc B	98.8	0.82	66.1	8.77			11.8	0.8		-
3 Pb Cl Conc C	105.9	0.88	63.1	9.7			12.1	1.0		-
4 Pb Cl Conc D	139.8	1.16	59.5	11			15.1	1.4		-
5 Pb Cl Conc E	73.2	0.61	68.3	7.92			9.1	0.5		-
6 Pb Cl Conc F	142.4	1.19	59.5	11.1			15.4	1.5		-
7 Pb 4th Cl Tail F	77.1	0.64	37.3	20.1		-	5.2	1.4		-
8 Pb 3rd Cl Tail F	91.1	0.76	25.2	22		-	4.2	1.9		-
9 Pb 2nd Cl Tail F	88.8	0.74	10.9	22.3		-	1.8	1.8		-
10 Pb 1st Cl Scav Conc F	58.4	0.49	7.29	23.5		-	0.8	1.3		-
11 Zn Cl Conc A	216.5	1.80	1.65	56.5		-	0.6	11.4		-
12 Zn Cl Conc B	230.6	1.92	1.7	55.3		-	0.7	11.9		-
13 Zn Cl Conc C	223.3	1.86	1.78	55.6		-	0.7	11.6		-
14 Zn Cl Conc D	235.3	1.96	2.04	56.8		-	0.9	12.4		-
15 Zn Cl Conc E	243.1	2.02	2.03	53.7		-	0.9	12.1		-
16 Zn Cl Conc F	231.2	1.92	2.33	54		-	1.0	11.6		-
17 Zn 4th Cl Tail F	57.3	0.48	3.21	33.5		-	0.3	1.8		-
18 Zn 3rd Cl Tail F	74.8	0.62	2.85	21.4		-	0.4	1.5		-
19 Zn 2nd Cl Tail F	145.6	1.21	2.33	16.3		-	0.6	2.2		-
20 Zn 1st Cl Scav Conc F	37.2	0.31	2.37	9.51		-	0.2	0.3		-
21 Zn 1st Cl Scav Tail A	151.1	1.26	0.64	2.32		-	0.2	0.3		-
22 Zn 1st Cl Scav Tail B	182.6	1.52	0.86	2.48		-	0.3	0.4		-
23 Zn 1st Cl Scav Tail C	185.7	1.55	0.99	2.48		-	0.3	0.4		-
24 Zn 1st Cl Scav Tail D	202.2	1.68	1	2.84		-	0.4	0.5		-
25 Zn 1st Cl Scav Tail E	201.1	1.67	1.09	2.75		-	0.4	0.5		-
26 Zn 1st Cl Scav Tail F	266.0	2.21	1.02	2.89		-	0.5	0.7		-
27 Zn Scavenger Tail A	1347.6	11.22	0.27	0.91	0	-	0.7	1.1		-
28 Zn Scavenger Tail B	1371.0	11.41	0.34	1.02	0	-	0.8	1.3		-
29 Zn Scavenger Tail C	1389.1	11.56	0.37	1.06	0	-	0.9	1.4		-
30 Zn Scavenger Tail D	1383.4	11.52	0.36	1.08	0	-	0.9	1.4		-
31 Zn Scavenger Tail E	1364.5	11.36	0.41	1.12	0	-	1.0	1.4		-
32 Zn Scavenger Tail F	1302.8	10.85	0.33	1.01	0	-	0.8	1.2		-
Head (calc)	12012.4	100.00	4.59	8.95	0.0	-	100.0	100.0		-

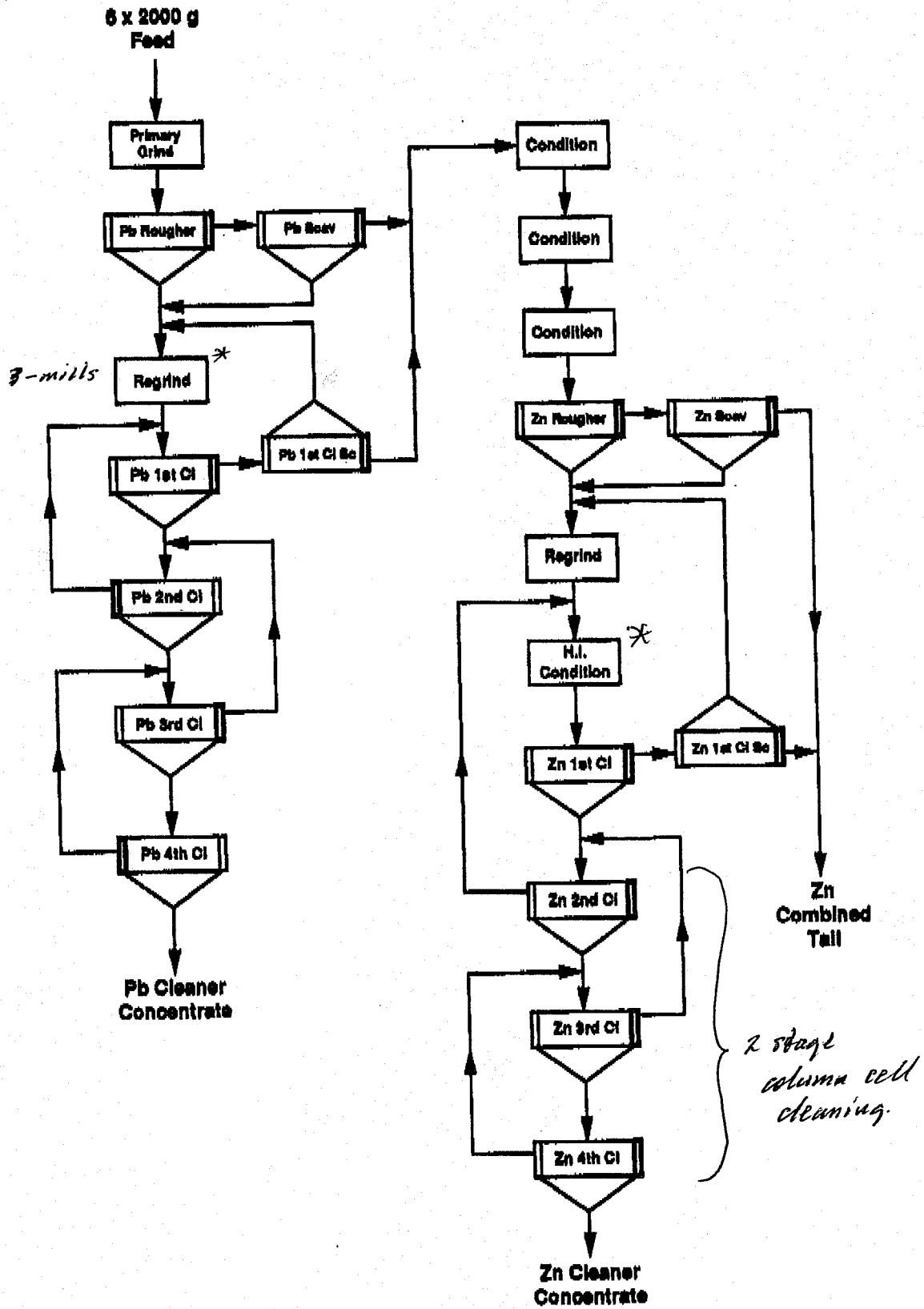
Combined Products

Comb Pb Conc 1 to 6	5.45	62.8	9.91	0.0	-	74.6	6.0		-
Comb Pb Cl Tails 7 to 10	2.63	20.8	21.9	0	-	11.9	6.4		-
Comb Zn Cl Conc 11 to 16	11.49	1.93	55.3	0.0	-	4.8	71.0		-
Comb Zn Cl Tails 17 to 20	2.62	2.62	19.8	0	-	1.5	5.8		-
Comb Zn Cl Scav Tails 21 to 26	9.90	0.95	2.58	0.0	-	2.1	2.9		-
Comb Zn Ro Sc Tails 27 to 32	67.92	0.35	1.03	0.0	-	5.1	7.9		-

Projected Results Cycles E, F

Pb Cleaner Conc	6.27	62.5	10.0	0.0	-	85.3	7.0		-
Zn Cleaner Conc	13.49	2.18	53.8	0.0	-	6.4	81.2		-
Overall Tail	80.24	0.47	1.31	0.0	-	8.3	11.8		-
Head (calc)	100.00	4.59	8.95	0.0	-	100.0	100.0		-

Test No. 13 Flowsheet



* NEW EQUIPMENT

LAKEFIELD RESEARCH

Test No.: 14 Project No.: _____ Date: _____ Operator: _____

Purpose: To repeat the conditions of test 13 but reduce lead regrinding time to 30 minutes and regrind 1st cl. Scav.

Procedure: Lead second cleaner feeding before recycling
as indicate below and accompanying flow sheet

Feed: 6 x 2000 grams minus 10 mesh Composite G-3A

Grind: 40 minutes at 65% solids in a laboratory ball mill

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	SD ²⁰⁰ NaCN	A317 3418A	MIBC			GRIND	COND.	FROTH	pH
GRINDING	700	200					40			
Pb Rougher 1			40	25				13		9.0
(2)			12	5				13		
PB REGRIND 1	150	150	8	10			30			
Pb 1st cleaner								13		
Pb 1st cl. scav			2	4				13		
PB REGRIND 2	Combined 1st cl. Scav Concentrate + 2nd cl Tail									
	50	50		6			15			
Pb 2nd Cleaner		20						13		9.0
Pb 3rd Cleaner		20						23		9.0
Pb 4th Cleaner		20						23		9.0

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 14 Project No.: 4237 Date: Jan 24/92 Operator: D.L.

Purpose: _____

Procedure: _____

Feed: Pb Ro Tail + Pb 1st Cleaner Tail.

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
							GRIND	COND.	FROTH	pH
<u>Aggr Circuit</u>	<u>Ca(OH)₂</u>	<u>CaSO₄</u>	<u>A343</u>	<u>DF1012</u>	<u>52200</u>					
<u>Condition</u>	<u>2000</u>							<u>5</u>		
<u>Condition</u>		<u>1000</u>						<u>5</u>		
<u>Aggr Rougher 1</u>			<u>60</u>	<u>2.5</u>				<u>3</u>	<u>4</u>	<u>11.9</u>
<u>2</u>			<u>10</u>	<u>2.5</u>				<u>1</u>	<u>3</u>	
<u>Aggr Conc. Regim. Pn</u>	<u>1000</u>	<u>100</u>			<u>100</u>		<u>30.</u>			
<u>H.I. Condition</u>								<u>15.</u>		
<u>Aggr 1st Cleaner</u>									<u>3.5</u>	<u>11.8</u>
			<u>10</u>	<u>2.5</u>				<u>1</u>	<u>2</u>	
<u>Aggr 2nd Cleaner</u>			<u>5</u>	<u>2.5</u>				<u>1</u>	<u>15</u>	
<u>Aggr 3rd Cleaner</u>	<u>200</u>							<u>1</u>	<u>4</u>	<u>11.9</u>
<u>Aggr 4th Cleaner</u>	<u>200</u>							<u>1</u>	<u>3</u>	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
mesh				

Test No. 14

Product	Weight		Assays,%g/t				% Distribution			
	g	%	Pb	Zn	Ag	Au	Pb	Zn	Ag	Au
1 Pb Cl Conc A	86.0	0.72	65.7	9.7	758	9.4	10.3	0.8	7.3	-
2 Pb Cl Conc B	106.8	0.89	64.8	9.96	780	6.83	12.6	1.0	9.3	-
3 Pb Cl Conc C	142.3	1.19	55.1	13.9	703	6.74	14.2	1.8	11.1	-
4 Pb Cl Conc D	105.4	0.88	61.2	11.7	727	7.01	11.7	1.1	8.5	-
5 Pb Cl Conc E	108.4	0.90	62.7	11.1	794	6.4	12.3	1.1	9.6	-
6 Pb Cl Conc F	128.7	1.07	60.4	12.1	695	6.9	14.1	1.4	9.9	-
7 Pb 4th Cl Tail F	44.0	0.37	37.6	19.8	506	-	3.0	0.8	2.5	-
8 Pb 3rd Cl Tail F	63.3	0.53	29	21.9	435	-	3.3	1.3	3.1	-
9 Pb 2nd Cl Tail F	64.0	0.53	17.5	22.4	329	-	2.0	1.3	2.3	-
10 Pb 1st Cl Scav Conc F	85.2	0.71	14.1	26	449	-	2.2	2.0	4.3	-
11 Zn Cl Conc A	208.4	1.74	1.73	55.9	66.5	-	0.7	10.6	1.5	-
12 Zn Cl Conc B	244.8	2.04	2.13	55.2	76.5	-	0.9	12.3	2.1	-
13 Zn Cl Conc C	226.6	1.89	1.82	54.5	70.6	-	0.7	11.3	1.8	-
14 Zn Cl Conc D	253.9	2.12	1.96	53.7	72	-	0.9	12.4	2.0	-
15 Zn Cl Conc E	256.2	2.14	1.78	53	77.1	-	0.8	12.4	2.2	-
16 Zn Cl Conc F	266.5	2.22	2.42	54.4	80.8	-	1.2	13.2	2.4	-
17 Zn 4th Cl Tail F	43.2	0.36	3.27	24.9	119	-	0.3	1.0	0.6	-
18 Zn 3rd Cl Tail F	75.2	0.63	3	20.8	112	-	0.4	1.4	0.9	-
19 Zn 2nd Cl Tail F	148.4	1.24	2.28	13.6	90.5	-	0.6	1.8	1.5	-
20 Zn 1st Cl Scav Conc F	51.8	0.43	2.3	7.09	91	-	0.2	0.3	0.5	-
21 Zn 1st Cl Scav Tail A	167.5	1.40	0.72	1.77	29.5	-	0.2	0.3	0.5	-
22 Zn 1st Cl Scav Tail B	168.2	1.40	0.78	2.09	29.7	-	0.2	0.3	0.6	-
23 Zn 1st Cl Scav Tail C	203.1	1.69	0.87	2.05	36.1	-	0.3	0.4	0.8	-
24 Zn 1st Cl Scav Tail D	256.9	2.14	1.02	2.46	42.3	-	0.5	0.6	1.2	-
25 Zn 1st Cl Scav Tail E	197.5	1.65	1.19	3	57.5	-	0.4	0.5	1.3	-
26 Zn 1st Cl Scav Tail F	284.6	2.37	1.13	2.32	47.6	-	0.6	0.6	1.5	-
27 Zn Scavenger Tail A	1300.0	10.84	0.34	0.96	10.3	-	0.8	1.1	1.5	-
28 Zn Scavenger Tail B	1366.5	11.40	0.42	1.24	12.2	-	1.0	1.5	1.9	-
29 Zn Scavenger Tail C	1307.0	10.90	0.34	1.1	11.7	-	0.8	1.3	1.7	-
30 Zn Scavenger Tail D	1354.9	11.30	0.35	1.04	12.1	-	0.9	1.3	1.8	-
31 Zn Scavenger Tail E	1401.3	11.69	0.37	1.11	13.7	-	0.9	1.4	2.1	-
32 Zn Scavenger Tail F	1275.2	10.63	0.32	0.96	12.1	-	0.7	1.1	1.7	-
Head (calc)	11991.8	100.00	4.59	9.13	75.0	-	100.0	100.0	100.0	-

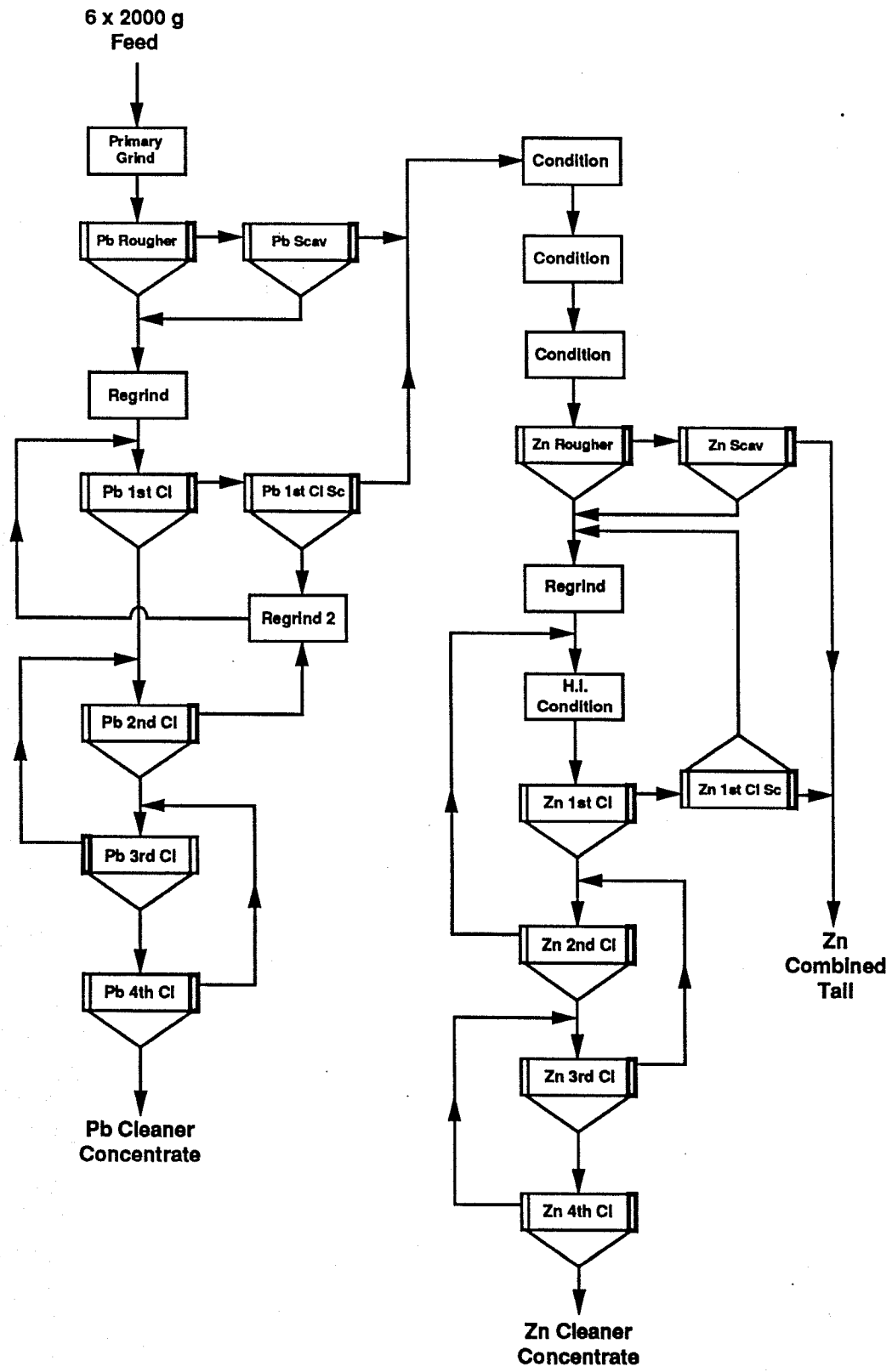
Combined Products

Comb Pb Conc 1 to 6	5.65	61.1	11.61	739	-	75.2	7.2	55.7	-
Comb Pb Cl Tails 7 to 10	2.14	22.7	23.0	425	-	10.6	5.4	12.1	-
Comb Zn Cl Conc 11 to 16	12.14	1.99	54.4	74.3	-	5.3	72.3	12.0	-
Comb Zn Cl Tails 17 to 20	2.66	2.59	15.8	100	-	1.5	4.6	3.5	-
Comb Zn Cl Scav Tails 21 to 26	10.66	0.98	2.31	41.5	-	2.3	2.7	5.9	-
Comb Zn Ro Sc Tails 27 to 32	66.75	0.36	1.07	12.0	-	5.2	7.8	10.7	-

Projected Results Cycles E, F

Pb Cleaner Conc	6.39	61.5	11.6	740	-	85.5	8.1	64.6	-
Zn Cleaner Conc	13.72	2.11	53.7	79.0	-	6.3	80.7	14.8	-
Overall Tail	79.89	0.47	1.28	18.8	-	8.2	11.2	20.6	-
Head(calc)	100.00	4.59	9.13	73.2	-	100.0	100.0	100.0	-

Test 14 Flowsheet



LAKEFIELD RESEARCH

Test No.: 15 Project No.: 4237 Date: February 5, 1992 Operator: _____

Purpose: Preliminary test on metabasite / quartzite ore

Procedure: Similar to Test 12 on bulk sulphide composite G-34 with less collector
CL composite was prepared from equal weights of metabasite
ore with disseminated sulphides and quartzite ore with
disseminated sulphides.

Feed: 2000 grams of minus 10 mesh CL composite

Grind: 37.5 minutes at 65% solids in a lab ball mill (Mill 1)

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Ca(OH) ₂	50200 No.FM	9317 3478A	MIBC		GRIND	COND.	FROTH	pH
Grind	700	200	8			37.5			
Pb Rougher 1			20	10			1	3	9.2
2			10	5			1	1	
Pb Re Conc Rougher	150	150	8			30			
Pb 1st Cleaner				2.5				2	9.8
			2.5	2.5			1	0.7	
Pb 1st Cleaner Spar			2.5	5			1	1.5	9.2
Pb 1st Cl. Conc Roper	50	50	2.5	10		15			
Pb 2nd Cleaner								1.5	9.7
				2.5			1	0.5	
Pb 3rd Cleaner		20		5				2.5	9.1
Pb 4th Cleaner		20					1	2	

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
					Pb Cl. Conc Tail: 154g ± wet
					= 8.1 g sample wet
% - mesh					

LAKEFIELD RESEARCH

Test No.: 15 Project No.: 4237 Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: Combine Pb Rougher and Pb CI Scan Tails

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	CaSO ₄	As ₂ S ₃	DF/012	SD 200		GRIND	COND.	FROTH	pH
Condition	2000							5		11.8
Condition		1000						5		11.7
3 rd Rougher 1			20	2.5				3	2	11.6
2			10	2.5				1	0.7	
3 rd Ho Case Regrind	1000	100			100		30			
H-I. Condition			12.5	2.5				15		
3 rd 1 st Cleaner									2	11.7
			5	2.5				1	1	
3 rd 1 st Cleaner Scan			5	2.5				1	1.5	
3 rd 2 nd Cleaner	200							1	1.7	11.8
3 rd 3 rd Cleaner	200							1	1.5	11.5
3 rd 4 th Cleaner	200							1	2	11.8
				2.5						

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% - mesh					

Test No. 15

Product	Weight		Assays,%		% Distribution	
	g	%	Pb	Zn	Pb	Zn
1. Pb Cl. Conc.	29.7	1.49	57.7	3.03	61.1	1.3
2. Pb 4th Cl. Tail	5.7	0.29	36.5	5.63	7.4	0.4
3. Pb 3rd Cl. Tail	9.3	0.47	21.7	8.04	7.2	1.0
4. Pb 2nd Cl. Tail	30.4	1.53	7.57	9.59	8.2	4.1
5. Pb 1st Cl.Sc Conc	15.8	0.79	2.77	9.32	1.6	2.0
6a. Pb 1st Cl Sc Tail (to Zn Ro)	108.1	5.42	0.62	8.26	2.4	12.4
6b. Pb 1st Cl Sc Tail (Sample)	6.0	0.30	0.62	8.26	0.1	0.7
7. Zn Cl Conc	70.1	3.52	0.55	58.4	1.4	54.9
8. Zn 4th Cl Tail	1.9	0.10	1.9	38.7	0.1	1.0
9. Zn 3rd Cl Tail	2.4	0.12	1.94	28.5	0.2	1.0
10. Zn 2nd Cl Tail	4.6	0.23	1.97	15.6	0.2	1.0
11. Zn 1st Cl Sc Conc	3.5	0.18	1.55	23.4	0.2	1.1
12. Zn 1st Cl Sc Tail	66.3	3.33	0.45	2.77	1.1	2.6
13. Zn Ro Tail	1747.3	87.67	0.18	1.19	11.2	28.9
Head Calc.	1993.0	100.00	1.41	3.61	100.0	100.0

Combined Products

Products 1+2 (Pb 3rd Cl Conc)	1.78	54.3	3.45	68.5	1.7
Products 1-3 (Pb 2nd Cl Conc)	2.24	47.5	4.40	75.7	2.7
Products 1-4 (Pb 1st Cl Conc)	3.77	31.3	6.50	83.9	6.8
Products 1-5 (Pb 1st Cl + Cl Scav Concs)	4.66	26.4	6.99	86.5	8.8
Products 1-6 (Pb Ro Conc)	10.29	12.0	7.70	88.0	21.9
Pb Ro Tail	89.71	0.19	3.14	12.0	78.1
Products 6a-6b (Pb 1st Cl Scav Tail)	5.73	0.62	8.26	2.5	13.1
Products 7-13 (Zn Ro Feed)	95.14	0.21	3.43	14.4	90.5
Products 7-8 (Zn 3rd Cl Conc)	3.61	0.59	55.9	1.5	56.0
Products 7-9 (Zn 2nd Cl Conc)	3.73	0.63	55.0	1.7	56.9
Products 7-10 (Zn 1st Cl Conc)	3.98	0.67	52.8	1.9	57.9
Products 7-10 (Zn 1st Cl+Cl Scav Concs)	4.14	0.71	51.5	2.1	59.0
Products 7-12 (Zn Ro Conc)	7.47	0.59	29.8	3.2	61.6
Products 12+13 (Zn Tails)	91.00	0.19	1.25	12.3	31.4
Products 6a +12 +13 (Comb Tails)	91.30	0.19	1.27	12.4	32.1

Product: Test No. 15 Zn Rougher Tail

Microns	Mesh	Weight Grams	% Weight		
			Ind.	Cum.	Passing
208	65	0.0	0.0	0.0	100.0
147	100	0.8	0.6	0.6	99.4
104	150	4.2	3.3	3.9	98.1
74	200	10.8	8.5	12.5	87.5
53	270	17.9	14.1	26.6	73.4
38	400	19.9	15.7	42.3	57.7
-38	-400	73.0	57.7	100.0	-
	Total	126.6	100.0	-	-

K80 = 61 μ m

PROJECT LR 3458B - TEST NO. 69

REASSAY BI: % Bi

Zn Cl Conc A-F Comb <0.0001

Pb Cl Conc A-F Comb 0.0021

COMPLETE ANALYSIS OF LEAD CONCENTRATES FROM VARIOUS GRUM COMPOSITES

Element %, g/t	Test 93 Comp. G-2	Test 107 Comp. G-1
Iron (Fe)	4.12	4.14
Copper (Cu)	0.47	0.14
Nickel (Ni)	<0.002	0.002
Lead (Pb)	66.4	68.0
Zinc (Zn)	7.53	5.11
Bismuth (Bi)	0.00007	0.0004
Cadmium (Cd)	0.013	0.009
Cobalt (Co)	0.003	0.002
Gallium (Ga)	0.0004	0.0004
Germanium (Ge)	<0.001	<0.001
Manganese (Mn)	0.010	0.009
Mercury (Hg)	0.0067	0.0054
Molybdenum (Mo)	0.002	<0.002
Thallium (Tl)	-	0.0108
Thorium (Th)	<0.001	-
Titanium (TiO ₂)	<0.05	0.05
Uranium (U)	0.001	0.005
Arsenic (As)	0.12	0.14
Antimony (Sb)	0.0002	0.25
Tin (Sn)	0.003	<0.001
Selenium (Se)	0.0013	0.011
Tellurium (Te)	<0.0003	0.0006
Fluorine (F)	0.03	0.01
Chlorine (Cl)	0.011	0.0075
Sulphur (S)	17.3	19.4
Phosphorus (P)	0.008	0.012
Carbon (C _T)	0.49	1.00
Silica (SiO ₂)	0.62	1.38
Alumina (Al ₂ O ₃)	0.12	0.09
Calcium (CaO)	<0.05	<0.05
Magnesia (MgO)	0.052	0.31
Sodium (Na ₂ O)	<0.002	<0.002
Potassium (K ₂ O)	0.019	0.018
Insol	0.86	1.94
Loss on Ignition (1000°C)	27.2	33.0
Gold (Au)	6.58	6.03
Silver (Ag)	893.	867.
Total	-	-

COMPLETE ANALYSES OF ZINC CONCENTRATES FROM VARIOUS GRUM COMPOSITES

Element %, g/t	Test 93 Comp. G-2	Test 107 Comp. G-1
Iron (Fe)	8.80	7.43
Copper (Cu)	0.40	0.50
Nickel (Ni)	<0.002	<0.002
Lead (Pb)	0.71	0.52
Zinc (Zn)	56.5	57.1
Bismuth (Bi)	0.0001	0.0001
Cadmium (Cd)	0.072	0.067
Cobalt (Co)	<0.002	<0.002
Gallium (Ga)	0.0009	0.0008
Germanium (Ge)	<0.001	<0.001
Manganese (Mn)	0.035	0.043
Mercury (Hg)	0.034	0.059
Molybdenum (Mo)	<0.002	<0.002
Thallium (Tl)	-	0.0012
Thorium (Th)	0.003	-
Titanium (TiO ₂)	<0.05	0.06
Uranium (U)	<0.001	<0.001
Arsenic (As)	0.061	0.13
Antimony (Sb)	0.0003	0.006
Tin (Sn)	<0.001	<0.001
Selenium (Se)	<0.0003	<0.0003
Tellurium (Te)	<0.0003	0.0013
Fluorine (F)	0.02	0.02
Chlorine (Cl)	0.003	0.011
Sulphur (S)	29.6	34.8
Phosphorus (P)	0.011	0.018
Carbon (C _T)	0.19	0.42
Silica (SiO ₂)	1.01	1.62
Alumina (Al ₂ O ₃)	0.16	0.17
Calcium (CaO)	0.17	0.13
Magnesia (MgO)	0.055	0.076
Sodium (Na ₂ O)	<0.002	0.002
Potassium (K ₂ O)	0.019	0.038
Insol	1.13	1.97
Loss on Ignition (1000°C)	16.4	16.0
Gold (Au)	0.40	0.63
Silver (Ag)	45.2	53.7
Total	-	-

LAKEFIELD RESEARCH

Test No.: 71 Project No.: 422 Date: June 27, 1967 Operator: _____

Purpose: Flotation of a sample of lead-zinc concentrate with various reagents for Composite G-1.

Procedure: _____

Feed: 200g / minute to mill 200 g sample of G-1

Grind: 70% - 200 mesh at 2000 rpm with 20% water

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE							TIME, MINUTES			pH
	Na ₂ S ₂ O ₈	NaOH	FeSO ₄	PbO	PbO	Composite	Water	GRIND	COND.	FROTH	
<u>Grinding</u>								20			
<u>Pb</u>				25	10	}			1	2	
					5				1	3	
			30		5				1	3	
					5				1	2	2.7
<u>Zn circuit</u>					DE 500						
<u>Control</u>						1500			5		
						800			5		
<u>Zn Pb</u>				30	10				1	2	
									1	2	
				10	5				1	2	11.6

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

Metallurgical Balance

Test No. 21

Product	Weight		Assay, % g/t		% Distribution	
	g	%	Pb	Zn	Pb	Zn
1. Pb Rougher. Conc.1	141.8	7.12	31.0	8.4	78.9	11.7
2. Pb Rougher. Conc.2	137.4	6.90	4.51	7.8	11.1	10.5
3. Pb Rougher. Conc.3	70.2	3.52	1.86	6.67	2.3	4.6
4. Pb Rougher. Conc.4	62.2	3.12	0.97	5.83	1.1	3.6
5. Zn Rougher. Conc.1	145.3	7.29	0.36	41.5	0.9	59.4
6. Zn Rougher. Conc.2	56.7	2.85	0.57	6.12	0.6	3.4
7. Zn Rougher. Conc.3	76.1	3.82	0.45	0.86	0.6	0.6
8. Zn Rougher. Tail	1302.5	65.38	0.19	0.48	4.4	6.2
Head Calc.	1992.2	100.00	2.80	5.10	100.0	100.0

Combined Products

Products 1+2		14.01	18.0	8.1	90.0	22.2
Products 1-3		17.54	14.7	7.8	92.3	26.8
Products 1-4		20.66	12.6	7.5	93.4	30.4
Products 5+6		10.14	0.42	31.6	1.5	62.8
Products 5-7		13.96	0.43	23.2	2.1	63.4
Products 5-8		79.34	0.23	4.47	6.6	69.6

LAKEFIELD RESEARCH

SCREEN ANALYSIS RECORD

Operator Kevin Sloan

Project No. 3733

Date June 23/99

F-21

Comb Prod

Microns	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.
			Ind.	Cum.				Ind.	Cum.	
1651	10					10				
1168	14					14				
833	20					20				
589	28					28				
417	35					35				
295	48					48				
208	65					65				
147	100					100				
104	150	0.1	0.1	0.1	99.9	150				
74	200	0.6	0.6	0.7	99.3	200				
53	270	3.1	3.1	3.8	96.2	270				
37	400	9.6	9.6	13.4	86.6	400				
	-400	86.6	86.6	100.0	—	-400				
	Total	100.0	100.0			Total				

Microns	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.
			Ind.	Cum.				Ind.	Cum.	
1651	10					10				
1168	14					14				
833	20					20				
589	28					28				
417	35					35				
295	48					48				
208	65					65				
147	100					100				
104	150					150				
74	200					200				
53	270					270				
37	400					400				
	-400					-400				
	Total					Total				

LAKEFIELD RESEARCH

Test No.: 22 Project No.: 200 Date: June 22 1950 Operator: _____

Purpose: Same as test 21 but to find grind

Procedure: As shown below

Feed: 2000 g of material to make 20 composite test

Grind: 60 minutes at 20% solids in lab. ball mill

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Water			Asa	NaOH	Tray	Grind	COND.	FROTH	
Flotation	1500	100	8				60			
Pb Rougher 1				25				1	2	10.1
2					5			1	2	
3				2	5			1	3	
4									2	
Zn Rougher										
1					1000	1000		5		
2						200		5		
Zn Fo 1				30	10			1	2	
2					5			1	2	
3				10	5			1	2	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

Metallurgical Balance

Test No. 22

Product	Weight		Assay, % g/t		% Distribution	
	g	%	Pb	Zn	Pb	Zn
1. Pb Rougher. Conc.1	182.1	9.16	25.2	8.8	83.4	16.0
2. Pb Rougher. Conc.2	120.2	6.05	3.49	7.1	7.6	8.5
3. Pb Rougher. Conc.3	59	2.97	1.55	6.54	1.7	3.9
4. Pb Rougher. Conc.4	29.7	1.49	1.15	5.95	0.6	1.8
5. Zn Rougher. Conc.1	151.7	7.63	0.37	39.3	1.0	59.6
6. Zn Rougher. Conc.2	58	2.92	0.63	5.75	0.7	3.3
7. Zn Rougher. Conc.3	93.3	4.69	0.46	0.88	0.8	0.8
8. Zn Rougher.Tail	1293.6	65.08	0.18	0.48	4.2	6.2
Head Calc.	1987.6	100.00	2.77	5.04	100.0	100.0

Combined Products

Products 1+2		15.21	16.6	8.1	91.0	24.5
Products 1-3		18.18	14.1	7.8	92.7	28.3
Products 1-4		19.67	13.1	7.7	93.3	30.1
Products 5+6		10.55	0.44	30.0	1.7	62.9
Products 5-7		15.24	0.45	21.0	2.5	63.7
Products 5-8		80.33	0.23	4.38	6.7	69.9

LAKEFIELD RESEARCH

SCREEN ANALYSIS RECORD

Operator BRYC

Project No. 3732

Date JUNE 26/80

COMB PPS F-22?

Microns	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.
			Ind.	Cum.				Ind.	Cum.	
1651	10					10				
1168	14					14				
833	20					20				
589	28					28				
417	35					35				
295	48					48				
208	65					65				
147	100					100				
104	150	0.2	0.2	0.2	99.8	150				
74	200	1.5	1.5	1.7	98.3	200				
53	270	4.7	4.7	6.4	93.6	270				
37	400	11.8	11.8	18.2	81.8	400				
	-400	81.8	81.8	100.0	—	-400				
	Total	100.0	100.0	—	—	Total				

Microns	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.	Mesh size (Tyler)	Weight grams	% Retained		% Pass. Cum.
			Ind.	Cum.				Ind.	Cum.	
1651	10					10				
1168	14					14				
833	20					20				
589	28					28				
417	35					35				
295	48					48				
208	65					65				
147	100					100				
104	150					150				
74	200					200				
53	270					270				
37	400					400				
	-400					-400				
	Total					Total				

LAKEFIELD RESEARCH

Test No.: 76 Project No.: 3733 Date: _____ Operator: CP

Purpose: To repeat the conditions of test No. 45 on composite G-1.

Procedure: Grind and float a lead rougher concentrate. Re-grind the rougher concentrate and clean four times.

Feed: 2000 grams minus 10 mesh composite G-1.

Grind: 30 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Na_2CO_3	NaCN	$\frac{\text{A317}}{\text{348A}}$	MIBC	Na_2SiO_3		GRIND	COND.	FROTH	pH
Primary Grind	1500	150	8				30			
Pb Rougher			40	10				1	2	9.8
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Re-grind		50	20		100		30			
Pb 1st Cleaner				10				1	3	9.4
				5	2.5			1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		25			50			1	3	
				5				1	2	
Pb 3rd Cleaner		25			50			1	2	9.6
				2.5				1	2	
Pb 4th Cleaner		25			50			1	3	

Stage	Rougher	Pb Re-grind	1st & 2nd Clean.	3rd & 4th Clean.
Flotation Cell	1000 D-1	Rod Mill	500g D-1	250g D-1
Speed: r.p.m.	1900		1400	1100
% Solids	33			
% - mesh				

LAKEFIELD RESEARCH

Test No.: 76

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Cone.	74.6	3.76	50.0	7.48			72.0	5.7			188.00	28.12		
2	Pb 4th Cl. Tail.	23.5	1.18	25.1	11.3			11.3	2.7			29.62	13.33		
3	Pb 3rd Cl. Tail.	20.5	1.03	8.36	9.11			3.3	1.9			8.61	9.38		
4	Pb 2nd Cl. Tail.	80.8	4.07	1.79	8.27			2.8	6.8			7.29	33.66		
5	Pb 1st Cl. Scav. Cone.	36.9	1.86	0.85	7.80			0.6	2.9			1.58	14.51		
6	Pb 1st Cl. Scav. Tail.	237.0	11.93	0.40	7.31			1.8	17.7			4.77	87.21		
7	Pb Rougher Tail.	1513.5	76.17	0.28	4.04			8.2	62.3			21.33	307.73		
8															
9															
10															
11															
12															
	Head (calc.)	1986.8	100.00	2.61	4.94			100.0	100.0			261.20	493.94		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	4.94	44.1	8.39			83.3	8.4			217.62	41.45		
Pb 2nd Cl. Cone. (1-3)	5.97	37.9	8.51			86.6	10.3			226.23	50.83		
Pb 1st Cl. Cone. (1-4)	10.04	23.3	8.42			89.4	17.1			233.52	84.49		
Pb 1st Cl. + Scav. Cones (1-5)	11.90	19.8	8.32			90.0	20.0			235.10	99.00		
Pb Rougher Cone. (1-6)	23.83	10.1	7.81			91.8	37.7			239.87	186.21		

LAKEFIELD RESEARCH

Test No.: 77 Project No.: 3733 Date: 15 Aug. 89 Operator: CP

Purpose: To repeat the conditions of test No. 53 (thiourea complex replacing NaCN) on Composite G-1.

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 30 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Na ₂ CO ₃	Thiourea Complex	A317 3418A	MIBC	Na ₂ SiO ₃	GRIND	COND.	FROTH	pH
Primary Grind	1500	150	8			30			
Pb Rougher			40	10			1	2	9.8
				5			1	3	
			20	5			1	3	
				5			1	2	
Pb Conc. Re-grind		50	20		100	30			
Pb 1st Cleaner				15			1	3	9.4
				5			1	3	
Pb 1st Ch. Scav.				5	2.5		1	2	
Pb 2nd Cleaner		15		2.5	50		1	3	
				5	2.5		1	2	
Pb 3rd Cleaner		15		2.5	50		1	2	9.5
				2.5	2.5		1	2	
Pb 4th Cleaner		15		2.5	50		1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 77

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn			Pb	Zn		
1	Pb 4th Cl. Cone.	86.7	4.33	53.9	6.87			84.8	5.9			233.39	29.75		
2	Pb 4th Cl. Tail.	20.5	1.02	8.86	13.4			3.3	2.7			9.04	13.67		
3	Pb 3rd Cl. Tail.	23.5	1.17	2.74	10.7			1.2	2.5			3.21	12.52		
4	Pb 2nd Cl. Tail.	72.3	3.61	0.96	8.47			1.3	6.1			3.47	30.58		
5	Pb 1st Cl. Seaw. Cone.	37.0	1.84	0.72	8.05			0.5	3.0			1.32	14.81		
6	Pb 1st Cl. Seaw. Tail.	234.9	11.72	0.34	7.41			1.4	17.3			3.98	86.85		
7	Pb Rougher Tail.	1530.0	76.31	0.27	4.11			7.5	62.5			20.60	313.63		
8															
9															
10															
11															
12															
	Head (calc.)	2004.9	100.00	2.75	5.02			100.0	100.0			275.01	501.81		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	5.35	45.3	8.12			88.1	8.6			242.43	43.42		
Pb 2nd Cl. Cone. (1-3)	6.52	37.7	8.58			89.3	11.1			245.64	55.94		
Pb 1st Cl. Cone. (1-4)	10.13	24.6	8.54			90.6	17.2			249.11	86.52		
Pb 1st Cl. + Seaw. Cones (1-5)	11.97	20.9	8.47			91.1	20.2			250.43	101.33		
Pb Rougher Cone. (1-6)	23.69	10.7	7.94			92.5	37.5			254.41	188.18		

LAKEFIELD RESEARCH

Test No.: 78 Project No.: 3733 Date: 15 Aug. 89 Operator: CP
 Purpose: To repeat the lead circuit of test No. 67 (CaOH₂ and Thiourea Complex) on composite G-1.

Procedure: As for test No. 76

Feed: 2000 grams minus 10 mesh Composite G-1
 Grind: 30 minutes at 65% solids in the lab. ball mill.

Conditions:

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	Thiourea Complex	A317 3418A	MIBC	Na ₂ SiO ₃		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				30			
Pb Rougher			40	10				1	2	10.2
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Regrind		50	20		100		30			
Pb 1st Cleaner				15				1	3	9.3
			5	5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		15			50			1	3	
			5	2.5				1	2	
Pb 3rd Cleaner		15			50			1	2	9.5
			2.5	2.5				1	2	
Pb 4th Cleaner		15		2.5	50			1	3	

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% - mesh					

LAKEFIELD RESEARCH

Test No.: 78

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Cone.	75.0	3.74	57.1	6.55			78.7	4.9			213.55	24.50		
2	Pb 4th Cl. Tail	13.4	0.67	19.4	13.4			4.7	1.8			13.00	8.98		
3	Pb 3rd Cl. Tail	16.1	0.80	8.33	12.5			2.5	2.0			6.66	10.00		
4	Pb 2nd Cl. Tail	43.2	2.15	2.03	9.49			1.6	4.1			4.36	20.40		
5	Pb 1st Cl. Scav. Cone.	22.4	1.12	1.23	8.76			0.5	2.0			1.38	9.81		
6	Pb 1st Cl. Scav. Tail	231.2	11.52	0.46	7.44			2.0	17.2			5.30	85.71		
7	Pb Rougher Tail	1605.0	80.00	0.34	4.23			10.0	68.0			27.20	338.40		
8															
9															
10															
11															
12															
	Head (calc.)	2006.3	100.00	2.71	4.98			100.0	100.0			271.45	497.90		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone (1+2)	4.41	51.4	7.59			83.4	6.7			226.55	33.48		
Pb 2nd Cl. Cone. (1-3)	5.21	44.8	8.35			85.9	8.7			233.21	43.48		
Pb 1st Cl. Cone. (1-4)	7.36	32.3	8.68			87.5	12.8			237.57	63.88		
Pb 1st Cl. + Scav. Cones (1-5)	8.48	28.2	8.69			88.0	14.8			238.95	73.69		
Pb Rougher Cone. (1-6)	20.00	12.2	7.97			90.0	32.0			244.25	159.40		

LAKEFIELD RESEARCH

Test No.: 79

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb Ro. Cone. No. 1	210.6	10.61	22.5	9.78			84.4	20.5			238.73	103.77		
2	Pb Ro. Cone. No. 2	137.5	6.92	2.44	7.57			5.9	10.4			16.88	52.38		
3	Pb Ro. Cone. No. 3	132.9	6.69	1.01	6.92			2.4	9.1			6.76	46.29		
4	Pb Ro. Cone. No. 4	39.6	1.99	0.72	6.05			0.5	2.4			1.43	12.04		
5	Zn Ro. Cone. No. 1	214.2	10.79	0.41	23.5			1.6	50.3			4.42	253.57		
6	Zn Ro. Cone. No. 2	64.3	3.24	0.51	2.00			0.6	1.3			1.65	6.48		
7	Zn Ro. Cone. No. 3	59.7	3.01	0.37	0.94			0.4	0.6			1.11	2.83		
8	Zn Rougher Tail	1126.8	56.75	0.21	0.48			4.2	5.4			11.92	27.24		
9															
10															
11															
12															
	Head (calc.)	1985.6	100.00	2.83	5.05			100.0	100.0			282.90	504.60		

Calculated Grades and Recoveries

Pb Ro Cones 1+2 (1+2)	17.53	14.6	8.91	90.3	30.9	255.61	156.15
Pb Ro. Cones 1-3 (1-3)	24.22	10.8	8.36	92.7	40.0	262.37	202.44
Pb Ro. Cones 1-4 (1-4)	26.21	10.1	8.18	93.2	42.4	263.80	214.48
Zn Ro. Cones 1+2 (5+6)	14.03	0.43	18.5	2.2	51.6	6.07	260.05
Zn Ro. Cones 1-3 (5-7)	17.04	0.42	15.4	2.6	52.2	7.18	262.88
Pb Rougher Tail (5-8)	73.79	0.26	3.93	6.8	57.6	19.10	290.12

Project No: 3733

Test No: 79

Product: Combined Product

S.G. 3.20

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
150	1.71	3.4	3.4	96.6
200	4.30	8.6	12.0	88.0
270	6.84	13.7	25.7	74.3
33.2 μ	8.86	17.7	43.4	56.6
25.7	6.22	12.4	55.9	44.1
18	6.06	12.1	68.0	32.0
12.4	4.76	9.5	77.5	22.5
9.5	2.11	4.2	81.7	18.3
-9.5	9.14	18.3	100.0	-
Total	50.00	100.0		

LAKEFIELD RESEARCH

Test No.: 80 Project No.: 3733 Date: 16 Aug. 89 Operator: CP

Purpose: To repeat test No. 79, but increase grinding time to 40 minutes.

Procedure: As for test No. 79

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE							TIME, MINUTES			pH
	Na_2CO_3	Thiourea Complex	A317 3+18A	MIBC	$\text{Ca}(\text{OH})_2$	CuSO_4	A343	GRIND	COND.	FROTH	
Primary Grind	1500	150	8					40			
Pb Ro. Cone. 1			40	10					1	2	9.6
Pb Ro. Cone. 2				5					1	3	
Pb Ro. Cone. 3			20	5					1	3	
Pb Ro. Cone. 4				5					1	2	
Condition					2000				5		
						600			5		11.4
Zn Ro. Cone. 1				10			20		1	2	
Zn Ro. Cone. 2				5					1	2	
Zn Ro. Cone. 3							10		1	2	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 80

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb Ro. Cone. No. 1	218.7	10.95	22.3	9.29			85.9	19.9			244.19	101.73		
2	Pb Ro. Cone. No. 2	142.0	7.13	2.01	6.91			5.0	9.7			14.33	49.27		
3	Pb Ro. Cone. No. 3	131.6	6.61	0.93	6.24			2.2	8.1			6.15	41.25		
4	Pb Ro. Cone. No. 4	53.3	2.68	0.58	5.42			0.6	2.8			1.55	14.53		
5	Zn Ro. Cone. No. 1	212.7	10.68	0.38	25.0			1.4	52.3			4.06	267.00		
6	Zn Ro. Cone. No. 2	88.9	4.46	0.34	1.85			0.5	1.6			1.52	8.25		
7	Zn Ro. Cone. No. 3	59.2	2.97	0.38	0.94			0.4	0.5			1.13	2.79		
8	Zn Rougher Tail	1086.2	54.52	0.21	0.48			4.0	5.1			11.45	26.17		
9															
10															
11															
12															
	Head (calc.)	1992.1	100.00	2.84	5.11			100.0	100.0			284.38	510.99		

Calculated Grades and Recoveries

Pb Ro. Cones 1+2 (1+2)	18.08	14.3	8.35			90.9	29.6			258.52	151.00
Pb Ro. Cones 1-3 (1-3)	24.69	10.7	7.79			93.1	37.7			264.67	192.25
Pb Ro. Cones 1-4 (1-4)	27.37	9.73	7.56			93.7	40.5			266.72	206.78
Zn Ro. Cones 1+2 (5+6)	15.14	0.37	18.2			1.9	53.9			5.58	275.25
Zn Ro. Cones 1-3 (5-7)	18.11	0.37	15.4			2.3	54.4			6.71	278.04
Pb Rougher Tail (5-8)	72.63	0.25	4.19			6.3	59.5			18.16	304.21

Test No: 80

Product: Combined Product

S.G. 3.20

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
150	4.30	2.6 2.6	8.6 2.6	91.4 97.4
200	2.06	4.1	12.7 6.7	87.3 93.3
270	4.50	9.0	21.7 15.7	78.3 84.3
33.2 μ	9.67	19.3	41.1 35.0	58.9 65.0
25.7	7.16	14.3	55.4 49.3	44.6 50.7
18	7.21	14.4	69.8 63.7	30.2 36.3
12.4	5.77	11.5	81.3 75.2	18.7 24.8
9.5	2.50	5.0	86.3 80.2	13.7 19.8
-9.5	6.83	19.8 19.8	100.0	-
Total	50.00	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 81 Project No.: 3733 Date: 16 Aug. 89 Operator: CP
 Purpose: To repeat tests 79 and 80, but increase grinding time to 50 minutes.

Procedure: As for test No. 79

Feed: 2000 grams minus 10 mesh Composite G-1.
 Grind: 50 minutes at 65% solids in the lab. ball mill.
 Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE							TIME, MINUTES			
	Na_2CO_3	Thiourea Complex	A317 3418A	MIBC	$\text{Ca}(\text{OH})_2$	CuSO_4	A343	GRIND	COND.	FROTH	pH
Primary Grind	1500	150	8					50			
Pb Ro. Conc. 1			40	10					1	2	9.6
Pb Ro. Conc. 2				5					1	3	
Pb Ro. Conc. 3			20	5					1	3	
Pb Ro. Conc. 4				5					1	2	
				DF1012							
Condition					2000				5		
						600			5		11.4
Zn Ro. Conc. 1				10			20		1	2	
Zn Ro. Conc. 2				5					1	2	
Zn Ro. Conc. 3							10		1	2	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 81

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb Ro. Cone. No. 1	215.6	10.82	23.2	9.03			87.5	19.2			251.02	97.70		
2	Pb Ro. Cone. No. 2	156.1	7.83	1.78	6.76			4.9	10.4			13.94	52.93		
3	Pb Ro. Cone. No. 3	132.4	6.64	0.84	6.03			1.9	7.9			5.58	40.04		
4	Pb Ro. Cone. No. 4	64.5	3.24	0.46	5.28			0.5	3.4			1.49	17.11		
5	Zn Ro. Cone. No. 1	165.1	8.29	0.31	31.6			0.9	51.5			2.57	261.96		
6	Zn Ro. Cone. No. 2	73.3	3.68	0.34	2.47			0.4	1.8			1.25	9.09		
7	Zn Ro. Cone. No. 3	54.8	2.75	0.34	1.01			0.3	0.6			0.94	2.78		
8	Zn Rougher Tail	1130.8	56.75	0.18	0.47			3.6	5.2			10.22	26.67		
9															
10															
11															
12															
	Head (calc.)	1992.6	100.00	2.87	5.08			100.0	100.0			287.01	508.28		

Calculated Grades and Recoveries

Pb Ro Cones 1+2 (1+2)	18.65	14.2	8.08	92.4	29.6	264.96	150.63
Pb Ro. Cones 1-3 (1-3)	25.29	10.7	7.54	94.3	37.5	270.54	190.67
Pb Ro. Cones 1-4 (1-4)	28.53	9.53	7.28	94.8	40.9	272.03	207.78
Zn Ro. Cones 1+2 (5+6)	11.97	0.32	22.6	1.3	53.3	3.82	271.05
Zn Ro. Cones 1-3 (5-7)	14.72	0.32	18.6	1.6	53.9	4.76	273.83
Pb Rougher Tail (5-8)	71.47	0.21	4.20	5.2	59.1	14.98	300.50

Project No: 3733 Test No: 81

Product: Combined Product S.G. 3.20

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
150	0.00	0.0	0.0	100.0
200	1.20	2.4	2.4	97.6
270	2.80	5.6	8.0	92.0
33.2 μ	9.14	18.3	26.3	73.7
25.7	7.43	14.9	41.1	58.9
18	7.99	16.0	57.1	42.9
12.4	6.47	12.9	70.1	29.9
9.5	2.88	5.8	75.8	24.2
-9.5	12.09	24.2	100.0	-
Total	50.00	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 82 Project No.: 3733 Date: 16 Aug. 89 Operator: CP
 Purpose: To repeat tests 79 to 81, but increase grinding time to 60 minutes.

Procedure: As for test No. 79.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 60 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE							TIME, MINUTES			
	Na ₂ CO ₃	Thiourea Complex	A317 3A18A	MIBC	Ca(OH) ₂	CuSO ₄	A343	GRIND	COND.	FROTH	pH
Primary Grind	1500	150	8					60			
Pb Ro. Cone. 1			40	10					1	2	9.5
Pb Ro. Cone. 2				5					1	3	
Pb Ro. Cone. 3			20	5					1	3	
Pb Ro. Cone. 4				5					1	2	
Condition				(DF1012)	2000				5		
						600			5		11.4
Zn Ro. Cone. 1				10			20		1	2	
Zn Ro. Cone. 2				5					1	2	
Zn Ro. Cone. 3							10		1	2	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 82

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb Ro. Cone. No. 1	205.7	10.35	22.8	8.58			86.4	17.6			235.98	88.80		
2	Pb Ro. Cone. No. 2	187.6	9.43	1.70	6.63			5.9	12.3			16.03	62.52		
3	Pb Ro. Cone. No. 3	137.4	6.91	0.72	5.55			1.8	7.6			4.98	38.35		
4	Pb Ro. Cone. No. 4	69.7	3.51	0.44	5.27			0.6	3.6			1.54	18.32		
5	Zn Ro. Cone. No. 1	158.3	7.96	0.25	32.5			0.7	51.3			1.99	258.70		
6	Zn Ro. Cone. No. 2	84.0	4.22	0.33	2.38			0.5	2.0			1.39	10.04		
7	Zn Ro. Cone. No. 3	61.1	3.07	0.30	0.97			0.3	0.6			0.92	2.98		
8	Zn Rougher Tail	1084.7	54.55	0.19	0.46			3.8	5.0			10.36	25.09		
9															
10															
11															
12															
	Head (calc.)	1988.5	100.00	2.73	5.05			100.0	100.0			273.19	504.80		

Calculated Grades and Recoveries

Pb Ro Cones 1+2 (1+2)	19.78	12.7	7.65			92.3	29.9			252.01	151.32		
Pb Ro. Cones 1-3 (1-3)	26.69	9.63	7.11			94.1	37.5			256.99	149.67		
Pb Ro. Cones 1-4 (1-4)	30.20	8.56	6.89			94.7	41.1			258.53	207.99		
Zn Ro. Cones 1+2 (5+6)	12.18	0.28	22.1			1.2	53.3			3.38	268.74		
Zn Ro. Cones 1-3 (5-7)	15.25	0.28	17.8			1.5	53.9			4.30	271.72		
Pb Rougher Tail (5-8)	69.80	0.21	4.25			5.3	58.9			14.66	296.81		

Test No: 82

Product: Combined Product

S.G. 3.20

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
150	0.00	0.0	0.0	100.0
200	0.00	0.0	0.0	100.0
270	2.62	5.2	5.2	94.8
33.2 μ	7.76	15.5	20.8	79.2
25.7	7.28	14.6	35.3	64.7
18	8.59	17.2	52.5	47.5
12.4	7.13	14.3	66.8	33.2
9.5	3.17	6.3	73.1	26.9
-9.5	13.45	26.9	100.0	-
Total	50.00	100.0	-	-

Repeat this test

LAKEFIELD RESEARCH

Test No.: 84 Project No.: 3733 Date: 18 Aug. 89 Operator: CP

Purpose: To repeat the conditions of test No. 76, but increase both primary and regrind times to 40 minutes.

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	Thiom. Complex	A317 3418A	MIBC	Na ₂ SiO ₃		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.3
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Regrind		50	20		100		40*			
Pb 1st Cleaner				15				1	3	9.6
				5				1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		15			50			1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		15			50			1	2	9.7
				2.5	2.5			1	2	
Pb 4th Cleaner		15		2.5	50			1	3	

* Problem with rod mill during regrind.

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 84

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb Cleaner Conc.	91.3	4.55	50.9	7.44			87.3	6.8			229.32	33.85		
2	Pb 4th Cl. Tail.	16.0	0.80	8.30	11.8			2.4	1.9			6.64	9.44		
3	Pb 3rd Cl. Tail.	24.9	1.24	3.42	9.42			1.6	2.4			4.24	11.68		T
4	Pb 2nd Cl. Tail.	93.6	4.66	1.24	7.68			2.1	7.2			5.78	35.79		
5	Pb 1st Cl. Scav. Conc.	43.1	2.15	0.81	6.93			0.6	3.0			1.74	14.90		
6	Pb 1st Cl. Scav. Tail.	239.0	11.90	0.42	6.42			1.8	15.4			5.00	76.40		
7	Pb Rougher Tail.	1500.3	74.70	0.26	4.20			7.2	63.3			19.42	313.74		
8															
9															
10															
11															
12															
	Head (calc.)	2008.2	100.00	2.72	4.96			100.0	100.0			272.14	495.80		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	5.35	44.1	8.09			86.7	8.7			235.96	43.29		
Pb 2nd Cl. Conc. (1-3)	6.59	36.4	8.34			88.3	11.1			240.20	54.97		
Pb 1st Cl. Conc. (1-4)	11.25	21.9	8.07			90.4	18.3			245.98	90.76		
Pb 1st Cl. + Scav. Concs (1-5)	13.40	18.5	7.89			91.0	21.3			247.72	105.66		
Pb Rougher Conc. (1-6)	25.30	9.99	7.20			92.8	36.7			252.72	182.06		

Project No: 3733

Product: Comb. Pb. Cl. Prod.

Test No: 84 S.G.- 3.65

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
29.1 μ	0.56	1.1	1.1	98.9
22.5	2.60	5.2	6.3	93.7
15.7	7.77	15.5	21.9	78.1
10.8	10.80	21.6	43.5	56.5
8.4	5.59	11.2	54.6	45.4
-8.4	22.68	45.4	100.0	-
Total	50.00	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 84A Project No.: 3733 Date: 22 Aug. 89 Operator: CP

Purpose: To repeat the conditions of test No. 78, but increase both primary and regrind times to 40 minutes.

Procedure: A1 for test No. 76.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions:

	REAGENTS ADDED, GRAMS PER TONNE						TIME MINUTES			
	Ca(OH) ₂	Thion. Complex	A317 3418A	MIBC	Na ₂ SiO ₃		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb rougher			40	15				1	2	10.3
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Regrind		50	20		100		40			
Pb 1st Cleaner				15				1	3	9.6
			5	5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		15			50			1	3	
			5	2.5				1	2	
Pb 3rd Cleaner		15			50			1	2	9.7
			2.5	2.5				1	2	
Pb 4th Cleaner		15		2.5	50			1	3	

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% - mesh					

LAKEFIELD RESEARCH

Test No.: 84 A

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Tail.	72.0	3.59	59.9	5.46			79.1	3.9			215.04	19.60		
2	Pb 4th Cl. Tail.	15.1	0.75	18.1	12.1			5.0	1.8			13.58	9.08		
3	Pb 3rd Cl. Tail.	18.6	0.93	7.74	10.9			2.7	2.0			7.20	10.14		
4	Pb 2nd Cl. Tail.	66.2	3.29	1.67	8.29			2.0	5.5			5.49	27.27		
5	Pb 1st Cl. Scav. Conc.	19.9	0.99	1.34	7.66			0.5	1.5			1.33	7.58		
6	Pb 1st Cl. Scav. Tail.	252.5	12.57	0.46	6.99			2.1	17.6			5.78	87.86		
7	Pb Rougher Tail.	1564.6	77.88	0.30	4.34			8.6	67.7			23.36	338.00		
8															
9															
10															
11															
12															
	Head (calc.)	2008.9	100.00	2.72	5.00			100.0	100.0			271.78	499.53		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	4.34	52.7	6.61	84.1	5.7	229.62	28.68
Pb 2nd Cl. Conc. (1-3)	5.27	44.7	7.37	86.8	7.7	235.82	38.82
Pb 1st Cl. Conc. (1-4)	8.56	28.2	7.72	88.8	13.2	241.31	66.09
Pb 1st Cl. + Scav. Concs (1-5)	9.55	25.4	7.71	89.3	14.7	242.64	73.67
Pb Rougher Conc. (1-6)	22.12	11.2	7.30	91.4	32.3	248.42	161.53

Project No: 3733 Test No: 84A

Product: Combined Pb. Cl. Product

S.G.- 3.73

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
28.6 μ	0.14	0.3	0.3	99.7
22.2	1.18	2.4	2.6	97.4
15.5	10.10	20.2	22.9	77.1
10.6	5.74	11.5	34.4	65.6
8.2	5.79	11.6	46.0	54.0
-8.2	26.95	54.0	100.0	-
Total	49.90	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 85 Project No.: 3733 Date: 21 Aug. 89 Operator: EP

Purpose: To repeat test No. 84, but increase lead grind time to 50 minutes.

Procedure: A ✓ for test No. 76.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids by the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Ca(OH) ₂	Thiourea Complex	A317 3+18A	MIBC	Na ₂ SiO ₃		GRIND	COND.	FROTH	
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.4
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Re-grind		50	20		100		50			
Pb 1st Cleaner				15				1	3	9.6
				5	5			1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		15			50			1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		15			50			1	2	9.7
				2.5	2.5			1	2	
Pb 4th Cleaner		15		2.5	50			1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 85

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Cone.	75.7	3.77	55.5	5.76			78.8	4.4			209.24	21.72		
2	Pb 4th Cl. Tail.	19.1	0.95	17.8	11.5			6.4	2.2			16.91	10.92		
3	Pb 3rd Cl. Tail.	22.6	1.13	5.86	9.96			2.5	2.3			6.62	11.25		
4	Pb 2nd Cl. Tail.	82.7	4.12	1.53	7.52			2.4	6.4			6.30	30.98		
5	Pb 1st Cl. Scav. Cone.	33.7	1.68	0.87	7.09			0.5	2.4			1.46	11.91		
6	Pb 1st Cl. Scav. Tail.	260.2	12.97	0.42	6.62			2.1	17.5			5.45	85.86		
7	Pb Rougher Tail.	1512.6	75.38	0.26	4.21			7.3	64.8			19.60	317.35		
8															
9															
10															
11															
12															
	Head (calc.)	2006.6	100.00	2.66	4.90			100.0	100.0			265.58	489.99		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	4.72	47.9	6.92	85.2	6.6	226.15	32.64
Pb 2nd Cl. Cone. (1-3)	5.85	39.8	7.50	87.7	8.9	232.77	43.89
Pb 1st Cl. Cone. (1-4)	9.97	24.0	7.51	90.1	15.3	239.07	74.87
Pb 1st Cl. + Scav. Cones (1-5)	11.65	20.6	7.45	90.6	17.7	240.53	86.78
Pb Rougher Cone. (1-6)	24.62	9.99	7.01	92.7	35.2	245.98	172.64

Product: Comb. Pb. Cl. Prod.

Test No: 85

S.G.- 3.65

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
29.1 μ	0.14	0.3	0.3	99.7
22.5	1.00	2.0	2.3	97.7
15.7	5.28	10.6	12.8	87.2
10.8	10.13	20.3	33.1	66.9
8.4	6.18	12.4	45.5	54.5
-8.4	27.27	54.5	100.0	-
Total	50.00	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 86 Project No.: 3733 Date: 21 Aug. 89 Operator: CP

Purpose: To repeat tests No. 84 and 85, but increase lead regrind time to 60 minutes

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	Thiourea Complex	A317 3418A	MIBC			GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.4
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Regrind		50	20		100		60			
Pb 1st Cleaner				15				1	3	9.5
				5				1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		15		2.5	50			1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		15			50			1	2	9.7
				2.5	2.5			1	2	
Pb 4th Cleaner		15		2.5	50			1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 86

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Cone.	69.3	3.46	59.7	4.85			76.2	3.4			206.56	16.78		
2	Pb 4th Cl. Tail.	19.0	0.94	23.2	10.9			8.0	2.1			21.81	10.25		
3	Pb 3rd Cl. Tail.	18.2	0.91	8.32	10.9			2.8	2.0			7.57	9.92		
4	Pb 2nd Cl. Tail.	80.7	4.03	1.48	7.72			2.2	6.3			5.96	31.11		
5	Pb 1st Cl. Scav. Cone.	26.7	1.33	0.83	7.12			0.4	1.9			1.10	9.47		
6	Pb 1st Cl. Scav. Tail.	287.5	14.34	0.40	6.59			2.1	19.2			5.74	94.50		
7	Pb Rougher Tail.	1503.4	74.99	0.30	4.28			8.3	65.1			22.49	320.96		
8															
9															
10															
11															
12															
	Head (calc.)	2004.8	100.00	2.71	4.93			100.0	100.0			271.23	492.99		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	4.40	51.9	6.14	84.2	5.5	228.37	27.03
Pb 2nd Cl. Cone. (1-3)	5.31	44.4	6.96	87.0	7.5	235.94	36.95
Pb 1st Cl. Cone. (1-4)	9.34	25.9	7.29	89.2	13.8	241.90	68.06
Pb 1st Cl. + Scav. Cones (1-5)	10.67	22.8	7.27	89.6	15.7	243.00	77.53
Pb Rougher Cone. (1-6)	25.01	9.95	6.88	91.7	34.9	248.74	172.03

Product: Comb. Pb. Cl. Prod.

Test No: 86

S.G.- 3.65

Mesh	Weight Grams	% Weight		
		Ind.	Cum.	Passing
29.1 μ	0.00	0.0	0.0	100.0
22.5	0.67	1.3	1.3	98.7
15.7	4.24	8.5	9.8	90.2
10.8	9.42	18.8	28.7	71.3
8.4	6.35	12.7	41.4	58.6
-8.4	29.32	58.6	100.0	-
Total	50.00	100.0	-	-

LAKEFIELD RESEARCH

Test No.: 87 Project No.: 3733 Date: 22 Aug. 89 Operator: CP

Purpose: To repeat test No. 84, but investigate the effect of high-intensity conditioning on the reground conc. prior to cleaning

Procedure: As for test 76, but with conditioning of the reground lead rougher concentrate prior to cleaning.

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions:

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			pH
	$\text{Ca}(\text{OH})_2$	Thiourea Complex	AB12 ?HBA	MIBC	$\text{Na}_2\text{S}_2\text{O}_3$	GRIND	COND.	FROTH	
Primary Grind	750	150	8			40			
Pb Rougher			40	15			1	2	10.4
				5			1	3	
			20	5			1	3	
				5			1	2	
Pb Conc. Regrind	250	50			100	40			
High Int. Cond.			20	15			15		
Pb 1st Cleaner								3	10.2
			5	5			1	3	
Pb 1st Cl. Scav.			5	2.5			1	2	
Pb 2nd Cleaner		15	2.5	2.5	50		1	3	9.9
			2.5	2.5			1	2	
Pb 3rd Cleaner		15			50		1	2	
			2.5				1	2	
Pb 4th Cleaner		15			50		1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 87

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%		Pb	Zn				Pb	Zn				
1	Pb 4th Cl. Cone.	41.7	2.08		58.9	4.98			47.1	2.1			122.51	10.36	
2	Pb 4th Cl. Tail.	17.1	0.85		33.2	7.52			10.9	1.3			28.22	6.39	
3	Pb 3rd Cl. Tail.	17.9	0.89		26.6	8.17			9.1	1.4			23.67	7.27	
4	Pb 2nd Cl. Tail.	50.2	2.50		12.7	8.12			12.2	4.0			31.75	20.30	
5	Pb 1st Cl. Scav. Cone.	34.5	1.72		3.22	9.56			2.1	3.3			5.54	16.44	
6	Pb 1st Cl. Scav. Tail.	305.2	15.19		1.86	7.29			10.9	22.0			28.25	110.74	
7	Pb Rougher Tail.	1542.2	76.77		0.26	4.32			7.7	65.9			19.96	331.65	
8															
9															
10															
11															
12															
	Head (calc.)	2008.8	100.00		2.60	5.03			100.0	100.0			259.90	503.15	

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	2.93		51.4	5.72			58.0	3.4			150.73	16.75		
Pb 2nd Cl. Cone. (1-3)	3.82		45.7	6.29			67.1	4.8			174.43	24.02		
Pb 1st Cl. Cone. (1-4)	6.32		32.6	7.01			79.3	8.8			206.15	44.32		
Pb 1st Cl. + Scav. Cones (1-5)	8.04		26.3	7.56			81.4	12.1			211.69	60.76		
Pb Rougher Cone. (1-6)	23.23		10.3	7.38			92.3	34.1			239.94	171.50		

LAKEFIELD RESEARCH

Test No.: 89 Project No.: 3733 Date: 24 Aug. 89 Operator: CP

Purpose: To repeat the conditions of test No. 84A but double the Na_2SiO_3 additions to the lead cleaners.

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite B-1.

Grind: 40 minutes at 65% solids in the lab-ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	$\text{Ca}(\text{OH})_2$	Thiourea Complex	A317 3HBA	MIBC	Na_2SiO_3		GRIND	COND.	FROTH	
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.4
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Re-grind		50	20		200		40			
Pb 1st Cleaner				15				1	3	9.9
			5	5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		15			100			1	3	
			5	2.5				1	2	
Pb 3rd Cleaner		15			100			1	2	10.2
			2.5	2.5				1	2	
Pb 4th Cleaner		15		2.5	100			1	3	10.4

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% - mesh					

LAKEFIELD RESEARCH

Test No.: 89

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%		Pb	Zn			Pb	Zn					
1	Pb 4th Cl. Conc.	50.3	2.51		50.1	4.76			47.9	2.4			125.75	11.95	
2	Pb 4th Cl. Tail.	31.6	1.58		42.8	8.46			25.7	2.7			67.62	13.37	
3	Pb 3rd Cl. Tail.	25.8	1.29		19.9	10.9			9.8	2.9			25.67	14.06	
4	Pb 2nd Cl. Tail.	71.4	3.56		3.75	8.91			5.0	6.5			13.35	31.72	
5	Pb 1st Cl. Seas. Conc.	35.0	1.75		1.44	8.31			1.0	3.0			2.52	14.54	
6	Pb 1st Cl. Seas. Tail.	237.1	11.82		0.64	6.97			2.9	16.9			7.57	82.46	
7	Pb Rougher Tail.	1552.4	77.48		0.26	4.14			7.7	65.6			20.15	320.77	
8															
9															
10															
11															
12															
	Head (calc.)	2003.6	100.00		2.63	4.89			100.0	100.0			262.63	488.87	

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1-2)	4.09		47.3	6.19			73.6	5.1			193.37	25.32		
Pb 2nd Cl. Conc. (1-3)	5.38		40.7	7.32			83.4	8.0			219.04	39.38		
Pb 1st Cl. Conc. (1-4)	8.94		26.0	7.95			88.4	14.5			232.39	71.10		
Pb 1st Cl. + Seas. Conc. (1-5)	10.69		22.0	8.01			89.4	17.5			234.91	85.64		
Pb Rougher Conc. (1-6)	22.52		10.8	7.46			92.3	34.4			242.48	168.10		

LAKEFIELD RESEARCH

Test No.: 90 Project No.: 3733 Date: 24 Aug. 89 Operator: CP
 Purpose: To repeat test No. 84A but double the Thiourea complex additions to the lead cleaners.

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite B-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	Thiourea Complex	A317 3418A	MIBC	Na ₂ SiO ₃		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.4
				5				1	3	
			20	5				1	3	
				5				1	2	
Pb Conc. Re-grind		100	20		100		40			
Pb 1st Cleaner				15				1	3	9.8
			5	5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		30			50			1	3	
			5	2.5				1	2	
Pb 3rd Cleaner		30			50			1	2	10.1
			2.5	2.5				1	2	
Pb 4th Cleaner		30		2.5	50			1	3	10.2

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				

LAKEFIELD RESEARCH

Test No.: 90

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%		Pb	Zn				Pb	Zn				
1	Pb 4th Cl. Conc.	71.8	3.59		61.1	6.01			79.0	4.3			219.35	21.57	
2	Pb 4th Cl. Tail.	14.5	0.72		15.9	12.8			4.1	1.8			11.45	9.22	
3	Pb 3rd Cl. Tail.	18.2	0.91		7.25	10.4			2.4	1.9			6.60	9.46	
4	Pb 2nd Cl. Tail.	49.3	2.46		2.18	8.74			2.0	4.3			5.36	21.50	
5	Pb 1st Cl. Seav. Conc.	50.0	2.49		0.81	7.52			0.7	3.7			2.02	18.72	
6	Pb 1st Cl. Seav. Tail.	249.6	12.45		0.46	6.98			2.1	17.2			5.73	86.90	
7	Pb Rougher Tail.	1551.1	77.38		0.35	4.35			9.7	66.8			27.08	336.60	
8															
9															
10															
11															
12															
	Head (calc.)	2004.5	100.00		2.78	5.04			100.0	100.0			277.59	503.97	

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1-2)	4.31		53.5	7.14			83.1	6.1			230.80	30.79	
Pb 2nd Cl. Conc. (1-3)	5.22		45.5	7.71			85.5	8.0			237.40	40.25	
Pb 1st Cl. Conc. (1-4)	7.68		31.6	8.04			87.5	12.3			242.76	61.75	
Pb 1st Cl. + Seav. Concs. (1-5)	10.17		24.1	7.91			88.2	16.0			244.78	80.47	
Pb Rougher Conc. (1-6)	22.62		11.1	7.40			90.3	33.2			250.51	167.37	

LAKEFIELD RESEARCH

Test No.: 92 Project No.: 3733 Date: 28 Aug. 89 Operator: CP
 Purpose: To repeat test No. 90, but omit Na₂SiO₃ from the cleaners.

Procedure: As for test No. 76

Feed: 2000 grams minus 10 mesh composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	Tilium Complex	A317 3418A	MIBC			GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.3
				5				1	3	
			20	5				1	3	
			10	5				1	2	
Pb Conc. Re-grind		100	20				40			
Pb 1st Cleaner				15				1	3	9.3
				5	5			1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		30						1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		30						1	2	9.4
				2.5	2.5			1	2	
Pb 4th Cleaner		30			2.5			1	3	9.5

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% - mesh					

LAKEFIELD RESEARCH

Test No.: 92

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Conc.	75.3	3.76	59.5	6.06			81.0	4.6			223.72	22.79		
2	Pb 4th Cl. Tail.	16.6	0.83	10.9	12.3			3.3	2.0			9.05	10.21		
3	Pb 3rd Cl. Tail.	19.5	0.97	3.72	9.44			1.3	1.8			3.61	9.16		
4	Pb 2nd Cl. Tail.	86.2	4.30	1.79	7.83			2.8	6.7			7.70	33.67		
5	Pb 1st Cl. Scav. Conc.	49.1	2.45	1.12	7.28			1.0	3.6			2.74	17.84		
6	Pb 1st Cl. Scav. Tail.	263.8	13.16	0.64	6.61			3.0	17.5			8.42	86.99		
7	Pb Rougher Tail.	1494.0	74.53	0.28	4.27			7.6	63.8			20.87	318.21		
8															
9															
10															
11															
12															
	Head (calc.)	2004.5	100.00	2.76	4.99			100.0	100.0			276.11	498.90		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	4.59	50.7	7.19	84.3	6.6	232.77	33.00
Pb 2nd Cl. Conc. (1-3)	5.56	42.5	7.58	85.6	8.4	236.38	42.16
Pb 1st Cl. Conc. (1-4)	9.86	24.8	7.69	88.4	15.1	244.08	75.83
Pb 1st Cl. + Scav. Concs (1-5)	12.31	20.1	7.61	89.4	18.7	246.82	93.67
Pb Rougher Conc. (1-6)	25.47	10.0	7.09	92.4	36.2	255.24	180.66

LAKEFIELD RESEARCH

Test No.: 93 Project No.: 3733 Date: 29 Aug. 89 Operator: CP+TS

Purpose: To perform a six-stage locked cycle test on Comp. G-2 following the conditions of test 91.

Procedure: See flowsheet

Feed: Six 2000 gram charges minus 10 mesh Composite G-2.
 Grind: 30 minutes per charge at 65% solids in the lab ball mill.

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Ca(OH) ₂	Thiourea Complex	A317 3+15A	MIBC		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8			30			
Pb Rougher			40	10			1	2	10.0
				5			1	3	
			20	5			1	3	
				5			1	2	
Pb Conc. Regrind		50	20			30			
Pb 1st Cleaner				10			1	3	9.4
			5	2.5			1	3	
Pb 1st Cl: Scav.			5	2.5			1	2	
Pb 2nd Cleaner		15					1	3	9.5
			5				1	2	
Pb 3rd Cleaner		15					1	2	
			2.5				1	2	
Pb 4th Cleaner		15						3	9.6

Stage	Pb Rougher	Pb Regrind	Pb 1st & 2nd Cl.	Pb 3rd & 4th Cl.
Flotation Cell	1000 g D-1	Rad Mill	500 g D-1	250 g D-1
Speed: r.p.m.	1960		1700	1160
% Solids				
% — mesh				

LAKEFIELD RESEARCH

Test No.: 93 (Cont'd) Project No.: _____ Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: _____

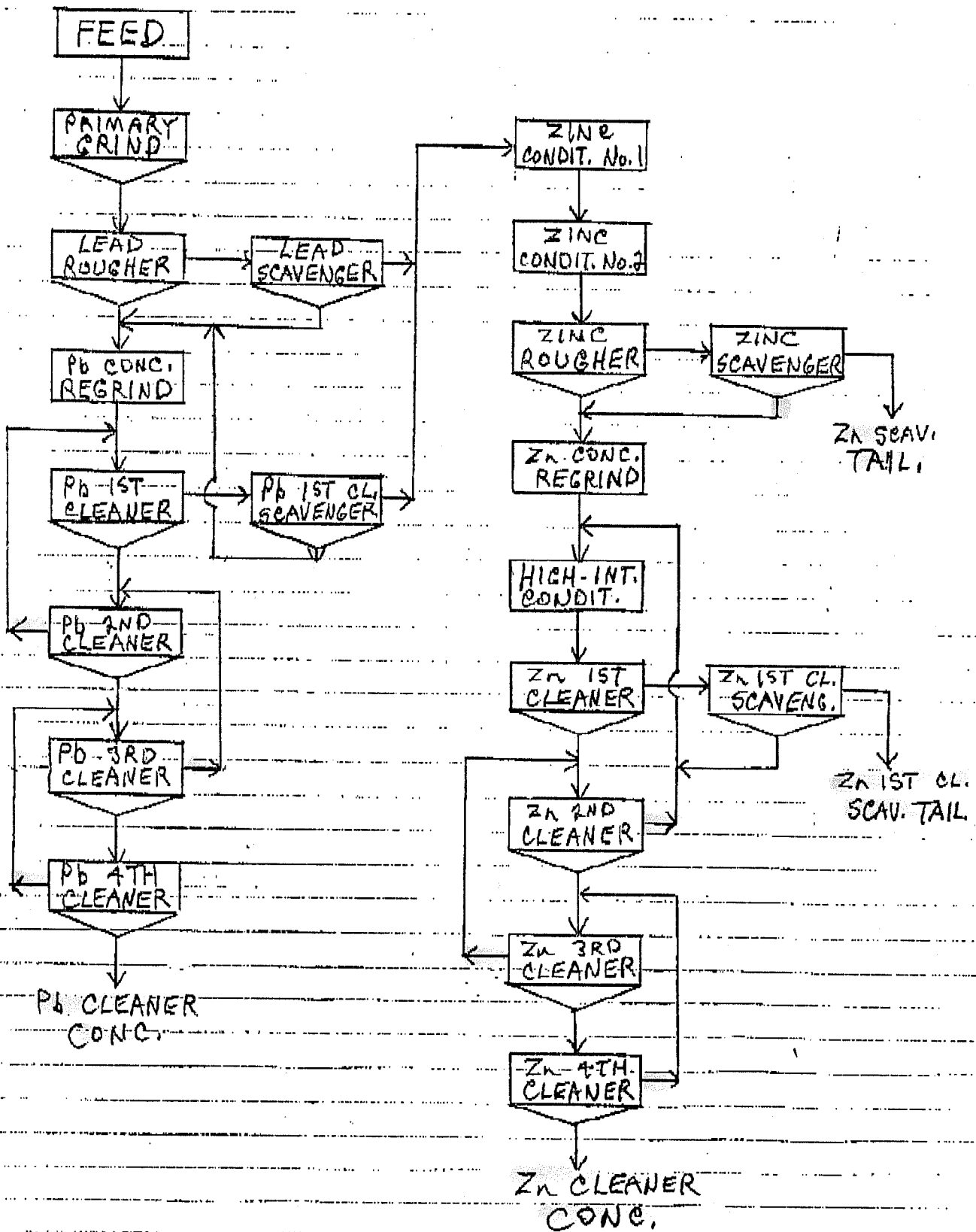
Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	CaSO ₄	A343	DF1017			GRIND	COND.	FROTH	pH
Zn Conditioner 1	2000							5		
2		600						5		11.5
Zn Rougher			25	5				1	3	
			15	5				1	3	
Zn Cone. Regrind	1000	100					30			
High-Int. Condit.			20	5				15		
Zn 1st Cleaner									5	11.5
Zn 1st Cl. Scav.			10	2.5				1	3	
Zn 2nd Cleaner	500							1	3	
Zn 3rd Cleaner	500							1	2 1/2	12.2
Zn 4th Cleaner	500							1	2	"

Stage	Zn Rougher	Zn Regrind	High-Int. Cond.	Zn Cleaners
Flotation Cell	1000 g D-1	Roller Mill	W. conc. Temp.	500 g D-1
Speed: r.p.m.	1200		2200	1400
% Solids				
% - mesh				

3733 - Test 93 - FLOWSHEET



LAKEFIELD RESEARCH

Test No.: 93

Project No.: _____

Date: _____

Metallurgical Results

PRODUCT	WEIGHT		ASSAYS, % g/t					% DISTRIBUTION				METAL UNITS				
	g	%	Cu	Pb	Zn	Au	Ag	Pb	Zn	Au	Ag	Cu	Pb	Zn	Au	Ag
1 Pb Cleaner Conc. A	83.6	0.70	0.45	71.0	5.57			13.6	0.6			0.315	49.70	3.90		
2 Pb Cleaner Conc. B	93.0	0.77	0.38	68.7	6.78			14.5	0.8			0.293	52.90	5.22		
3 Pb Cleaner Conc. C	99.9	0.83	0.52	66.1	7.16			15.0	1.0			0.492	54.86	5.94		
4 Pb Cleaner Conc. D	96.4	0.80	0.55	67.9	6.74			14.9	0.9			0.440	54.32	5.39		
5 Pb Cleaner Conc. E	97.2	0.81	0.41	66.1	7.28			14.7	0.9			0.332	53.54	5.70		
6 Pb Cleaner Conc. F	103.4	0.86	0.45	64.7	7.74			15.2	1.1			0.387	55.64	6.66		
7 Pb 4th Cl. Tail. F	21.5	0.18	2.15	13.4	22.3			0.7	0.6			0.387	2.41	4.01		
8 Pb 3rd Cl. Tail. F	30.7	0.26	1.88	7.71	22.6			0.5	0.9			0.499	2.00	5.89		
9 Pb 2nd Cl. Tail. F	72.5	0.60	0.87	3.79	18.7			0.6	1.8			0.522	2.27	11.22		
10 Pb 1st Cl. Scan. Conc. F	49.0	0.41	0.76	2.17	15.8			0.3	1.1			0.312	0.89	6.48		
11 Zn Cleaner Conc. A	167.1	1.39	0.30	0.78	54.5			0.3	12.0			0.47	1.08	75.76		
12 Zn Cleaner Conc. B	170.0	1.41	0.30	0.80	56.4			0.3	12.6			0.423	1.13	79.52		
1 Zn Cleaner Conc. C	155.3	1.29	0.33	0.73	56.8			0.3	11.7			0.426	0.94	73.27		
2 Zn Cleaner Conc. D	167.9	1.40	0.40	0.79	56.4			0.3	12.6			0.560	1.11	78.96		
3 Zn Cleaner Conc. E	161.3	1.34	0.38	0.68	56.3			0.2	12.0			0.509	0.91	75.44		
4 Zn Cleaner Conc. F	158.3	1.32	0.37	0.67	57.0			0.2	12.0			0.488	0.89	75.24		
5 Zn 4th Cl. Tail. F	41.9	0.18	0.70	1.57	46.6			0.1	1.3			0.126	0.28	8.39		
6 Zn 3rd Cl. Tail. F	56.5	0.47	0.73	1.73	39.6			0.2	3.0			0.343	0.81	18.61		
7 Zn 2nd Cl. Tail. F	65.1	0.54	0.57	1.82	22.8			0.3	2.0			0.308	0.98	12.31		
8 Zn 1st Cl. Scan. Conc. F	59.6	0.50	0.27	1.43	11.6			0.2	0.9			0.145	0.72	5.80		
9 Zn 1st Cl. Scan. Tail. A	151.4	1.26	-	0.46	1.55			0.1	0.3				0.58	1.95		
10 Zn 1st Cl. Scan. Tail. B	155.7	1.29	-	0.71	2.37			0.3	0.4				0.92	3.06		
11 Zn 1st Cl. Scan. Tail. C	147.8	1.23	-	0.78	2.88			0.3	0.6				0.96	3.54		
12 Zn 1st Cl. Scan. Tail. D	149.6	1.24	-	0.83	3.48			0.3	0.7				1.03	4.32		
1 Zn 1st Cl. Scan. Tail. E	156.9	1.30	-	0.79	3.33			0.3	0.7				1.03	4.33		
2 Zn 1st Cl. Scan. Tail. F	161.1	1.34	-	0.60	2.81			0.2	0.6				0.80	3.77		
3 Zn Scan. Tail. A	1470.0	12.22	-	0.29	0.57			1.0	1.1				3.54	6.97		
4 Zn Scan. Tail. B	1510.0	12.56	-	0.31	0.57			1.1	1.1				3.89	7.16		
5 Zn Scan. Tail. C	1572.6	13.08	-	0.29	0.58			1.0	1.2				3.79	7.59		
6 Zn Scan. Tail. D	1574.5	13.09	-	0.31	0.58			1.1	1.2				4.06	7.59		
7 Zn Scan. Tail. E	1523.1	12.67	-	0.29	0.58			1.0	1.2				3.67	7.35		
8 Zn Scan. Tail. F	1523.0	12.66	-	0.27	0.53			0.9	1.1				3.42	6.71		
Head (calc.)	1045.9	100.00	-	3.65	6.28			100.0	100.0				365.20	629.24		

Calculated Grades and Recoveries

Comb. Pb Cl. Concs A-F	4.77	0.46	67.3	6.92				87.9	5.3			2.20	320.96	33.01		
Comb. Pb Cl. Tails F	1.45	1.18	5.22	19.0				2.1	4.4			1.71	7.57	27.59		
Comb. Zn Cl. Concs A-F	8.15	0.35	0.79	56.2				1.6	72.9			2.82	6.05	458.19		
Comb. Zn Cl. Tails F	1.69	0.54	1.65	26.7				0.8	7.2			0.92	2.79	45.11		
Comb. Zn 1st Cl. Scan. Tail. A-F	7.66	-	0.69	2.74				1.5	3.3				5.32	20.97		
Comb. Zn Scan. Tails A-F	76.28	-	0.29	0.57				6.1	6.9				22.37	43.37		
Comb. Zn 1st Cl. Scan. + Scan. Tails	83.94	-	0.33	0.77				7.6	10.2				27.69	64.34		

376.B

LAKEFIELD RESEARCH

Test No.: 93 (Cont'd)

Project No.: _____

Date: _____

Metallurgical Results: Projected Results of Cycles E and F

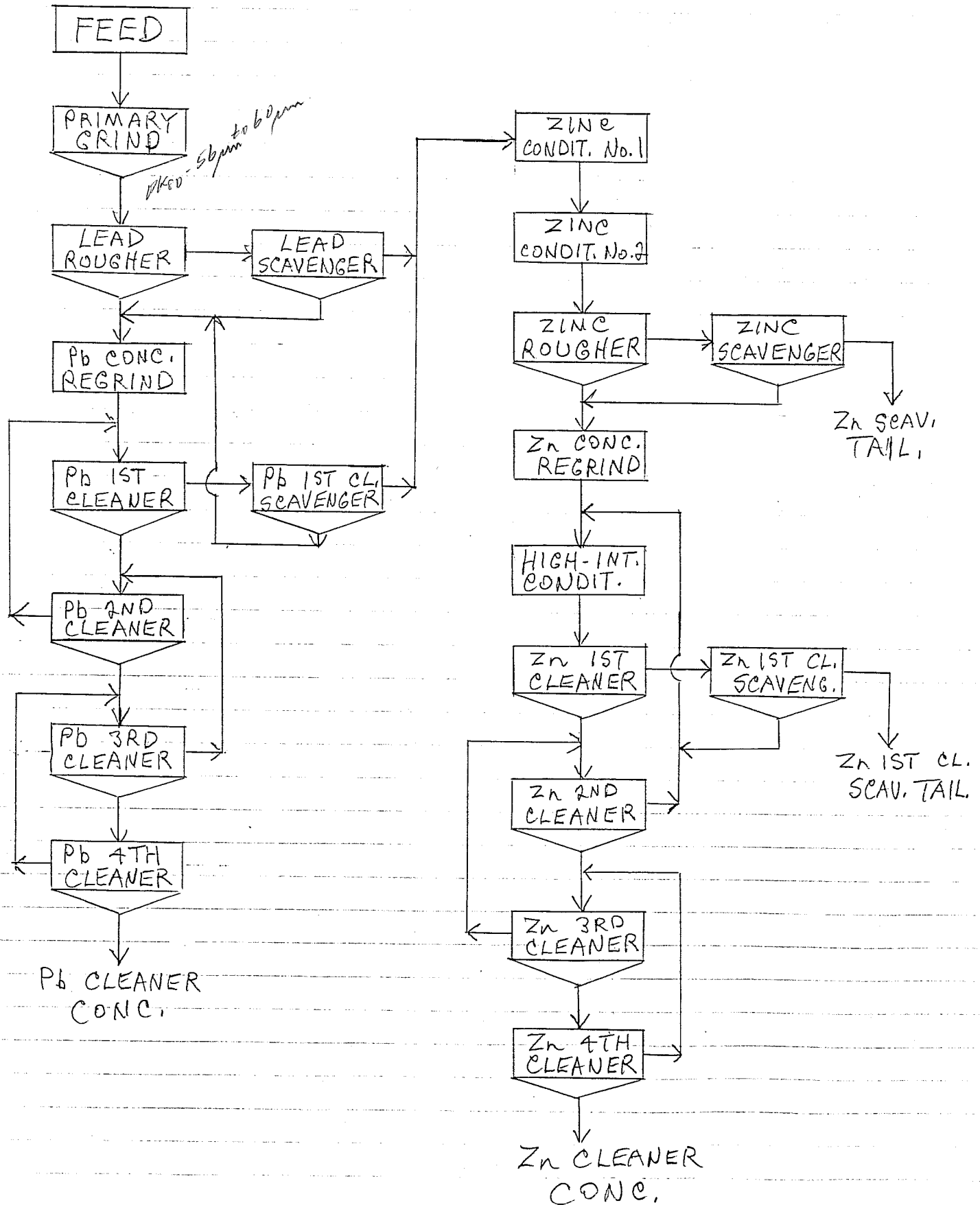
PRODUCT	WEIGHT		ASSAYS, %, g/t				% DISTRIBUTION				METAL UNITS			
	g	%	Pb	Zn	Au	Ag	Pb	Zn			Pb	Zn		
1 Pb Cleaner Conc.		5.07	65.4	7.51			90.8	6.1			331.56	38.13		
2 Zn Cleaner Conc.		9.23	0.67	56.6			1.7	83.2			6.18	522.42		
3 Zn let cl. Scan Tail		7.85	0.69	3.07			1.5	3.8			5.42	24.10		
4 Zn Scavenger Tail		77.85	0.28	0.56			6.0	6.9			21.80	43.60		
5														
6														
7														
8														
9														
10														
11														
12														
Head (calc.)		100.00	3.65	6.28			100.0	100.0			364.98	628.25		

Calculated Grades and Recoveries

Zn Combined Tails,			0.32	0.79			7.5	10.7						

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8733 - Test 93 - FLOWSHEET



LAKEFIELD RESEARCH

Test No.: 193

Project No.:

Date:

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, % g/t					% DISTRIBUTION				METAL UNITS				
		g	%	Cu	Pb	Zn	Au	Ag	Pb	Zn	Au	Ag	Cu	Pb	Zn	Au	Ag
1	Pb Cleaner Conc. A	83.6	0.70	0.45	71.0	5.57	9.40	96.5	13.6	0.6	8.9	11.3	0.315	49.70	3.90	6.58	675.5
2	Pb Cleaner Conc. B	93.0	0.77	0.38	68.7	6.78	6.47	933.	14.5	0.8	6.8	12.1	0.293	52.90	5.22	4.98	718.4
3	Pb Cleaner Conc. C	99.9	0.83	0.52	66.1	7.16	5.90	918.	15.0	1.0	6.7	12.8	0.492	54.86	5.94	4.90	761.9
4	Pb Cleaner Conc. D	96.4	0.80	0.55	67.9	6.74	6.57	937.	14.9	0.9	7.1	12.6	0.440	54.32	5.39	5.26	749.6
5	Pb Cleaner Conc. E	97.2	0.81	0.41	66.1	7.28	6.43	928.	14.7	0.9	7.1	12.6	0.332	53.54	5.90	5.21	751.7
6	Pb Cleaner Conc. F	103.4	0.86	0.45	64.7	7.74	6.97	892.	15.2	1.1	8.1	12.9	0.387	55.64	6.66	5.99	767.1
7	Pb 4th Cl. Tail. F	21.5	0.18	2.15	13.4	22.3	3.01	236.	0.7	0.6	0.7	0.7	0.387	2.41	4.01	0.54	42.5
8	Pb 3rd Cl. Tail. F	30.7	0.26	1.88	7.71	22.6	2.45	147.	0.5	0.9	0.9	0.6	0.499	2.00	5.88	0.64	38.2
9	Pb 2nd Cl. Tail. F	72.5	0.60	0.87	3.79	18.7	1.83	85.3	0.6	1.8	1.5	0.9	0.522	2.27	11.22	1.10	51.2
10	Pb 1st Cl. Scan. Conc. F	49.0	0.41	0.76	2.17	15.8	1.48	64.1	0.3	1.1	0.8	0.5	0.312	0.89	6.48	0.61	26.3
11	Zn Cleaner Conc. A	167.1	1.39	0.30	0.78	54.5	0.40	43.5	0.3	12.0	0.8	1.0	0.417	1.08	75.76	0.56	60.5
12	Zn Cleaner Conc. B	170.0	1.41	0.30	0.80	56.4	0.37	46.1	0.3	12.6	0.7	1.1	0.423	1.13	79.52	0.52	65.0
1	Zn Cleaner Conc. C	155.3	1.29	0.33	0.73	56.8	0.35	43.0	0.3	11.7	0.6	0.9	0.426	0.94	73.27	0.45	55.5
2	Zn Cleaner Conc. D	167.9	1.40	0.40	0.79	56.4	0.51	46.0	0.3	12.6	0.9	1.1	0.560	1.11	78.96	0.71	64.4
3	Zn Cleaner Conc. E	161.3	1.34	0.38	0.68	56.3	0.30	44.8	0.2	12.0	0.5	1.0	0.509	0.91	75.44	0.40	60.0
4	Zn Cleaner Conc. F	158.3	1.32	0.37	0.67	57.0	0.37	44.4	0.2	12.0	0.7	1.0	0.498	0.88	75.24	0.49	58.6
5	Zn 4th Cl. Tail. F	21.9	0.18	0.70	1.57	46.6	0.62	72.9	0.1	1.3	0.2	0.2	0.126	0.28	8.39	0.11	13.1
6	Zn 3rd Cl. Tail. F	56.5	0.47	0.73	1.73	39.6	1.01	87.0	0.2	3.0	0.6	0.7	0.343	0.81	18.61	0.47	40.9
7	Zn 2nd Cl. Tail. F	65.1	0.54	0.57	1.82	22.8	1.14	70.5	0.3	2.0	0.9	0.6	0.306	0.98	12.31	0.62	38.1
8	Zn 1st Cl. Scan. Conc. F	59.6	0.50	0.29	1.43	11.6	1.09	55.6	0.2	0.9	0.7	0.5	0.145	0.72	5.80	0.55	27.8
9	Zn 1st Cl. Scan. Tail. A	151.4	1.26	—	0.46	1.55	1.19	18.4	0.1	0.3	2.0	0.4	—	0.58	1.95	1.50	23.2
10	Zn 1st Cl. Scan. Tail. B	155.7	1.29	—	0.71	2.37	1.18	25.7	0.3	0.4	2.1	0.5	—	0.92	3.06	1.52	33.2
11	Zn 1st Cl. Scan. Tail. C	147.8	1.23	—	0.78	2.88	1.17	28.2	0.3	0.6	1.9	0.6	—	0.96	3.54	1.44	34.7
12	Zn 1st Cl. Scan. Tail. D	149.6	1.24	—	0.83	3.48	1.06	29.5	0.3	0.7	1.8	0.6	—	1.03	4.32	1.21	36.6
5	Zn 1st Cl. Scan. Tail. E	156.9	1.30	—	0.79	3.33	1.13	30.7	0.3	0.7	2.0	0.7	—	1.03	4.33	1.47	39.9
6	Zn 1st Cl. Scan. Tail. F	161.1	1.34	—	0.60	2.81	0.88	27.6	0.2	0.6	1.6	0.6	—	0.80	3.77	1.18	37.0
7	Zn Scan. Tail. A	1470.0	12.22	—	0.29	0.57	0.27	8.5	1.0	1.1	4.5	1.7	—	3.54	6.97	3.30	103.9
8	Zn Scan. Tail. B	1510.0	12.56	—	0.31	0.57	0.31	10.0	1.1	1.1	5.3	2.1	—	3.89	7.16	3.89	125.6
9	Zn Scan. Tail. C	1572.6	13.08	—	0.29	0.58	0.33	8.1	1.0	1.2	5.9	1.8	—	3.79	7.59	4.32	105.9
10	Zn Scan. Tail. D	1574.5	13.09	—	0.31	0.58	0.35	10.4	1.1	1.2	6.2	2.3	—	4.06	7.59	4.58	136.1
11	Zn Scan. Tail. E	1523.1	12.67	—	0.29	0.58	0.33	8.7	1.0	1.2	5.7	1.8	—	3.67	7.35	4.18	110.2
12	Zn Scan. Tail. F	1523.0	12.66	—	0.27	0.53	0.34	8.4	0.9	1.1	5.8	1.8	—	3.42	6.71	4.30	106.3
	Head (calc.)	12095.9	100.00	—	3.65	6.28	0.74	59.6	100.0	100.0	100.0	100.0	—	365.06	628.24	73.68	5958.9

Calculated Grades and Recoveries

Comb. Pb Cl. Concs A-F	4.77	0.46	67.3	6.92	6.90	92.7	87.9	5.3	44.7	74.3	2.20	320.96	33.01	32.92	4424.2
Comb. Pb Cl. Tails F	1.45	1.18	5.22	19.0	1.99	109.	2.1	4.4	3.9	2.7	1.71	7.57	27.59	2.89	158.2
Comb. Zn Cl. Concs A-F	8.15	0.35	0.74	56.2	0.38	44.7	1.6	72.9	4.2	6.1	2.82	6.05	458.19	3.13	364.0
Comb. Zn Cl. Tails F	1.69	0.54	1.65	26.7	1.04	70.9	0.8	7.2	2.4	2.0	0.92	2.79	45.11	1.75	119.9
Comb. Zn 1st Cl. Scan. Tail. A-F	7.66	—	0.59	2.74	1.10	26.7	1.5	3.3	11.4	3.4	—	5.32	20.97	8.42	204.6
Comb. Zn Scan. Tail. A-F	76.88	—	0.29	0.57	0.32	9.0	6.1	6.9	33.4	11.5	—	22.37	43.37	24.57	698.0
Comb. Zn 1st Cl. Scan. Tail. F	83.94	—	0.33	0.77	0.39	10.6	7.6	10.2	44.8	14.9	—	27.69	64.34	32.99	892.6

LAKEFIELD RESEARCH

Test No.: 93 (Cont'd)

Project No.: _____

Date: _____

Metallurgical Results: Projected Results of Cycles E and F

PRODUCT	WEIGHT		ASSAYS, % _{g/t}				% DISTRIBUTION				METAL UNITS			
	g	%	Pb	Zn	Au	Ag	Pb	Zn	Au	Ag	Pb	Zn		
1 Pb Cleaner Conc.		5.07	65.4	7.52	6.71	97.7	90.8	6.1	48.2	79.1	331.58	38.13	34.02	4953.4
2 Zn Cleaner Conc.		9.23	0.67	56.6	0.33	44.6	1.7	83.2	4.3	6.6	6.18	522.42	3.05	411.7
3 Zn Litch. Scav. Tail.		7.85	0.69	3.07	1.00	29.1	1.5	3.8	11.1	3.7	5.42	24.10	7.85	228.4
4 Zn Scavenger Tail.		77.85	0.28	0.56	0.33	8.55	6.0	6.9	36.4	10.6	21.80	43.60	25.69	665.6
5														
6														
7														
8														
9														
10														
11														
12														
Head (calc.)		100.00	3.65	6.28	0.71	62.6	100.0	100.0	100.0	100.0	364.98	628.25	70.61	6259.1

Calculated Grades and Recoveries

Zn Combined Tailings	85.70		0.32	0.79	0.39	10.4		7.5	10.7	47.5	14.3			33.54	894.0

LAKEFIELD RESEARCH

Test No.: 94 Project No.: 3733 Date: 1 Sept. 89 Operator: CP

Purpose: To repeat test No. 92, but substitute PKD complex for the thiosurea complex

Procedure: As per test No. 76

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the Lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Ca(OH) ₂	PKD Complex	A312 FHSB	MIBC			GRIND	COND.	FROTH	
Primary Grind	750	200	8				40			
Pb Rougher			40	15				1	2	10.1
				5				1	3	
			20	5				1	3	
			10	5				1	2	
Pb Conc. Re-grind		100	20				40			
Pb 1st Cleaner				15				1	3	9.0
			5	2.5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		30						1	3	8.9
			5	2.5				1	2	
Pb 3rd Cleaner		30						1	2	
			2.5	2.5				1	2	
Pb 4th Cleaner		30		2.5				1	3	8.8

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 94

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Conc.	58.2	2.90	67.3	5.14			72.8	2.9			195.17	14.91		
2	Pb 4th Cl. Tail.	13.6	0.68	33.7	12.5			8.5	1.7			22.92	8.50		
3	Pb 3rd Cl. Tail.	16.1	0.80	12.0	12.9			3.6	2.1			9.60	10.32		
4	Pb 2nd Cl. Tail.	52.9	2.64	3.03	9.95			3.0	5.2			8.00	26.27		
5	Pb 1st Cl. Scav. Conc.	39.2	1.95	0.99	8.71			0.7	3.3			1.93	16.98		
6	Pb 1st Cl. Scav. Tail.	253.8	12.66	0.49	7.67			2.3	19.2			6.20	97.10		
7	Pb Rougher Tail.	1571.7	78.37	0.31	4.23			9.1	65.6			24.29	331.51		
8															
9															
10															
11															
12															
	Head (calc.)	2005.5	100.00	2.68	5.06			100.0	100.0			268.11	505.59		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	3.58	60.9	6.54	81.3	4.6	218.09	23.41
Pb 2nd Cl. Conc. (1-3)	4.38	52.0	7.70	84.9	6.7	227.69	33.73
Pb 1st Cl. Conc. (1-4)	7.02	33.6	8.55	87.9	11.9	235.69	60.00
Pb 1st Cl. + Scav. Concs (1-5)	8.97	26.5	8.58	88.6	15.2	237.62	76.98
Pb Rougher Conc. (1-6)	21.63	11.3	8.05	90.9	34.4	243.87	174.08

LAKEFIELD RESEARCH

Test No.: 95 Project No.: 3775 Date: 5 Sept. 89 Operator: CF

Purpose: To investigate the effect of new leaching thiosulphate complex with NaCN.

Procedure: As for test No. 76.

Feed: 2000 grams minus 10 mesh Composite B-1.

Grind: 40 minutes at 65% solids in the Lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	NaCN	A317 3418A	MIBC			GRIND	COND.	FROTH	pH
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.2
				5				1	3	
			20	5				1	3	
			10	5				1	3	
Pb Conc. Re-grind		50	20				40			
Pb 1st Cleaner				15				1	3	8.9
				5	5			1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		15						1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		15						1	2	9.0
				2.5	2.5			1	2	
Pb 4th Cleaner		15			2.5			1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 95

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS				
		g	%		Pb	Zn				Pb	Zn					
1	Pb 4th Cl. Conc.	81.7	4.07		56.0	7.71			85.2	6.3			227.92	31.38		
2	Pb 4th Cl. Tail.	7.8	0.39		9.06	12.8			1.3	1.0			3.53	4.99		
3	Pb 3rd Cl. Tail.	10.8	0.54		4.38	9.28			0.9	1.0			2.37	5.01		
4	Pb 2nd Cl. Tail.	51.9	2.58		1.83	9.87			1.8	5.1			4.72	25.46		
5	Pb 1st Cl. Seav. Conc.	32.6	1.62		1.11	8.70			0.7	2.8			1.80	14.09		
6	Pb 1st Cl. Seav. Tail.	282.3	14.06		0.45	7.84			2.3	22.1			6.33	110.23		
7	Pb Rougher Tail.	1541.0	76.74		0.27	4.01			7.8	61.7			20.72	307.73		
8																
9																
10																
11																
12																
	Head (calc.)	2008.1	100.00		2.67	4.99			100.0	100.0			267.39	498.89		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	4.46		51.9	8.15				86.5	7.3			231.45	36.37		
Pb 2nd Cl. Conc. (1-3)	5.00		46.8	8.28				87.4	8.3			233.82	41.38		
Pb 1st Cl. Conc. (1-4)	7.58		31.5	8.82				89.2	13.4			238.54	66.84		
Pb 1st Cl. + Seav. Concs (1-5)	9.20		26.1	8.80				89.9	16.2			240.34	80.93		
Pb Rougher Conc. (1-6)	23.26		10.6	8.22				92.2	38.3			246.67	191.16		
Comb. Pb Tailings (6+7)	90.80		0.30	4.60				10.1	83.8			27.05	117.96		

LAKEFIELD RESEARCH

Test No.: 96 Project No.: 3733 Date: 5 Sept. 87 Operator: CF
 Purpose: To repeat test No. 95, but double the NaCN addition to the lead cleaner.

Procedure: As for test No. 76

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Ca(OH) ₂	NaCN	A317 3H6A	MIBC			GRIND	COND.	FROTH	
Primary Grind	750	150	8				40			
Pb Rougher			40	15				1	2	10.2
				5				1	3	
			20	5				1	3	
			10	5				1	3	
Pb Conc. Re-grind		100	20				40			
Pb 1st Cleaner				15				1	3	9.0
				5	5			1	3	
Pb 1st Cl. Scav.				5	2.5			1	2	
Pb 2nd Cleaner		30						1	3	
				5	2.5			1	2	
Pb 3rd Cleaner		30						1	2	9.1
				2.5	2.5			1	2	
Pb 4th Cleaner		30			2.5			1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 96

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn						
1	Pb 4th Cl. Cone.	85.7	4.27	54.5	8.79			85.0	7.4			232.72	37.53		
2	Pb 4th Cl. Tail.	9.3	0.46	6.76	12.3			1.1	1.1			3.11	5.66		
3	Pb 3rd Cl. Tail.	14.6	0.73	2.95	6.53			0.8	0.9			2.15	4.77		
4	Pb 2nd Cl. Tail.	50.6	2.52	1.12	7.95			1.0	3.9			2.82	20.03		
5	Pb 1st Cl. Seav. Cone.	46.1	2.29	0.96	8.39			0.8	3.8			2.20	19.21		
6	Pb 1st Cl. Seav. Tail.	278.2	13.85	0.48	7.19			2.4	19.6			6.65	99.58		
7	Pb Rougher Tail.	1524.7	75.88	0.32	4.24			8.9	63.3			27.28	321.73		
8															
9															
10															
11															
12															
	Head (calc.)	2008.9	100.00	2.74	5.09			100.0	100.0			273.93	508.51		

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	4.73		49.9	9.13			86.1	8.5			235.83	43.19		
Pb 2nd Cl. Cone. (1-3)	5.46		43.6	8.78			86.9	9.4			237.98	47.96		
Pb 1st Cl. Cone. (1-4)	7.98		30.2	8.52			87.9	13.3			240.80	67.99		
Pb 1st Cl. + Seav. Cones (1-5)	10.27		23.7	8.49			88.7	17.1			243.00	87.20		
Pb Rougher Cone. (1-6)	24.12		10.4	7.74			91.1	36.7			249.65	186.78		

LAKEFIELD RESEARCH

Test No.: 97 Project No.: 3733 Date: 6 Sept. 89 Operator: CP

Purpose: To repeat test No. 94, but slightly reduce PKD Complex addition and float in a different D-1 cell.

Procedure: As for test No. 76

Feed: 2000 grams minus 10 mesh Composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			pH
	Ca(OH) ₂	PKD Complex	A317 348A	MIBC		GRIND	COND.	FROTH	
Primary Grind	750	180	8			40			
Pb Rougher			40	15			1	2	10.5
				5			1	3	
			20	5			1	3	
			10	5			1	3	
Pb Conc. Re-grind		100	20			40			
Pb 1st Cleaner				15			1	3	9.0
				5			1	3	
Pb 1st Cl. Scav.				5	2.5		1	2	
Pb 2nd Cleaner		15					1	3	
				5	2.5		1	2	
Pb 3rd Cleaner		15					1	2	9.0
				2.5	2.5		1	2	
Pb 4th Cleaner		15			2.5		1	3	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 97

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS				
		g	%		Pb	Zn				Pb	Zn					
1	Pb 4th Cl. Cone.	80.6	4.02		54.4	7.58				82.1	6.2				218.69	30.47
2	Pb 4th Cl. Tail.	24.5	1.22		12.4	13.1				5.6	3.3				15.13	15.98
3	Pb 3rd Cl. Tail.	40.4	2.02		2.59	11.8				2.0	4.9				5.23	23.84
4	Pb 2nd Cl. Tail.	123.2	6.15		0.87	11.9				2.0	14.9				5.35	73.19
5	Pb 1st Cl. Seav. Cone.	50.5	2.52		0.59	11.0				0.6	5.7				1.49	27.72
6	Pb 1st Cl. Seav. Tail.	343.1	17.13		0.26	12.2				1.7	42.6				4.45	208.99
7	Pb Rougher Tail.	1340.8	66.94		0.24	1.64				6.0	22.4				16.06	109.78
8																
9																
10																
11																
12																
	Head (calc.)	2003.1	100.00		2.66	4.90				100.0	100.0				266.40	489.97

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	5.24		44.6	8.86				87.7	9.5				233.82	46.45
Pb 2nd Cl. Cone. (1-3)	7.26		32.9	9.68				89.7	14.4				239.05	70.29
Pb 1st Cl. Cone. (1-4)	13.41		18.2	10.7				91.7	29.3				244.40	143.18
Pb 1st Cl. + Seav. Cones (1-5)	15.93		15.4	10.8				92.3	35.0				245.89	171.20
Pb Rougher Cone. (1-6)	33.06		7.57	11.5				94.0	77.6				250.34	380.19

LAKEFIELD RESEARCH

Test No.: 98 Project No.: 3733 Date: 7 Sept. 89 Operator: CP

Purpose: To perform a complete test on composite G-1, including both lead and zinc circuits.

Procedure: Standard procedure.

Feed: 2000 grams minus 10 mesh composite G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions:

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Ca(OH) ₂	PKD Complex	A317 348A	MIBC			GRIND	COND.	FROTH	
Primary Grind	750	180	8				40			
Pb Rougher			40	15				1	2	10.3
				5				1	3	
			20	5				1	3	
			10	5				1	3	
Pb Conc. Re-grind		100	20				40			
Pb 1st Cleaner				15				1	3	8.9
			5	2.5				1	3	
Pb 1st Cl. Scav.			5	2.5				1	2	
Pb 2nd Cleaner		15						1	3	9.0
			5	2.5				1	2	
Pb 3rd Cleaner		15						1	2	
			2.5	2.5				1	2	
Pb 4th Cleaner		15		2.5				1	3	9.0
<u>Combine Pb rougher and 1st cleaner tailings for zinc flotation.</u>										

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 98 (Cont'd) Project No.: _____ Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: _____

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	CaCl_2	CaSO_4	A343	DF1012			GRIND	COND.	FROTH	
Condition	2000							5		
		600						5		11.5
Zn Rougher			20	10				1	3	
			10	5				1	3	
Zn Conc. Re-grind	1000	100					30			
High Int. Cond.			15	10				15		
Zn 1st Cleaner									5	11.4
Zn 1st Cl. Scav.			5	2.5				1	2	
Zn 2nd Cleaner	500							1	4	11.9
Zn 3rd Cleaner	500							1	3½	
Zn 4th Cleaner	500							1	3	12.1

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				

LAKEFIELD RESEARCH

Test No.: 98

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn	Zn Circ.					
1	Pb 4th Cl. Conc.	64.7	3.22	65.6	5.73			78.6	3.7	—			211.23	18.45	
2	Pb 4th Cl. Tail.	15.5	0.77	21.4	14.6			6.1	2.2	—			16.48	11.24	
3	Pb 3rd Cl. Tail.	19.4	0.96	8.28	13.0			3.0	2.5	—			7.95	12.48	
4	Pb 2nd Cl. Tail.	50.0	2.49	1.95	9.15			1.8	4.5	—			4.86	22.78	
5	Pb 1st Cl. Scav. Conc.	36.8	1.83	1.07	8.65			0.7	3.2	—			1.96	15.83	
6	Zn 4th Cl. Conc.	126.3	6.28	0.53	56.4			1.2	70.6	84.2			3.33	354.19	
7	Zn 4th Cl. Tail.	6.4	0.32	1.20	24.1			0.1	1.5	1.8			0.38	7.71	
8	Zn 3rd Cl. Tail.	9.7	0.48	1.00	11.5			0.2	1.1	1.3			0.48	5.52	
9	Zn 2nd Cl. Tail.	21.2	1.05	0.59	3.25			0.2	0.7	0.8			0.62	3.41	
10	Zn 1st Cl. Scav. Conc.	21.3	1.06	0.67	3.28			0.3	0.7	0.8			0.71	3.48	
11	Zn 1st Cl. Scav. Tail.	205.2	10.20	0.30	0.87			1.1	1.8	2.1			3.06	8.87	
12	Zn Rougher Tail.	1434.5	71.34	0.25	0.53			6.7	7.5	9.0			17.83	37.81	
	Head (calc.)	2011.0	100.00	2.69	5.02			100.0	100.0	100.0			268.89	501.77	

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	3.99	57.1	7.44			84.7	5.9	—			227.71	29.69
Pb 2nd Cl. Conc. (1-3)	4.95	47.6	8.52			87.7	8.4	—			235.66	42.17
Pb 1st Cl. + Scav. Conc. (1-5)	9.27	26.2	8.71			90.2	16.1	—			242.48	80.78
Zn 3rd Cl. Conc. (6+7)	6.60	0.56	54.8			1.3	72.1	86.0			3.71	361.90
Zn 2nd Cl. Conc. (6-8)	7.08	0.59	51.9			1.5	73.2	87.3			4.19	367.42
Zn 1st Cl. + Scav. Conc. (6-10)	9.19	0.60	40.7			2.0	74.6	88.9			5.52	374.31
Zn Rougher Conc. (6-11)	19.39	0.44	19.8			3.1	76.4	91.0			8.58	383.18
Zn Flot. Feed (6-12)	90.73	0.29	4.64			9.8	83.9	100.0			26.41	420.99

LAKEFIELD RESEARCH

Test No.: 99 Project No.: 3733 Date: 8 Sept. 89 Operator: CP

Purpose: To report test No. 98, but replace the PKD complex with Thiourea complex in the lead circuit.

Procedure: Standard

Feed: 2000 grams minus 10 mesh G-1.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions:

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Ca(OH) ₂	Thiourea Complex	A317 349A	MIBC		GRIND	COND.	FROTH	pH
Primary Grind	750	150	8			40			
Pb Rougher			40	15			1	2	10.2
				5				3	
			20	5				3	
			10	5				3	
Pb Conc. Re-grind		100	20			40			
Pb 1st Cleaner				15			1	3	8.8
			5	2.5				3	
Pb 1st Cl. Scav.			5	2.5			1	2	
Pb 2nd Cleaner		30					1	3	9.0
			5	2.5				2	
Pb 3rd Cleaner		30					1	2	
			2.5	2.5				2	
Pb 4th Cleaner		30		2.5			1	3	9.0
Combine Pb rougher and 1st cleaner tailings for zinc flotation									

Stage					
Flotation Cell					
Speed: r.p.m.					
% Solids					
% — mesh					

LAKEFIELD RESEARCH

Test No.: 99 (Contd) Project No.: _____ Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: _____

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH)_2	CaSO_4	A3A3	DF1012			GRIND	COND.	FROTH	pH
Condition	2000							5		
		600						5		11.7
Zn Rougher			20	10				1	3	
			10	5				1	3	
Zn Conc. Re-grind	1000	100					30			
High Int. Cond.			15	10				15		
Zn 1st Cleaner									5	11.5
Zn 1st Cl. Scav.			5	2.5				1	2	
Zn 2nd Cleaner	500							1	4	
Zn 3rd Cleaner	500							1	3½	12.0
Zn 4th Cleaner	500							1	3	12.1

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				

LAKEFIELD RESEARCH

Test No.: 99

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION				METAL UNITS			
		g	%	Pb	Zn			Pb	Zn	Zn Circuit					
1	Pb 4th Cl. Conc.	84.9	4.24	55.9	7.27			87.0	6.2	—		237.02	30.82		
2	Pb 4th Cl. Tail.	16.0	0.80	6.10	12.5			1.8	2.0	—		4.88	10.00		
3	Pb 3rd Cl. Tail.	16.7	0.84	2.59	8.73			0.8	1.5	—		2.18	7.33		
4	Pb 2nd Cl. Tail.	59.1	2.95	1.08	8.32			1.2	4.9	—		3.19	24.54		
5	Pb 1st Cl. Scav. Conc.	19.4	0.97	0.86	7.59			0.3	1.5	—		0.83	7.36		
6	Zn 4th Cl. Conc.	116.8	5.83	0.45	55.7			1.0	65.2	77.7		2.62	324.73		
7	Zn 4th Cl. Tail.	10.3	0.51	0.72	32.1			0.1	3.3	3.9		0.37	16.37		
8	Zn 3rd Cl. Tail.	13.3	0.67	0.70	17.4			0.2	2.3	2.8		0.47	11.66		
9	Zn 2nd Cl. Tail.	25.1	1.25	0.55	5.75			0.2	1.5	1.7		0.69	7.19		
10	Zn 1st Cl. Scav. Conc.	25.7	1.28	0.57	4.61			0.3	1.2	1.4		0.73	5.90		
11	Zn 1st Cl. Scav. Tail.	231.6	11.56	0.32	1.14			1.3	2.6	3.2		3.70	13.18		
12	Zn Rougher Tail.	1384.0	69.10	0.23	0.56			5.8	7.8	9.3		15.89	38.70		
	Head (calc.)	2002.9	100.00	2.73	4.98			100.0	100.0	100.0		272.57	497.78		

Calculated Grades and Recoveries

Pb 3rd Cl. Conc. (1+2)	5.04	48.0	8.10			88.8	8.2	—		241.90	40.82		
Pb 2nd Cl. Conc. (1-3)	5.88	41.5	8.19			89.6	9.7	—		247.08	48.15		
Pb 1st Cl. + Scav. Concs (1-5)	9.80	25.3	8.17			91.1	16.1	—		248.10	80.05		
Zn 3rd Cl. Conc. (6+7)	6.34	0.47	53.8			1.1	68.5	81.6		2.99	341.10		
Zn 2nd Cl. Conc. (6-8)	7.01	0.49	50.3			1.3	70.8	84.4		3.46	352.76		
Zn 1st Cl. + Scav. Concs (6-10)	9.54	0.51	38.3			1.8	73.5	87.5		4.88	365.85		
Zn Rougher Conc (6-11)	21.10	0.41	18.0			3.1	76.1	90.7		8.58	379.03		
Zn Flot. Feed (6-12)	90.20	0.27	4.63			8.9	83.9	100.0		24.47	417.73		

LAKEFIELD RESEARCH

Test No.: 107 Project No.: 3733 Date: 20 Sept. 89 Operator: CP & TJ

Purpose: To perform a six-stage locked cycle test on Composite G-1 following the procedure of test No. 93.

Procedure: As for test No. 93

Feed: Six 2000 gram charges of minus 10 mesh Composite G-1.

Grind: 40 minutes per charge at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	PKD Complex	A317 3418A	MIBC			GRIND	COND.	FROTH	pH
Primary Grind	750	180	8				40			
Pb Rougher			40	15				1	2	
				5				1	3	
			20	5				1	3	
			5	5				1	3	
Pb Conc. Re-grind		100	20				40			
Pb 1st Cleaner				10				1	3	
			5					1	3	
Pb 1st Cl. Scav.			5					1	2	
Pb 2nd Cleaner		15						1	2	
			5					1	2	
Pb 3rd Cleaner		15						1	2	
			2.5					1	1	
Pb 4th Cleaner		10						1	2	
		1.2								

150

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 107 (Cont'd) Project No.: _____ Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: _____

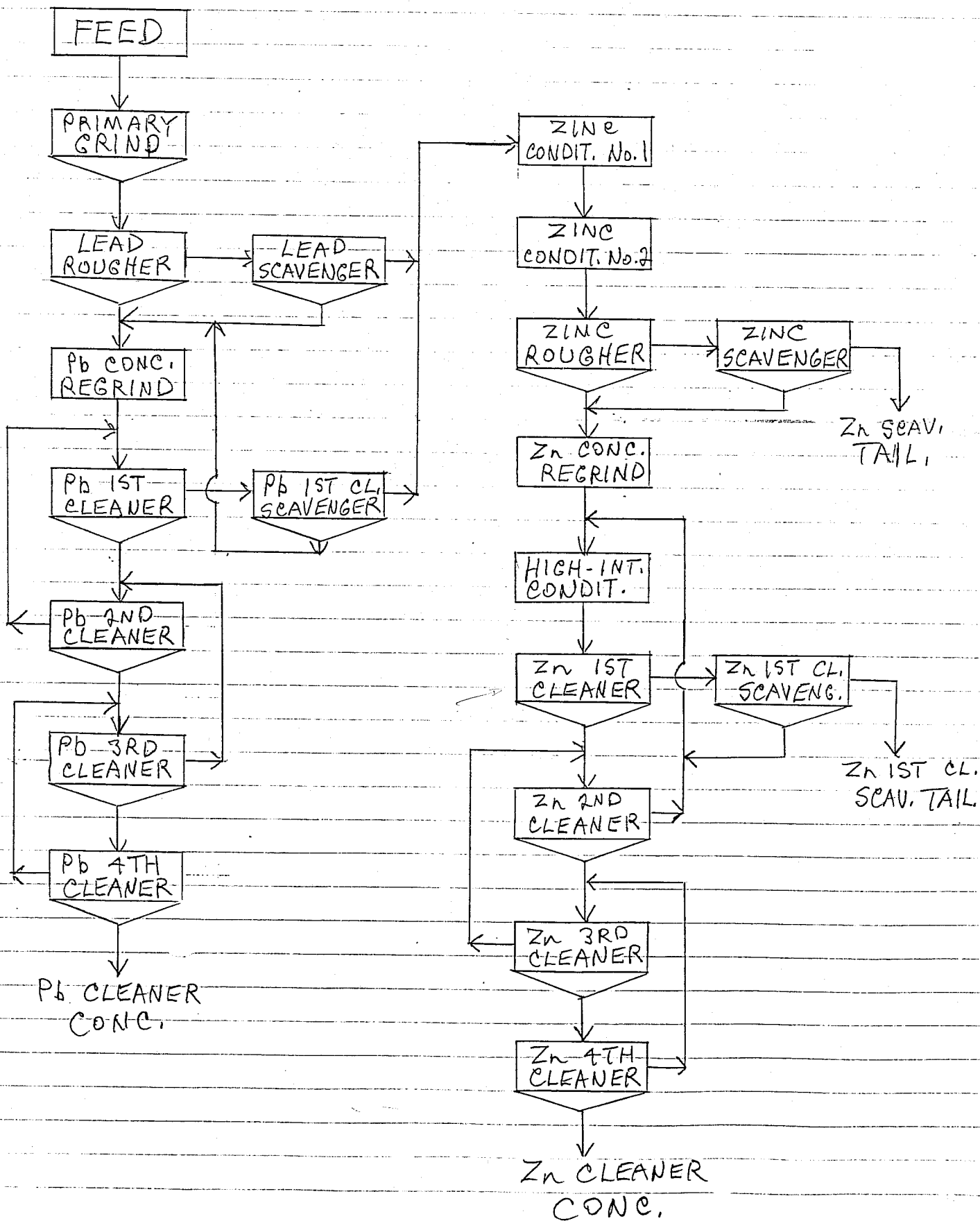
Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			
	Ca(OH) ₂	CuSO ₄	A343	DF1012			GRIND	COND.	FROTH	pH
Condition	2000							5		
		600						5		
Zn Rougher			30	10				1	3	11.
Zn Scavenger			10	5				1	3	
Zn Conc. Re-grind	1000	100					30			
High-Int. Cond.			20	5				15		
Zn 1st Cleaner									5	
Zn 1st Cl. Scav.			10	2.5				1	3	
Zn 2nd Cleaner	500							1	4	
Zn 3rd Cleaner	500							1	3	
Zn 4th Cleaner	500							1	2½	

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

3733 - Test ¹⁰⁷ ~~98~~ - FLOWSHEET



LAKEFIELD RESEARCH

Test No.: 135 Project No.: 3733 Date: 17 Nov. 89 Operator: CP

Purpose: To repeat test No. 133, but slightly increase collector addition to the lead rougher, increase PKD to Pb cleaners and add a zinc circuit.

Procedure: As for test No. 132, then combine Pb rougher and 1st cleaner scavenger tailings, condition and float a zinc rougher concentrate. Regrind the concentrate and clean four times.

Feed: 2000 grams minus 10 mesh Composite G-3.

Grind: 40 minutes at 65% solids in the lab. ball mill.

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE					TIME, MINUTES			
	Na_2CO_3	PKD Complex	A317 3A8A	MIBC		GRIND	COND.	FROTH	pH
Primary Grind	1500	150	8			40			
Pb Rougher			40	10			1	5	9.3
			15	5			1	3	
			10	5			1	3	
Pb Conc. Regrind	250	75	20			30			
Pb 1st Cleaner			5	2.5			1	3	9.2
Pb 1st Cl. Scav.			5	2.5			1	2	
Pb 2nd Cleaner		20	5	2.5			1	3	9.1
Pb 3rd Cleaner		10	5	2.5			1	2	
Pb 4th Cleaner		10	2.5	2.5			1	2	
			10	2.5			1	3	9.0
Combine lead rougher and 1st cleaner scav. tailings for zinc flotation									

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% - mesh				

LAKEFIELD RESEARCH

Test No.: 135 (Contd) Project No.: _____ Date: _____ Operator: _____

Purpose: _____

Procedure: _____

Feed: _____

Grind: _____

Conditions: _____

	REAGENTS ADDED, GRAMS PER TONNE						TIME, MINUTES			pH
	Ca(OH) ₂	CuSO ₄	A343	DF 1012			GRIND	COND.	FROTH	
Condition	2000							5		
Zn Rougher		800	30					5		11.4
			10					1	3	
			10					1	2	
Zn Conc. Re-grind	1000	100					30			
High-Int Cond.			20	5				15		
Zn 1st Cleaner									5	11.5
Zn 1st Cl. Scav.			10	2.5				1	3	
Zn 2nd Cleaner	500							1	4	11.9
Zn 3rd Cleaner	500							1	3 1/2	12.0
Zn 4th Cleaner	500							1	3	12.0

Stage				
Flotation Cell				
Speed: r.p.m.				
% Solids				
% — mesh				

LAKEFIELD RESEARCH

Test No.: 135

Project No.: _____

Date: _____

Metallurgical Results

	PRODUCT	WEIGHT		ASSAYS, %				% DISTRIBUTION			METAL UNITS			
		g	%	Pb	Zn			Pb	Zn	Zn Circuit				
1	Pb 4th Cl. Cone.	99.2	4.97	54.0	7.25			66.0	5.1	-		268.38	36.03	
2	Pb 4th Cl. Tail.	32.6	1.63	22.2	12.8			8.9	2.9	-		36.19	20.86	
3	Pb 3rd Cl. Tail.	34.4	1.72	12.9	12.9			5.5	3.1	-		22.19	22.19	
4	Pb 2nd Cl. Tail.	93.3	4.67	5.50	10.6			6.3	6.9	-		25.69	49.50	
5	Pb 1st Cl. Seav. Cone.	30.6	1.53	2.39	9.89			0.9	2.1	-		3.66	15.13	
6	Zn 4th Cl. Cone.	113.2	5.67	0.71	57.9			1.0	46.1	57.8		4.03	328.29	
7	Zn 4th Cl. Tail.	10.5	0.53	1.45	42.2			0.2	3.2	3.9		0.77	22.37	
8	Zn 3rd Cl. Tail.	18.2	0.91	1.41	38.1			0.3	4.9	6.1		1.28	34.67	
9	Zn 2nd Cl. Tail.	29.9	1.50	1.60	21.8			0.6	4.6	5.8		2.40	32.70	
10	Zn 1st Cl. Seav. Cone.	24.6	1.23	1.68	27.1			0.5	4.7	5.9		2.07	33.33	
11	Zn 1st Cl. Seav. Tail.	141.4	7.08	1.13	4.13			2.0	4.1	5.1		8.00	29.24	
12	Zn Rougher Tail.	1368.4	68.56	0.47	1.28			7.8	12.3	15.4		32.22	87.76	
	Head (calc.)	1996.3	100.00	4.07	7.12			100.0	100.0	100.0		406.88	712.07	

Calculated Grades and Recoveries

Pb 3rd Cl. Cone. (1+2)	6.60	46.1	8.62			74.9	8.0	-		304.57	56.89	
Pb 2nd Cl. Cone. (1-3)	8.32	39.3	9.50			80.4	11.1	-		326.76	79.08	
Pb 1st Cl. + Seav. Cones (1-5)	14.52	24.5	9.90			87.6	20.1	-		356.11	143.71	
Zn 3rd Cl. Cone. (6+7)	6.20	0.77	56.6			1.2	49.3	61.7		4.80	350.66	
Zn 2nd Cl. Cone. (6-8)	7.11	0.86	54.2			1.5	54.2	67.8		6.08	385.33	
Zn 1st Cl. + Seav. Cones (6-10)	9.84	1.07	45.9			2.6	63.5	79.5		10.55	451.36	
Zn Rougher Cone. (6-11)	16.92	1.10	28.4			4.6	67.6	84.6		18.55	480.60	
Zn Flot. Feed (6-12)	85.48	0.59	6.65			12.4	79.9	100.0		50.77	568.36	