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MOGUL OF IRELAND LIMITED

INTER-OFFICE MEMORANDUM

FROM ALAN NORTON TO W.J. HOBBA

DATE 31st May, 1977 COPY TO BRUCE WOODLAND

SUBJECT GRUM TESTWORK - REPORT NO. 2 COPY TO P.S.C.

FILE No. COPY TO

1. INTRODUCTION

In an effort to improve results, particularly lead recovery and grade, a further set of tests were performed, involving variation in grinding time, regrinding and grade/recovery curves.

2. TESTWORK

2.1. Tests 3A - 3E (Appendix 1 - 5)

The purpose of this set of tests was to determine the effect of grinding time and regrinding on lead and zinc recovery and grade.

It was found that lead recovery decreased with an increase in grind time, but the grade improved. Regrinding a rougher concentrate improved cleaner recovery but worsened grade. It was thought the regrinding technique (pestle and mortar) may, however, have influenced the results. There was little change in zinc recovery with increased grinding time but grade did improve.

The effect of regrinding a zinc rougher concentrate was indeterminate. Production of an extra lead scavenger concentrate improved recovery whilst maintaining grade. Production of an extra zinc scavenger concentrate improved recovery at the expense of grade.

The most likely cause of reducing lead recovery with grind time was thought to be increased slimes losses. Grade improvements were no doubt due to liberation of galena from pyrite as reflected in the dramatic decrease in iron recovery with increased grind time. It was interesting to note that in 3C and 3D tests only 1.8% of the iron was distributed in the lead concentrates (equal to a 98.2% rejection), but this amount of iron was still sufficient to bring down the lead grade considerably.

As zinc recovery was much the same for all the grinds, the zinc must have been liberated at fairly coarse sizes, the increased grind giving liberation from pyrite and grade improvements, but not changing recovery.

The effect of regrinding both lead and zinc rougher concentrates was somewhat vague and this was almost certainly attributable to the technique of regrinding. The technique used was known to give a slimey product.

2.2. Tests 4A - 4F (Appendix 6 - 11)

From the previous test series, it was obvious that changes in primary grind time were not the key to improved recovery.

Tests 4A - 4D were to establish grade/recovery curves with varying conditions (pH modifier and cyanide dosage). Graph 1 indicates that at recoveries around 50%, lime with a cyanide dosage of 0.3 lb/ton gives much better grades than soda ash with 0.1 lb/ton of cyanide. As recovery increased above 50% the curves tended towards the same point. The top curve, however, seemed to fall more rapidly than the bottom curve, indicating that grade would fall less sharply with recovery with the soda ash with 0.1 lb/ton cyanide condition than with any other.

An attempt to duplicate the top and bottom curves, but at extended recovery, was made in Tests 4E and 4F.

The results of these two tests show that up to 66% Pb recovery lime gave better grades than soda ash but beyond 66% recovery soda ash gave better grades. This can be deduced from Graph 2.

Also soda ash had a more favourable weight of concentrate/recovery relationship indicating a more selective float, and much better zinc rejection. This was the case for recoveries in excess of 80%.

3. CONCLUSIONS

3.1. Changes in primary grind will not produce increased lead or zinc recoveries.

3.2. The effect of regrinding was not clear because of the technique used.

3.3. The advantages of soda ash with 0.1 lb/ton of cyanide over the lime system with higher cyanide have been shown on the grade/recovery relationship.

4. CONTINUATION OF TESTWORK

4.1. It is proposed to cut off lead rougher recovery at 70% and to perform a grade/recovery excercise on the lead 1st cleaner stage.

4.2. With regard to regrinding, it is proposed that after lead roughing a scavenger concentrate will be removed (bringing rougher/scavenger recovery to 85%) and reground along with the lead 1st cleaner tail in the laboratory mill.

Cyanide dosage in lead will be 0.1 lb/ton, with soda ash as the pH modifier.

4.3. Grade/recovery curves for zinc would be useful and will be performed using both lime and soda ash as pH modifiers.

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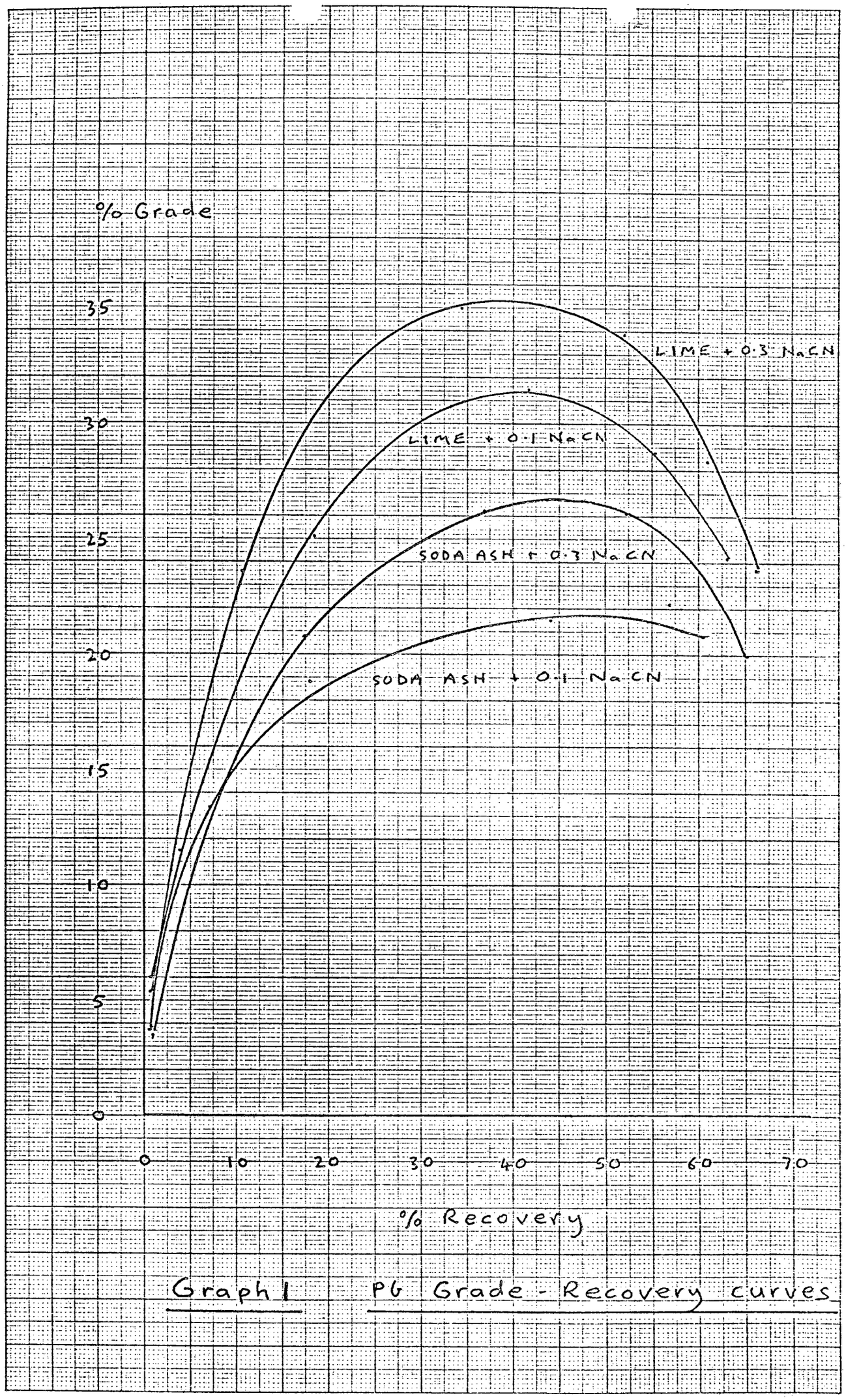
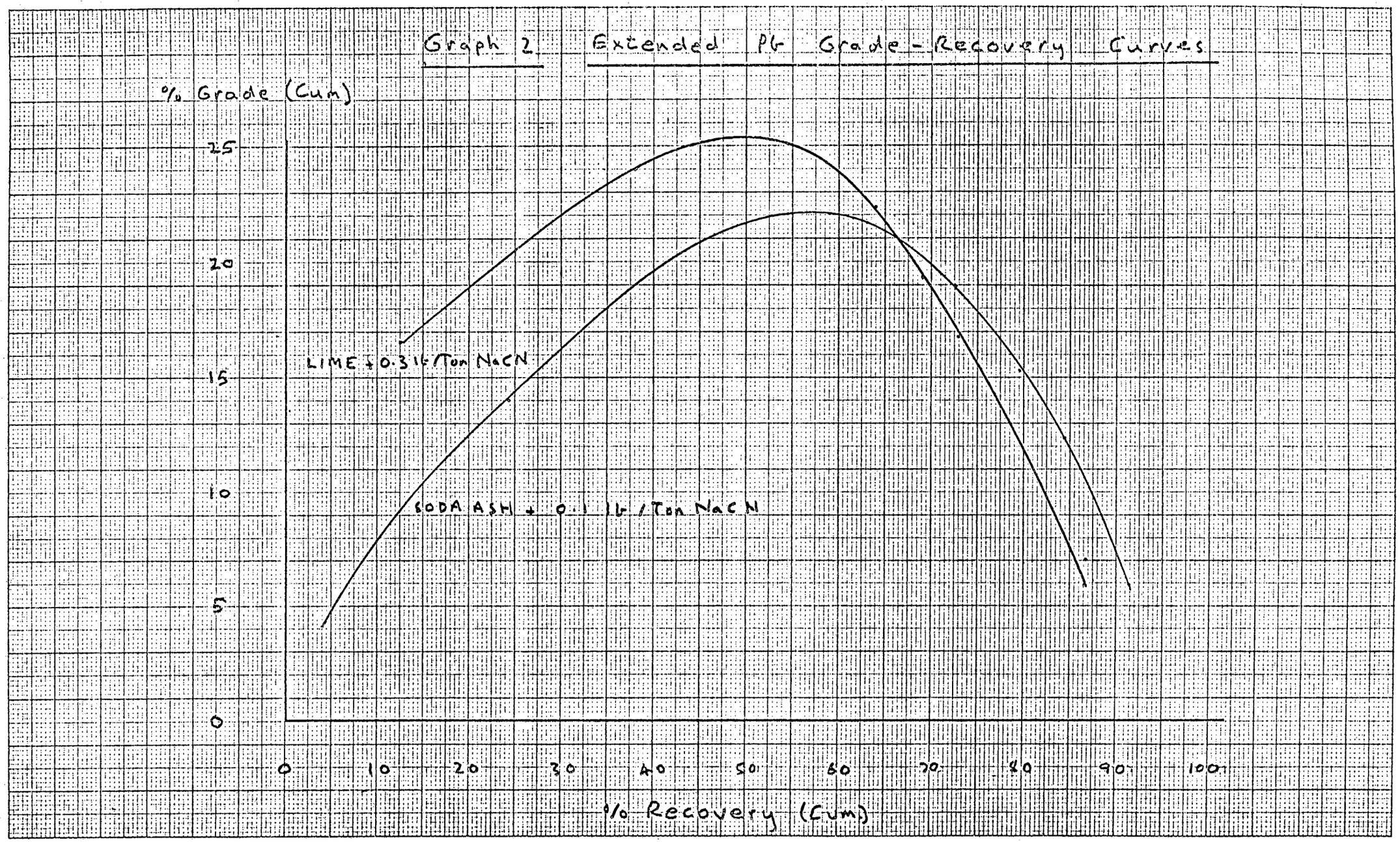
AN/mp



Graph 1 Pb Grade - Recovery curves

Graph 2 Extended Pb Grade - Recovery Curves



Appendix 1

TEST : GRUM - EFFECT OF GRINDING TIME

TEST No. : G/3A

DATE : 5/5/77

TEST FEED : 1 Kg - 4# GRUM ORE

FEED TREATMENT : 45 min. GRIND

STAGE	NaCN ml	NaCN lb/Ton	SIPX ml	SIPX lb/Ton	PAX ml	PAX lb/Ton	Z200 ml	Z200 lb/Ton	$CuSO_4$ ml	$CuSO_4$ lb/Ton	LIME → pH:	MIBC (DROPS)	TIME (MIN.)		REMARKS
CONDITION	3·0	0·3			1·5	0·06					9·5		9		
FLOAT												7	2	COMBINE	Pb Roughe
FLOAT					0·5	0·02							1		Pb Scaven
CONDITION			0·5	0·02							10·0				
FLOAT												4	TO COMPLETION		
CONDITION			0·2	0·008							10·0				
FLOAT												3	TO COMPLETION		
CONDITION							2·0	0·08	12·0	1·2	10·0		9		
FLOAT													2	COMBINE	Zn Rough
FLOAT							1·0	0·04	3·0	0·3			2		Zn Scaver
CONDITION							1·0	0·04	1·0	0·1	11·0		1		
FLOAT												2			
CONDITION							0·5	0·02			11·5		1		
FLOAT												2			

PRODUCT	WEIGHT g.	WEIGHT %	ASSAY % Pb	ASSAY % Zn	ASSAY % Fe	CONTENT % Pb	CONTENT % Zn	CONTENT % Fe	DISTRIBUTION % Pb	DISTRIBUTION % Zn	DISTRIBUTION % Fe	RE-ASSAY
Pb Conc	171·0	17·33	12·4	3·22	32·5				67·8	9·2	31·6	
Pb 1st Cl. Tail	144·0	14·59	1·90	5·93	38·5				8·7	14·3	27·3	
" 2nd " "	29·0	2·94	4·69	5·69	37·7				4·3	2·8	5·4	
Zn Conc	106·9	10·83	0·82	27·0	24·3				2·8	68·3	12·8	
Zn 1st Cl Tail	60·7	6·15	2·25	8·73	21·0				4·4	8·9	6·3	
" 2nd " "	19·8	2·02	1·55	12·1	26·1				1·1	4·0	2·6	
Zn Scav Tail	455·3	46·14	0·75	1·64	6·3				10·9	12·5	14·0	
Calc. Head	?...	800·04	3·17	6·05	20·6				100·0	100·0	100·0	

Pb Rec/Sc 80.9 @ 7.36

Zn Rec/Sc 83.0* @ 19.5

* All Zn Recoveries based on Pb Roughers Tail.

Appendix 2

TEST : GRUM

TEST No. : G/3B

DATE : 5/5/77

TEST FEED : 1Kg - 4# GRUM ORE

FEED TREATMENT : 55 min GRIND

STAGE											REMARKS
		As G/3A		Except :-		3 Pb Cleans					
						No Zn Cleans					

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Conc	38·3	3·81	42·8	5·10	18·8				50·6	3·3	3·6	
Pb 1st Cl Tail	96·6	9·62	6·25	5·60	36·5				12·7	9·2	17·6	
" 2nd " "	12·4	1·23	18·4	5·91	26·7				7·0	1·2	1·6	
" 3rd " "	11·2	1·12	19·3	5·16	28·9				6·7	1·0	1·6	
Zn Ro/Sc. Conc	250·8	24·99	1·36	16·6	32·1				10·5	70·7	40·2	
Zn Scav Tail	596·8	59·23	0·68	1·45	11·9				12·5	14·6	35·6	
Calc. Head	1004·2	100·00	3·22	5·87	20·0				100·0	100·0	100·0	

Pb Ro/Sc 77·0 @ 15·7

Zn Ro/Sc 82·9 @ 16·6

Appendix 3

TEST : GRUM

TEST No. : G/3C

DATE : 5/5/77

TEST FEED : 1 Kg – 4# GRUM ORE

TEST TREATMENT : 65 min GRIND

STAGE											REMARKS
		As G/3A		Except :-		Zn Ro/St Conc		→ 100%	– 50 mm		

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Conc	25·4	2·53	56·0	6·53	13·2				42·4	1·9	1·8	
Pb 1st Cl. Tail	62·8	6·26	4·37	5·94	30·5				16·2	6·2	9·9	
" 2nd " "	16·2	1·62	18·9	6·39	26·2				8·3	1·5	1·9	
Zn Conc	86·0	8·56	0·89	40·3	18·0				2·3	56·7	7·8	
Zn 1st Cl. Tail	70·2	7·00	2·40	9·98	32·2				5·2	11·8	11·8	
" 2nd " "	20·5	2·04	1·88	10·5	34·1				1·2	3·6	3·6	
Zn Scav. Tail	726·5	72·39	0·99	1·50	16·8				22·4	18·3	63·2	
Calc. Head	1003·6	100·0	3·22	5·95	19·2				100·0	100·0	100·0	

Pb 69.0 @ 21.7

Zn 80.0 @ 24.6

Appendix 4

TEST : GRUM

TEST No. : G/3D

DATE : 5/6/77

TEST FEED : 1 Kg - 4# GRUM ORE

FEED TREATMENT : 75 min GRIND

STATE										REMARKS
		As G/3A								

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	gm	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Conc	26·0	2·57	52·0	3·75	13·8				43·8	1·6	1·8	
Pb 1st CC Tail	54·1	5·36	9·57	4·30	32·5				16·9	3·9	9·1	
" 2nd " "	8·0	0·79	4·07	5·02	24·7				1·1	0·7	1·0	
Zn Conc	83·2	8·24	1·88	43·6	15·1				5·1	60·5	6·5	
Zn 1st CC Tail	71·7	7·10	3·32	9·05	29·7				7·7	10·8	10·6	
" 2nd " "	17·4	1·72	4·37	16·1	27·4				2·5	4·7	2·4	
Zn Scav Tail	749·8	74·22	0·94	1·43	17·8				22·9	17·8	58·6	
Calc Head	1010·2	100·0	3·05	5·96	19·3				100·0	100·0	100·0	

Pb 61·8 @ 21·6

Zn 81·0 @ 26·5

Appendix 5

TEST : GRUM | TEST No. : G/3E | DATE : 5/6/77

TEST FEED : 1Kg - 4" GRUMORE | FEED TREATMENT : 65 min GRIND

STAGE											REMARKS
		As G/3A Except			: Pb	Extra Scav	0.5ml PAX	1 min			
						Rougher Conc	100% -50Nm				
						3 Cleans					
					: Zn	Extra Scav	0.5ml PAX	1 min			
						3 Cleans					

PRODUCT	WEIGHT		ASSAY			CONTENT			DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Conc	31·8	3·16	48·8	4·53	14·2				50·3	2·6	2·5	
Pb 1st Cl. Tail	42·3	4·21	9·23	7·35	28·8				12·7	5·2	6·0	
2nd	7·6	0·76	13·5	7·42	26·9				3·4	0·9	1·0	
3rd	18·5	1·84	11·9	6·34	32·4				7·1	2·0	2·8	
Zn Conc	109·8	10·92	0·81	35·4	21·2				2·9	66·8	11·6	
Zn 1st Cl. Tail	196·6	19·35	1·23	2·28	38·2				7·8	7·4	36·4	
2nd	54·9	5·46	1·24	3·23	40·1				2·2	3·0	10·7	
3rd	46·7	4·64	1·07	3·31	42·0				1·6	2·6	9·6	
Zn Scav. Tail	499·7	49·55	0·74	1·40	7·90				12·0	11·7	19·6	
Calc Head.	1005·9	100·00	3·07	5·96	20·9				100·0	100·0	100·0	

Pb 73.5 @ 22.6

Zn 87.0 @ 12.5

Appendix 6

TEST : GRUM GRADE - RECOVERY

TEST No : G/4A

DATE : 25/5/77

TEST FEED : 1Kg - 4" GRUM ORE

FEED TREATMENT : STANDARD GRIND

STAGE	NaCN ml	NaCN lb/Ton	PAX ml	PAX lb/Ton	LIME →PH:	TIME (MIN.)	MIBC (DROPS)					REMARKS
CONDITION	3·0	0·3	0·5	0·03	9·5	9						
FLOAT						0·25	7					
FLOAT			0·3	0·018		0·5						
FLOAT			0·2	0·012		0·75						
FLOAT			0·2	0·012		1·0						
FLOAT			0·1	0·006		1·5						
FLOAT			0·1	0·006		2·0						

PRODUCT CUMULATIVE	CUM. WT.		CUM. ASSAY			CONTENT			CUM. DISTRIBUTION			RE-ASSAY
	g.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
PbRo Conc 1		0·37	53·9	5·19	23·0				0·6	0·3	0·6	
- - - 2		1·41	23·6	5·96	19·1				10·4	1·4	1·4	
- - - 3		3·13	35·0	6·33	14·6				34·3	3·3	2·5	
- - - 4		4·91	33·9	7·41	15·2				52·1	6·0	3·9	
- - - 5		6·84	28·4	8·62	17·5				61·0	9·5	6·3	
- - - 6		8·90	23·7	8·97	19·6				66·2	13·2	9·8	

Appendix 7

TEST : GRUM - Pb GRADE - RECOVERY

TEST No. : G/48

DATE : 25/6/77

TEST FEED : 1 Kg - 4# GRUM ORE

FEED TREATMENT : STANDARD GRIND

STAGE										REMARKS
	As G/4A		Except :	0.1	lb/Ton	Na CN				

PRODUCT CUMULATIVE	CUM. WT.		CUM. ASSAY			CONTENT			CUM. DISTRIBUTION			RE-ASSAY
	oz	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro Conc 1		0.39	69.7	5.97	23.1				0.6	0.4	0.5	
" " " 2		0.99	11.5	7.37	20.6				3.7	1.2	1.1	
" " " 3		2.26	25.1	7.61	15.8				18.4	2.8	1.9	
" " " 4		4.08	31.5	8.14	14.0				41.7	5.6	3.1	
" " " 5		5.90	25.8	8.81	15.5				55.3	8.5	5.0	
" " " 6		8.01	24.2	9.29	17.6				63.0	12.2	7.7	

Appendix 8

TEST : GRUM - Pb GRADE - RECOVERY

TEST No. : G/4C

DATE : 26/5/77

TEST FEED : 1Kg - 4# GRUM ORE

FEED TREATMENT : STANDARD GRIND

STAGE										REMARKS
		As G/4A Except : Soda ash as pH modifier								

PRODUCT CUMULATIVE	CUM. WT.		CUM. ASSAY			CONTENT			CUM. DISTRIBUTION			RE-ASSAY
	Gms	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro Conc 1		0·72	3·50	3·65	32·5				0·8	0·4	1·2	
" " " 2		2·52	20·8	6·19	21·9				17·4	2·6	2·8	
" " " 3		4·26	26·2	8·08	15·1				36·9	5·7	3·8	
" " " 4		6·04	26·1	9·82	17·3				52·2	9·9	5·3	
" " " 5		7·75	22·2	9·86	19·1				56·9	12·8	7·5	
" " " 6		9·89	20·0	10·63	19·6				65·5	17·6	9·8	

Appendix 9

TEST : GRUM - GRADE RECOVERY

TEST No. : G/4D

DATE : 25/5/77

TEST FEED : 1 Kg - 4# GRUM ORE

FEED TREATMENT : STANDARD GRIND

STAGE										REMARKS
		As G/4A Except : Soda ash as pH modifier								
					0.1 lb/Ton NaCN					

PRODUCT CUMULATIVE	CUM. WT		CUM. ASSAY			CONTENT			CUM. DISTRIBUTION			RE-ASSAY
	Gs.	%	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro Conc 1		0.45	3.66	5.64	24.3				0.5	0.4	0.6	
" " " 2		1.62	13.4	5.68	21.6				7.1	1.5	1.8	
" " " 3		2.91	18.8	6.08	19.6				18.0	2.9	2.8	
" " " 4		4.58	20.6	6.33	18.9				31.1	4.8	4.4	
" " " 5		6.28	21.5	6.45	19.2				46.2	6.7	6.4	
" " " 6		8.79	20.8	6.53	20.9				60.6	9.6	9.8	

Appendix 10

TEST : GRUM Pb GRADE - RECOVERY

TEST NO. : G/4E

DATE : 27/5/77

TEST FEED : 1 Kg - 4# GRUM ORE

FEED TREATMENT : STANDARD GRIND

STAGE	NaCN ml	NaCN lb/Ton	PAX ml	PAX lb/Ton	LIME → pH:	TIME (MIN.)	MIBC (DROPS)					REMARKS
CONDITION	3·0	0·3	1·0	0·06	9·5	9						
FLOAT						0·5	7					
FLOAT						1·0						
FLOAT			0·3	0·018		1·5						
FLOAT			0·2	0·012		2·0						
FLOAT			0·2	0·011		3·0	3					
FLOAT			0·2	0·011		2·0		}				
FLOAT			0·5	0·03		2·0						
FLOAT			0·5	0·03		2·0						
FLOAT			0·5	0·03		2·0	2		COMBINE			
FLOAT			0·5	0·03		2·0						
FLOAT			0·5	0·03		2·0		}				

PRODUCT CUMULATIVES	CUM. WT. g.	CUM. WT. %	CUM. ASSAY % Pb	% Zn	% Fe	CONTENT % Pb	% Zn	% Fe	CUM. DISTRIBUTION % Pb	% Zn	% Fe	RE-ASSAY
Pb Ro Conc 1		2·26	16·6	3·46	28·6				12·5	1·6	3·3	
" " " 2		4·76	24·0	4·80	21·7				38·0	4·1	5·3	
" " " 3		8·60	22·6	6·31	21·9				66·0	9·6	9·7	
" " " 4		10·70	19·4	6·66	23·1				69·0	12·5	12·7	
" " " 5		13·00	16·8	6·87	24·1				72·9	15·7	16·1	
" " " 6		43·36	5·93	9·42	24·6				86·6	72·5	71·9	

Appendix II

TEST : GRUM Pb GRADE - RECOVERY

TEST No. : G/4F

DATE : 27/5/77

TEST FEED : 1Kg - 4* GRUM ORE

FEED PREPARATION : STANDARD GRIND

STAGE										REMARKS
		As G/4E Except : Soda ash as pH modifier								
						0.1 lb/Ton NaCN				

PRODUCT CUMULATIVE	CUM. WT.	CUM. ASSAY			CONTENT			CUM. DISTRIBUTION			RE-ASSAY
	Gms	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	% Pb	% Zn	% Fe	
Pb Ro Conc 1	3·09	4·06	4·25	31·0				4·0	2·2	5·1	
" " " 2	5·43	16·0	4·95	26·5				24·3	4·6	7·2	
" " " 3	11·92	19·0	5·91	25·8				72·6	12·1	15·5	
" " " 4	16·23	15·3	6·26	28·0				79·6	17·3	22·8	
" " " 5	21·22	12·4	6·51	29·2				84·3	23·6	31·5	
" " " 6	48·29	5·90	5·11	35·3				91·3	42·2	8·6	