

To: Ron Murarka

From: Sibyl Frei, Ed Morris, Henry Ylitalo, Von Baudreau

Date: January '9, 1984'

Subject: Preliminary Condition by Size Report

### Conclusions:

1. Conditioning by size appears to show some promise with respect to improved metallurgy, particularly in the zinc circuit.

### Recommendations:

1. Conditioning time optimization should be performed to improve our testing method prior to further condition by size testing.
2. Reagent / grind optimization should be done on each ore type prior to further condition by size testing (and on each new ore sample in the future).
3. Further condition by size testing should be performed, including evaluation of the relationship between conditioning by size and reagent consumption.

## Analysis and Discussion

### A. General

In this conditioning by size test program, little was done to optimize procedures before the testwork was initiated. Therefore the tests should only be compared to each other, with little comparison drawn with previous testwork.

Three types of conditioning prior to flotation were utilized: the standard method; the condition by size method and the parallel method. It must be noted that the "standard" method is actually a modified standard as no Z-11 was added during primary grinding. Procedure is outlined following analysis and discussion. Reagent/time schemes for each test are detailed in Appendix C.

High recoveries (at reasonable grades) has been the major thrust of ore type testwork. Lead and Zinc recoveries throughout this test program have been considerably lower than expected. These differences can be explained in part by no use of Z-11 in the primary grind and losses of reagents on washing the samples through the 325 mesh screen. Also, the new technicians are not as yet as proficient at flotation testwork as the previous crew of technicians.

Regardless of these reasons, it is felt that a major factor contributing to the poor results is the difference in ore samples. The ore samples presently used in the met. lab. are samples collected in June, 1983. Previous reagent/grind optimization tests and locked cycle tests were performed with other samples collected in December, 1982. A comparison of head grades of these samples can be seen in Table I below. As the samples are different, reagent and grind optimization should be performed and in the future, new ore samples should require testwork to compensate for differences in the sample quality.

# Analysis and Discussion (contd.)

## A General (contd.)

TABLE I: ORE SAMPLE HEAD GRADES

ORE TYPE	SAMPLE	ASSAYS (%)				
		Pb	Zn	Fe	Cu	Ag
2BCD	December/82, normal grade	2.2	4.0	10.3	no assay	1.9
"	December/82, high grade	3.1	6.0	13.6	0.15	1.4
"	June/83	3.1	5.9	12.7	0.12	2.3
2EF	December/82	3.2	4.6	39.5	0.10	1.3
"	June/83	3.5	5.1	29.7	0.18	1.2
2H	December/82	4.8	7.0	38.4	0.34	2.2
"	June/83	4.0	7.2	34.0	0.37	2.5

## Analysis and Discussion (cntd.)

### B. ZBCD Ore

This ore type was the first tested for conditioning by size. Several tests (1, 2, 11 and 12) were performed in order to establish technique and procedures. These tests have little importance to the series of condition by size tests as extraneous variables were introduced to determine the method for subsequent testing. It is interesting to note that in test 11  $\text{Na}_2\text{S}_2\text{O}_3$  was used in addition to the (modified) standard reagent scheme. This test showed similar metallurgical performance to the standard in the Pb circuit but showed somewhat improved grades and recoveries over the standard in the Zn circuit.

Throughout the rest of the ZBCD ore portion of these tests; conditioning times, primary grind times and amounts of Z-11 additions were varied, making comparisons between tests difficult. A comparison of the test parameters and results obtained in the ZBCD ore testing are contained in the following tables (Table II and Table III). Detailed explanation of reagent/time schemes employed can be found in Appendix C. The final results and graphs for these tests are in Appendix A and B.

TABLE II: LEAD TESTS ON ZBCD ORE

TEST NUMBER	TEST TYPE	TYPE OF CONDITIONING	CONDITIONING TIME (min)	ADDITIONAL PARAMETERS	CUM. LEAD METALLURGY	
					% Grade	% Recovery
3	rougher	cond by size	5.0	15 min grind normal reagents	30.87	87.92
4	"	parallel	5.0	"	26.32	86.23
5	"	cond by size	2.5	"	33.41	87.20
6	"	parallel	2.5	"	32.84	86.27
7	"	cond by size	4.0	16 1/2 min grind normal reagents	27.91	86.21
8	"	parallel	4.0	"	23.88	87.35
9	"	cond by size	4.0	15 min grind + 50% Z-11	20.34	88.75
10	"	parallel	4.0	"	19.19	87.42
13	"	Standard	none	15 min grind normal reagents	24.76	91.89
20	cleaner	Standard	none	"	77.90	56.55
21	"	cond by size	5.0	"	71.10	74.83

## Analysis and Discussion (Contd.)

### B. 2BCD Ore (Contd.)

TABLE III: ZINC TESTS ON 2BCD ORE

TEST NUMBER	TEST TYPE	TYPE OF CONDITIONING	CONDITIONING TIME (min)	ADDITIONAL PARAMETERS	CUM. ZINC METALLURGY	
					% Grade	% Recovery
13	rougher	standard	none	normal reagents	13.94	78.05
14	"	cond by size	8.0	"	18.19	80.19
15	"	parallel	8.0	"	32.62	75.05
16	"	cond by size	6.0	"	20.26	76.71
17	"	parallel	6.0	"	15.89	80.75
18	"	cond by size	4.0	"	13.92	74.83
19	"	parallel	4.0	"	17.44	79.68
22	"	cond by size	8.0	+50% Z-11	18.63	82.24
23	"	parallel	8.0	"	26.20	77.26
24	"	cond by size	8.0	repeat of test 14	17.56	77.90
25	"	parallel	8.0	repeat of test 15	14.92	75.09

The best rougher test for 2BCD ore in the Pb circuit was test 13, the standard test, indicating that conditioning by size may not be beneficial for Pb flotation. Conditioning by size did result in increased grade in rougher/scavenging but this improvement was negated by a greater than 3% drop in recovery.

Two lead cleaner tests were also performed as part of this series; one implementing the modified standard procedure and the other using the 5 minute condition by size method (tests 20 and 21 respectively). The condition by size test showed improved overall recovery (although the rougher/scavenger recovery was still somewhat lower than the standard test) with some loss in grade. These tests indicate that conditioning by size may have some benefit to the Pb circuit. Further work, is required to accurately determine the effects of conditioning by size on the Pb circuit.

## Analysis and Discussion (contd.)

### B. ZBCD Ore (contd.)

All testwork performed on the ZBCD ore Zn circuit for conditioning by size was in the form of rougher tests. The best Zn test in this series was test 22 which had a 4% improvement in grade and recovery over the standard (test 13). Test 22 utilized an 8 minute period of conditioning by size as well as a 50% increase in Z-11 consumption. The next best test was test 14 with 8 minute conditioning by size at normal Z-11 consumption levels.

Some interesting trends can be observed by comparing tests 14 through 19 with the standard (test 13). In the condition by size method tests (14, 16 & 18), as conditioning time for Zn decreased, the metallurgical performance dropped. However, the parallel tests (15, 17 & 19) showed very little difference between conditioning times, but with generally improved performance compared to the standard.

These trends and the "best test" results indicate that conditioning by size could be beneficial to the Zn circuit for ZBCD ore. More work should be done on conditioning by size, particularly examining longer conditioning times and the relationship between conditioning by size and reagent consumption.

A locked cycle test was performed on this ore type employing the most promising condition by size times as determined in the rougher and cleaner series of tests. The test used a 5 minute condition by size time in the Pb circuit at normal Z-11 consumption levels and an 8 minute condition by size time in the Zn circuit, also at normal Z-11 consumption levels.

Desirable stability was achieved in the locked cycle

## Analysis and Discussion (contd.)

### B. 2BCD Ore (contd.)

test but grades and particularly recoveries were disappointing. The  $P_{80}$ 's achieved were acceptable with 18.1  $\mu\text{m}$  size in the Pb concentrate and 22.9  $\mu\text{m}$  in the Zn concentrate and somewhat low in the final tails with  $P_{80} = 37.7 \mu\text{m}$ . Pb recoveries were 10% lower than expected and in the Zn circuit, recoveries were 15% lower than expected. These results can be explained in part by reagent losses on washing, no Z-11 in the primary grind and activation of pyrite with increased conditioning time. Further investigation into the differences between this sample of 2BCD ore and the previous sample must be done, followed by further investigation into conditioning by size.

### C. 2EF Ore

In the 2EF ore condition by size tests, conditioning time and amounts of Z-11 addition were the only parameters varied. All tests performed were rougher tests. Tables IV and V summarize the test parameters and results for 2EF ore tests in this program. The complete results and graphs for these tests can be found in Appendices A and B. A detailed explanation of reagent/time schemes can be found in Appendix C.

TABLE IV: LEAD TESTS ON 2EF ORE

TEST NUMBER	TEST TYPE	TYPE OF CONDITIONING	CONDITIONING TIME (min)	ADDITIONAL PARAMETERS	CUM. LEAD METALLURGY	
					% Grade	% Recovery
1	rougher	standard	none	normal reagents	29.84	91.47
2	"	cond by size	5.0	"	40.02	87.21
3	"	parallel	5.0	"	38.23	84.26
4	"	cond by size	2.5	"	39.00	86.52
5	"	parallel	2.5	"	39.21	82.92

## Analysis and Discussion (contd.)

### C. ZEF Ore (contd.)

TABLE V: ZINC TESTS ON ZEF ORE

TEST NUMBER	TEST TYPE	TYPE OF CONDITIONING	CONDITIONING TIME (min)	ADDITIONAL PARAMETERS	CUM. ZINC METALLURGY	
					% Grade	% Recovery
1	rougher	standard	8.0	normal reagents	17.69	85.16
6	"	cond by size	8.0	"	28.78	81.71
7	"	parallel	8.0	"	29.94	78.80
8	"	cond by size	6.0	"	36.75	35.20
9	"	parallel	6.0	"	47.62	70.90
10	"	cond by size	8.0	+50% Z-11	20.19	84.45
11	"	parallel	8.0	"	29.31	73.66

The best Pb condition by size test for ZEF ore was test 1, the standard test of this series. Although the condition by size method (and the parallel method) improved grades over the standard, there was no benefit to recoveries in the Pb circuit. It must be noted that longer Pb rougher/scavenger flotation time in a 5 minute condition by size test could improve the recovery to that of the standard, but at a loss of grade (see test 2). Conditioning by size appears not to be beneficial in the achievement of acceptable metallurgy in the Pb circuit of ZEF ore.

The best Zn test in the ZEF series of condition by size tests was also test 1, the standard. Another test (test 10) showed very similar metallurgy, with slightly better grade and slightly worse recovery. Generally, conditioning by size improved the cumulative grade of the rougher/scavenger grade. However, there were small to large losses in Zn recovery for the ZEF condition by size tests in the Zn circuit.

An examination of the graphs (see Appendix B) show that decreases in conditioning time for the condition by

## Analysis and Discussion (contd)

### C. 2EF Ore (contd.)

size method tests had significant negative effects on the recovery of Zn. This effect could be offset by increases in Z-II addition (see test (10)). These results suggest that conditioning by size could be favorable in the Zn circuit of 2EF ore if longer conditioning times are utilized. As well, the relationship between conditioning by size and reagent consumption should be examined.

A locked cycle test was also performed using 2EF ore and employing the most promising condition by size times as determined in this series of tests. The test used a 5 minute condition by size time in the Pb circuit at normal Z-II consumption levels and an 8 minute condition by size time in the Zn circuit with a 50% increase in the Z-II consumption over the standard.

Reasonable stability was achieved in the locked cycle test despite overflow problems in cycles 4 and 5. Grades and recoveries were lower than expected. These results can be explained in part due to the lack of Z-II in the primary grind which caused poor activation of lead and zinc. The washing of mineralized surfaces during wet screening caused losses of reagents, negatively affecting metallurgical performance. Further investigation into the differences between this sampled 2EF ore and the previous sample must be done, followed by further investigation into conditioning by size.

### D. 2H Ore

Only a small amount of work was done on conditioning by size for 2H ore. Only the Pb circuit was examined to the same degree as the other ore types. All tests performed were as follows: Tests Table VI summarizes

## Analysis and Discussion (contd.)

### D. 2H Ore (contd.)

The test parameters and results for the 2H ore tests in this series. The complete results and graphs for these tests can be found in Appendices A and B. A detailed explanation of reagent/time schemes can be found in Appendix C.

TABLE VI: LEAD TESTS ON 2H ORE

TEST NUMBER	TEST TYPE	TYPE OF CONDITIONING	CONDITIONING TIME (min)	ADDITIONAL PARAMETERS	CUM. LEAD METALLURGY	
					% Grade	% Recovery
1	rougher	standard	none	normal reagents	27.61	91.60
2	"	cond by size	5.0	"	32.53	87.02
3	"	parallel	5.0	"	26.76	90.78
4	"	cond by size	2.5	"	28.80	89.32
5	"	parallel	2.5	"	25.40	89.40

The best 2H condition by size series test in the Pb circuit was test 2, a 5 minute condition by size method test. Although the recovery is lower, adjustments in flotation time should improve the recovery. Grade was better in test 2. The parallel of test 2 (test 3) is very similar in grade and recovery. All three tests (1, 2 and 3) are similar in metallurgical performance, requiring further testwork to determine the optimum method.

In the shorter conditioning time tests (4 and 5), the condition by size method test shows superiority over the parallel method in grade with the same recovery. This indicates that conditioning by size may be advantageous to the Pb circuit.

Two tests were performed on the zinc circuit for 2H ore (tests 6 and 7, see Appendices A, B and C). Major pH meter problems were encountered and therefore these tests were not completed for conditioning by size methods.

## Procedure

### Standard Pb Conditioning prior to Flotation

- wash contents of primary grind into a 2.5 l flotation cell
- raise pH to 10.0 with  $\text{Na}_2\text{CO}_3$
- add 50 g/tonne Z-11 collector
- immediately collect Pb Ro/Sc concentrate samples

### Condition by Size Pb Conditioning prior to Flotation

- wash contents of primary grind through a 325 mesh screen
- filter -325 mesh fraction, collecting water for use as make-up water during the test
- condition each fraction separately in 1.5 l cells by:
  - raising pH to 10.0 with  $\text{Na}_2\text{CO}_3$
  - adding 15 g/tonne Z-11 collector to +325 mesh fraction and 35 g/tonne Z-11 collector to -325 mesh fraction and condition for set lengths of time (the same time for each fraction)
- recombine fractions in a 2.5 l cell and again raise pH to 10.0 with  $\text{Na}_2\text{CO}_3$
- immediately collect Pb Ro/Sc concentrate samples

### Parallel Pb Conditioning prior to Flotation

- wash contents of primary grind through a 325 mesh screen
- filter -325 mesh fraction, collecting water for use as make-up water during the test
- recombine fractions in a 2.5 l cell and raise pH to 10.0 with  $\text{Na}_2\text{CO}_3$
- add 50 g/tonne Z-11 collector and collect Pb Ro/Sc concentrate samples

Procedure (contd.)

### Standard Zn Conditioning prior to Flotation

- conditioning is done to Pb Ro / Sc Tails in the 2.5 l cell
- check pH, add 1000g/tonne  $\text{CuSO}_4$ , check pH again and then raise pH to 11.0 with lime while conditioning for 8 minutes
- add 60 g/tonne Z-11 collector and condition for 2 more minutes
- collect Zn Ro / Sc concentrate samples

### Condition by Size Zn Conditioning prior to Flotation

- wash Pb Ro / Sc Tails through a 325 mesh screen
- filter -325 mesh fraction, collecting water for make-up water
- condition each fraction separately in 1.5 l cells by:
  - checking pH of each fraction, adding 500g/tonne  $\text{CuSO}_4$  to each fraction, checking pH again and then raising pH to 11.0 with lime while conditioning each fraction for a set length of time (the same time for each fraction)
- recombine each fraction in a 2.5 l cell and again raise the pH to 11.0 with lime.
- add 60 g/tonne Z-11 collector (or 90g/tonne for locked cycle test) and condition for 2 more minutes
- collect Zn Ro / Sc concentrate samples

### Parallel Zn Conditioning prior to Flotation

- wash Pb Ro / Sc Tails through a 325 mesh screen
- filter -325 mesh fraction, collecting water for make-up water
- recombine fractions in a 2.5 l cell, check pH, add 1000g/tonne  $\text{CuSO}_4$ , check pH again and raise with lime for 8 minutes
- add 60g/tonne Z-11 collector and condition 2 more minutes before flotation

## Procedure (contd)

### Rougher Procedure for 2BCD, 2EF and 2H Ores

Grind: 1 kg of ore

3 kg/tonne  $\text{Na}_2\text{CO}_3$

100 g/tonne NaCN

500 ml  $\text{H}_2\text{O}$  (66% solids)

grind for: 15 min for 2BCD, 14 min for 2EF and 12 min for 2H ores

Condition prior to Pb flotation (standard, condition by size or parallel method).

Collect Pb rougher & scavenger concentrates using MIBC frother as necessary.

sample	flotation time	collector addition
PbRo <sub>1</sub>	1	
PbRo <sub>2</sub>	2	
PbSc <sub>1</sub>	2	15g/tonne Z-11
PbSc <sub>2</sub>	2	
PbSc <sub>3</sub>	3	15g/tonne Z-11

Condition prior to Zn flotation (standard, condition by size or parallel method)

Collect Zn rougher & scavenger concentrates using Dow 1012 frother as necessary.

sample	flotation time	collector addition
ZnRo <sub>1</sub>	1	
ZnRo <sub>2</sub>	2	
ZnSc <sub>1</sub>	2	20g/tonne Z-11
ZnSc <sub>2</sub>	2	
ZnSc <sub>3</sub>	3	20g/tonne Z-11

## Procedure (contd.)

### Cleaner Test Procedure used for ZBCD Ore Lead Circuits

Grind: 1 kg of ZBCD ore  
3 kg/tonne  $\text{Na}_2\text{CO}_3$   
100 g/tonne NaCN  
500 ml  $\text{H}_2\text{O}$  (66% solids)  
grind for 15 minutes

Condition prior to Pb flotation (standard, condition by size or parallel method).

Collect Pb rougher/scavenger concentrate as one sample using MiBC frother as necessary.

Sample	flotation time	collector addition
Pb Ro/Sc	3	
conc	2	15g/tonne Z-11
	3	15g/tonne Z-11

Regrind: Pb Ro/Sc concentrate  
50 g/tonne NaCN  
1 kg/tonne  $\text{Na}_2\text{CO}_3$   
grind for 10 minutes

Cleaner flotation of Pb (using MiBC frother as necessary)

- raise pH to between 10.0 and 10.2 with  $\text{Na}_2\text{CO}_3$ .
- add the correct amount of Z-11 collector before each cleaning stage and condition for two minutes prior to collection.

sample	condition time	collector addition	flotation time
PbCC <sub>1</sub>	2	60g/tonne Z-11	5
PbCC <sub>2</sub>	2	20g/tonne Z-11	4
PbCC <sub>3</sub>	2	10g/tonne Z-11	3

## Procedure (Contd.)

### Locked Cycle Condition by Size Procedure for 2BCD and 2EF Ores (KRAL)

See attached flowsheet for order and cycling arrangements for samples

Grind: 1 kg of ore + Pb Sc concentrate of previous cycle + PbCT<sub>1</sub> of previous cycle  
3 kg/tonne Na<sub>2</sub>CO<sub>3</sub>  
100 g/tonne NaCN  
500 ml H<sub>2</sub>O (66% solids)  
grind for: 15 min for 2BCD, 14 min for 2EF

Condition by size method used prior to Pb Flotation.

Collect Pb rougher and Pb scavenger concentrates (2 samples) using MiBC frother as necessary.

sample	flotation time	collector addition
Pb Ro	4	
Pb Sc	2	15 g/tonne Z-11
	2	15 g/tonne Z-11

Regrind: Pb Ro concentrate + PbCT<sub>2</sub> of previous cycle  
50 g/tonne NaCN  
1 kg/tonne Na<sub>2</sub>CO<sub>3</sub>  
grind for 5 minutes

Cleaner flotation of Pb (using MiBC frother as necessary)

- raise pH to between 10.0 and 10.2 with Na<sub>2</sub>CO<sub>3</sub> while conditioning for 2 minutes.

- add decreasing amounts of Z-11 collector each minute to a total for each collection stage.

sample	flotation time	collector addition (total)		samples added from last cycle
		2BCD	2EF	
PbCC <sub>1</sub>	5	60 g/tonne	60 g/tonne	—
PbCC <sub>2</sub>	4	20 g/tonne	20 g/tonne	PbCT <sub>3</sub>
PbCC <sub>3</sub>	3	20 g/tonne	10 g/tonne	—

Condition by size method used prior to Zn collection. Samples conditioned in preparation for Zn Ro/Sc stage are Pb Ro/Sc Tails from same cycle + Zn Sc concentrate from last cycle + ZnCT<sub>1</sub> from last cycle.

## Procedure (Contd.)

### Locked Cycle Condition by Size Procedure (Contd.)

Collect Zn rougher and Zn scavenger concentrates (two samples) using Dow 1012 frother as necessary.

sample	flotation time	collector addition
ZnRo	4	
ZnSc	2	30g/tonne Z-11
	2	30g/tonne Z-11

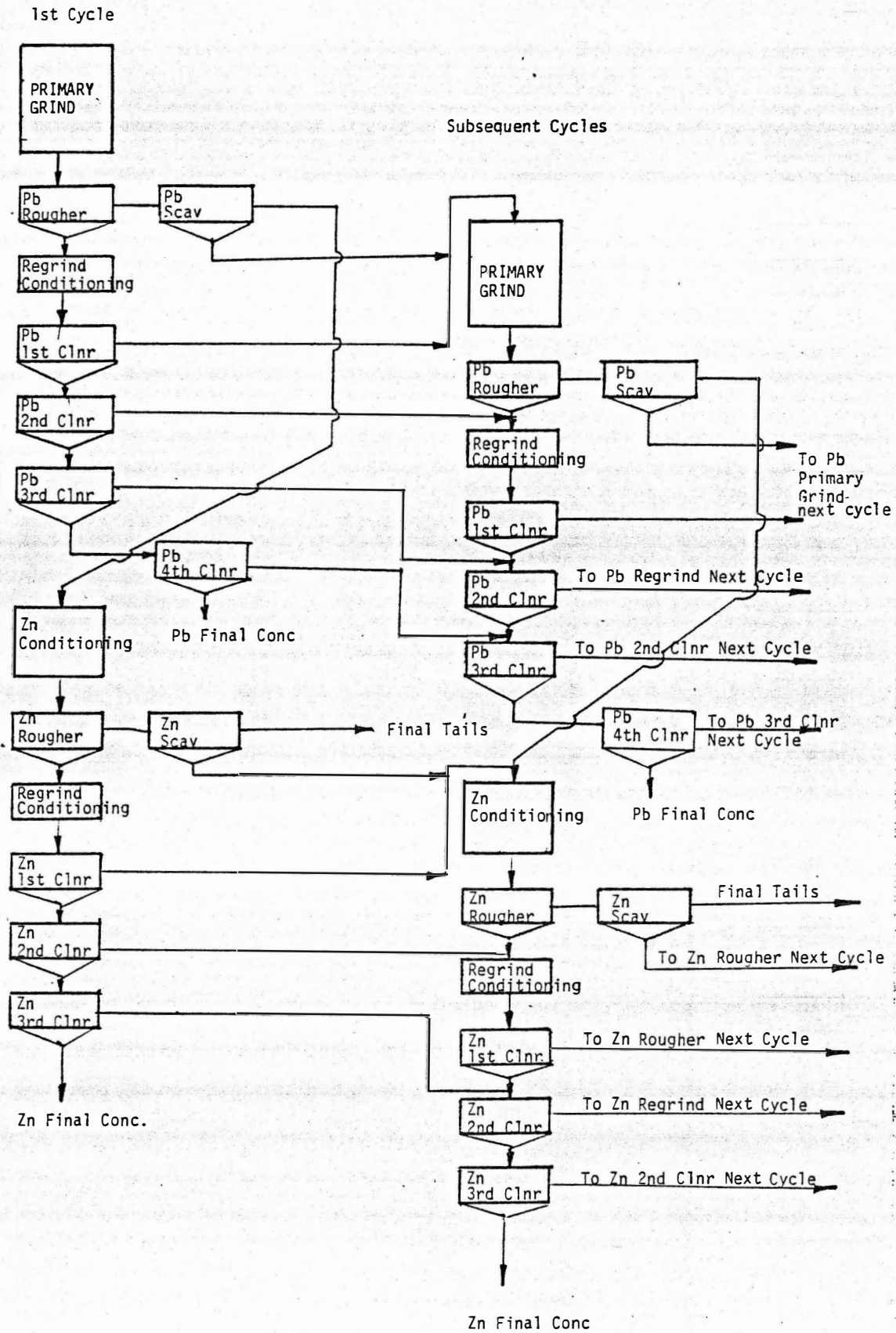
Regrind: Zn Ro concentrate + Zn CT<sub>2</sub> from last cycle  
500 g/tonne lime  
300g/tonne CuSO<sub>4</sub>  
grind for 5 minutes

Cleaner Flotation of Zn (using Dow 1012 frother as necessary)  
- raise pH with lime to: 11.5 for Zn 1<sup>st</sup> cleaner, 11.8 for Zn 2<sup>nd</sup> cleaner and 12.0 for Zn 3<sup>rd</sup> cleaner and condition for 2 minutes.  
- add decreasing amounts of Z-11 collector each minute to a total for each collection stage.

sample	flotation time	collector addition (total)		samples added from last cycle
		ZBCD	ZEF	
ZnCC <sub>1</sub>	7	80g/tonne	70g/tonne	—
ZnCC <sub>2</sub>	4	40g/tonne	30g/tonne	ZnCT <sub>3</sub>
ZnCC <sub>3</sub>	3	20g/tonne	20g/tonne	—

### Locked Cycle Test (KRAL method)

Pb CIRCUIT CLOSED - Zn CIRCUIT CLOSED



# Appendix A

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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #1 ABCD ORE

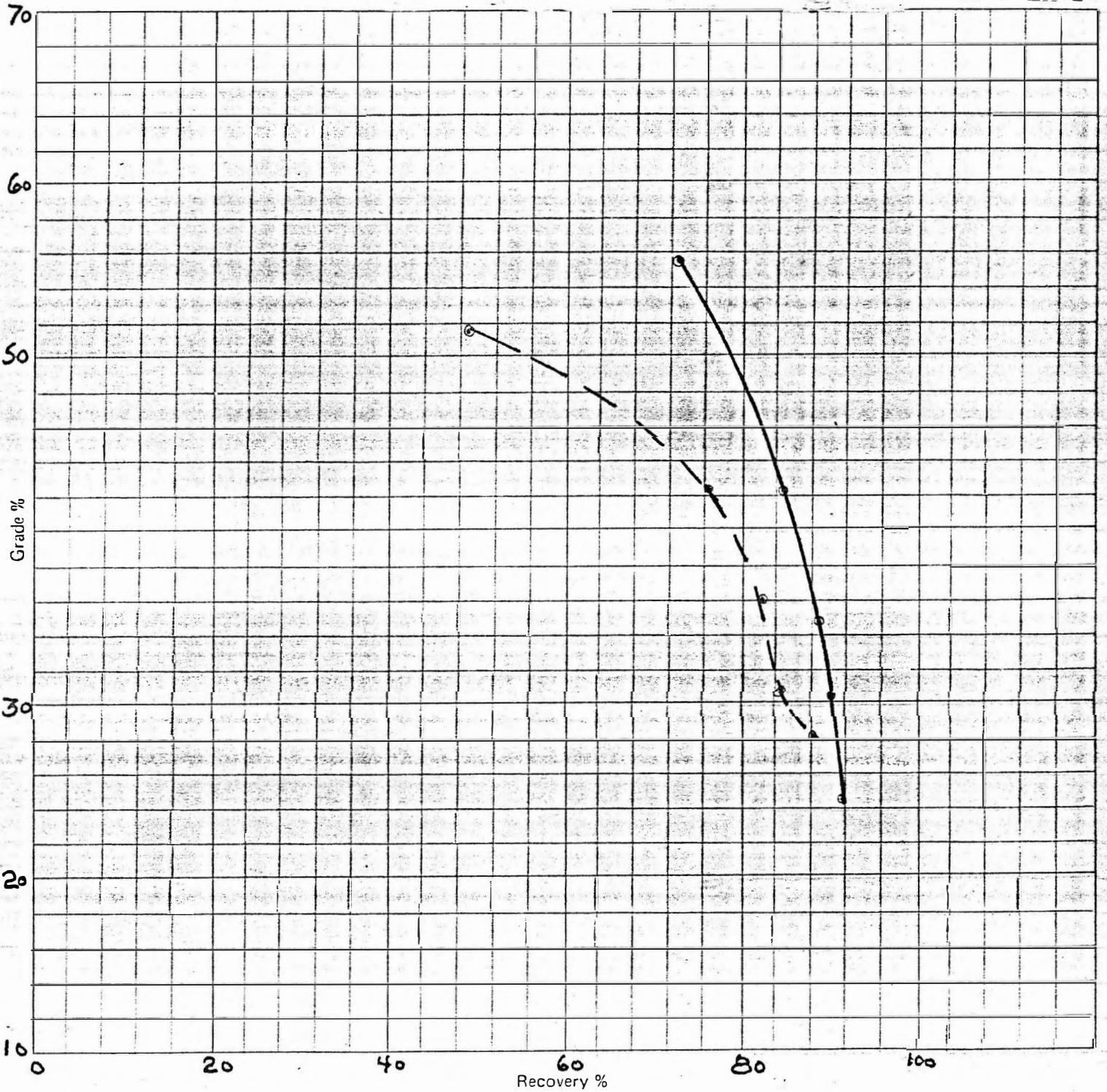
Date: January 4th, 1984

Objective: wet screen method development

Key: Pb Std. (13)

Reagents:

Pb Cond. By Size - - - - (1)



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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #2 200 ORE

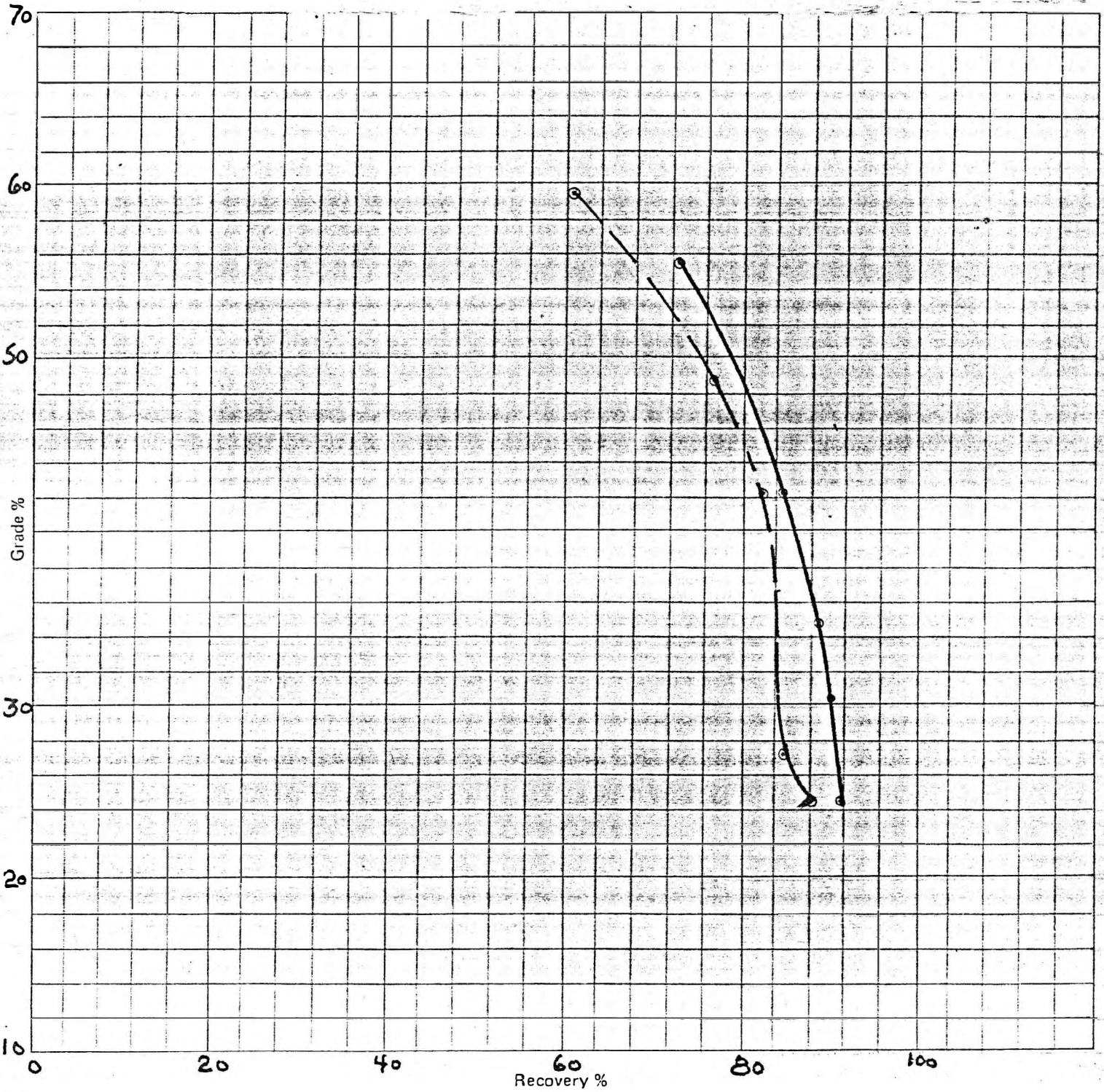
Date: January 4th, 1984

Objective: wet screen method development

Key: Pb Std.

Reagents:

Pb Cond. By Size - - - -

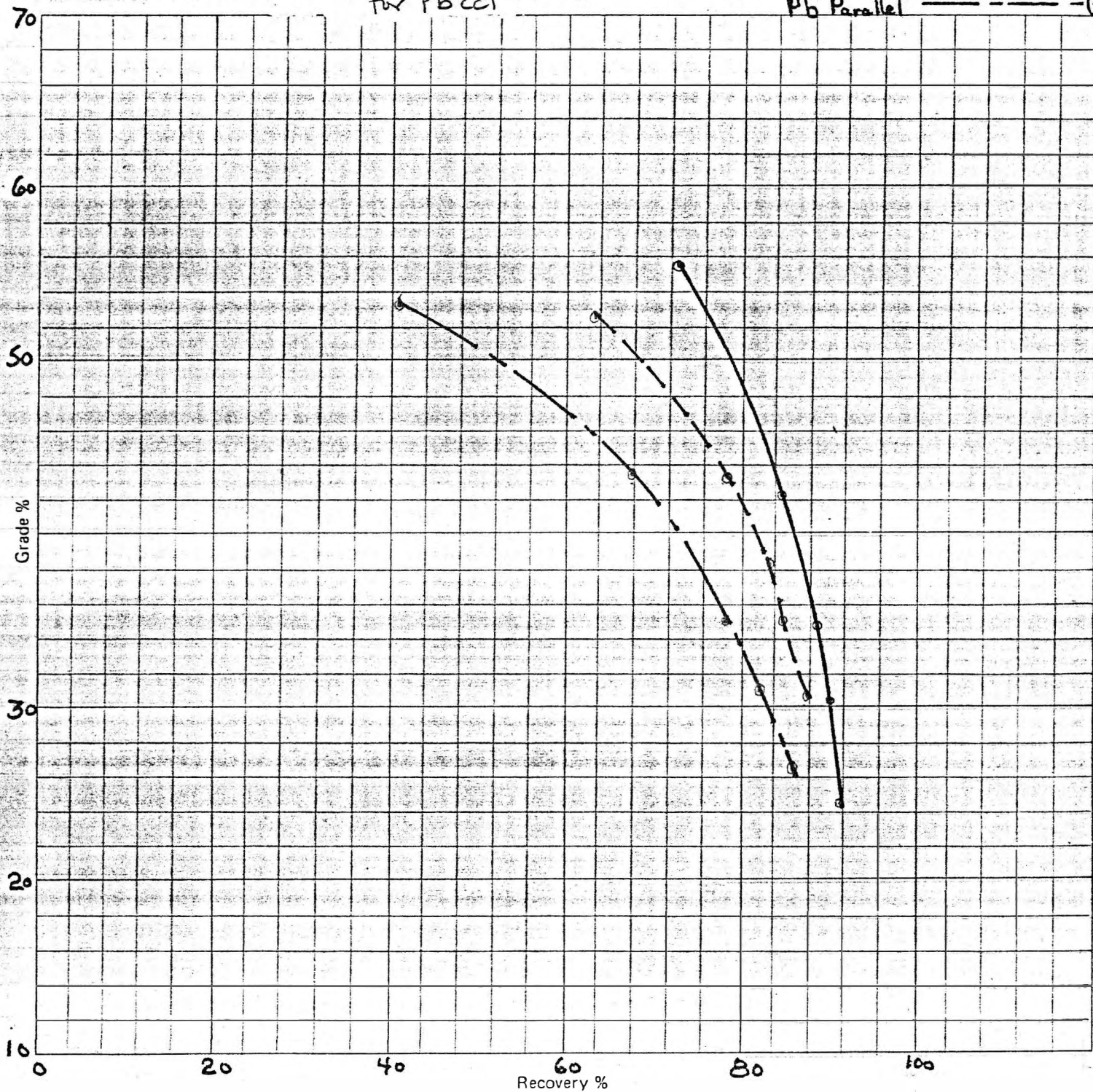


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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #54 2BCD ORE  
 Objective: 2BCD COND. By Size Test No.  
 Reagents: 5 minute conditioning tested for Pb cct

Date: January 4th, 1984  
 Key: Pb Std. (13)  
 Pb Cond. By Size --- (3)  
 Pb Parallel --- (1)

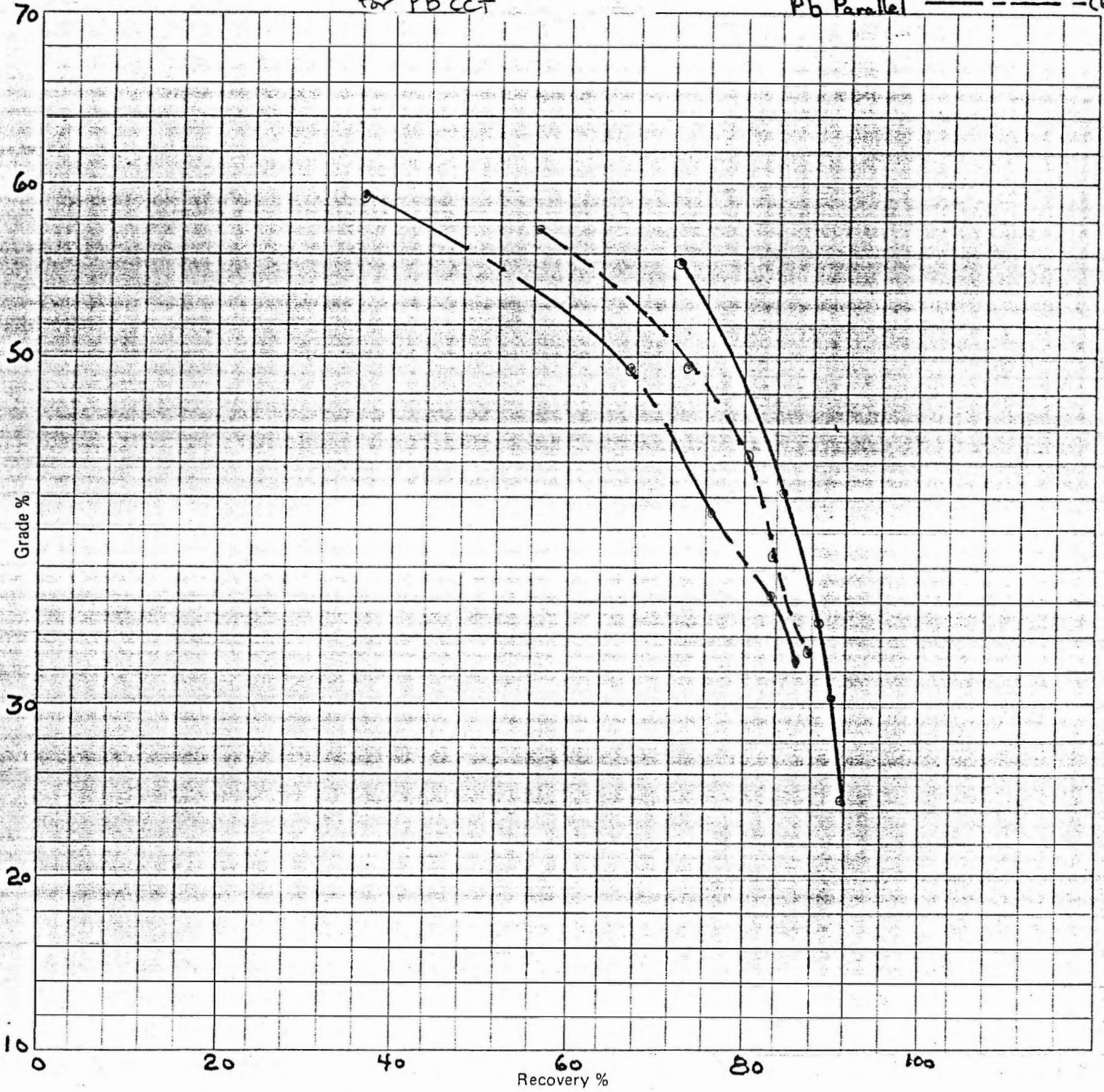


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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #546 2BCD ORE  
Objective: 2BCD COND. By Size Test R.  
Reagents: 2.5 min. conditioning tested  
for Pb cct

Date: January 4th, 1984  
Key: Pb Std. (3)  
Pb Cond. By Size --- (5)  
Pb Parallel - - - (6)



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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #748 2 BCD ORE

Date: January 4th, 1984

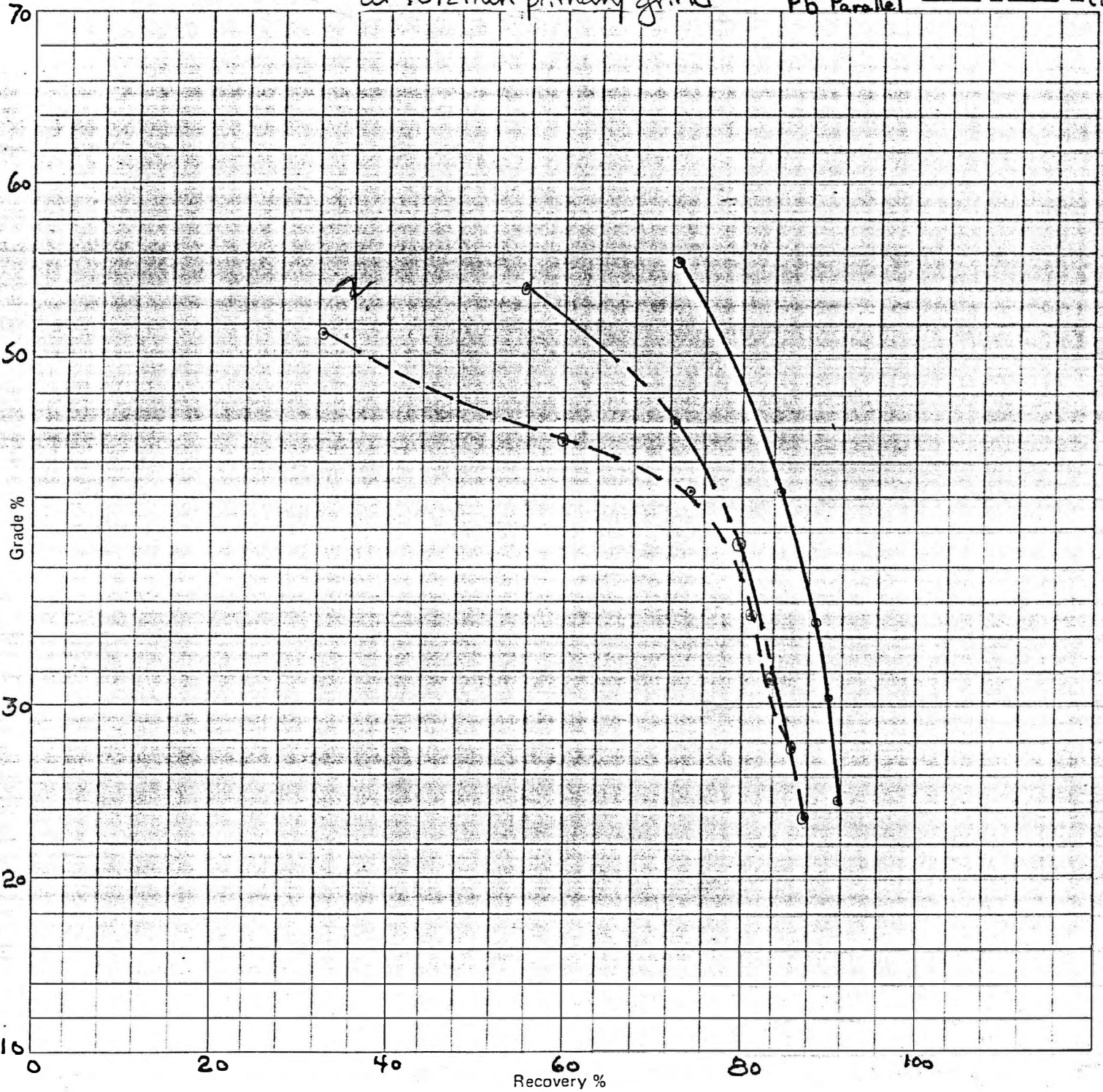
Objective: 2 BCD COND. By Size Test No.

Key: Pb Std. (13)

Reagents: 4 min conditioning tested for Pbct  
at 1 1/2 min primary grind

Pb Cond. By Size --- (7)

Pb Parallel - - - - (8)

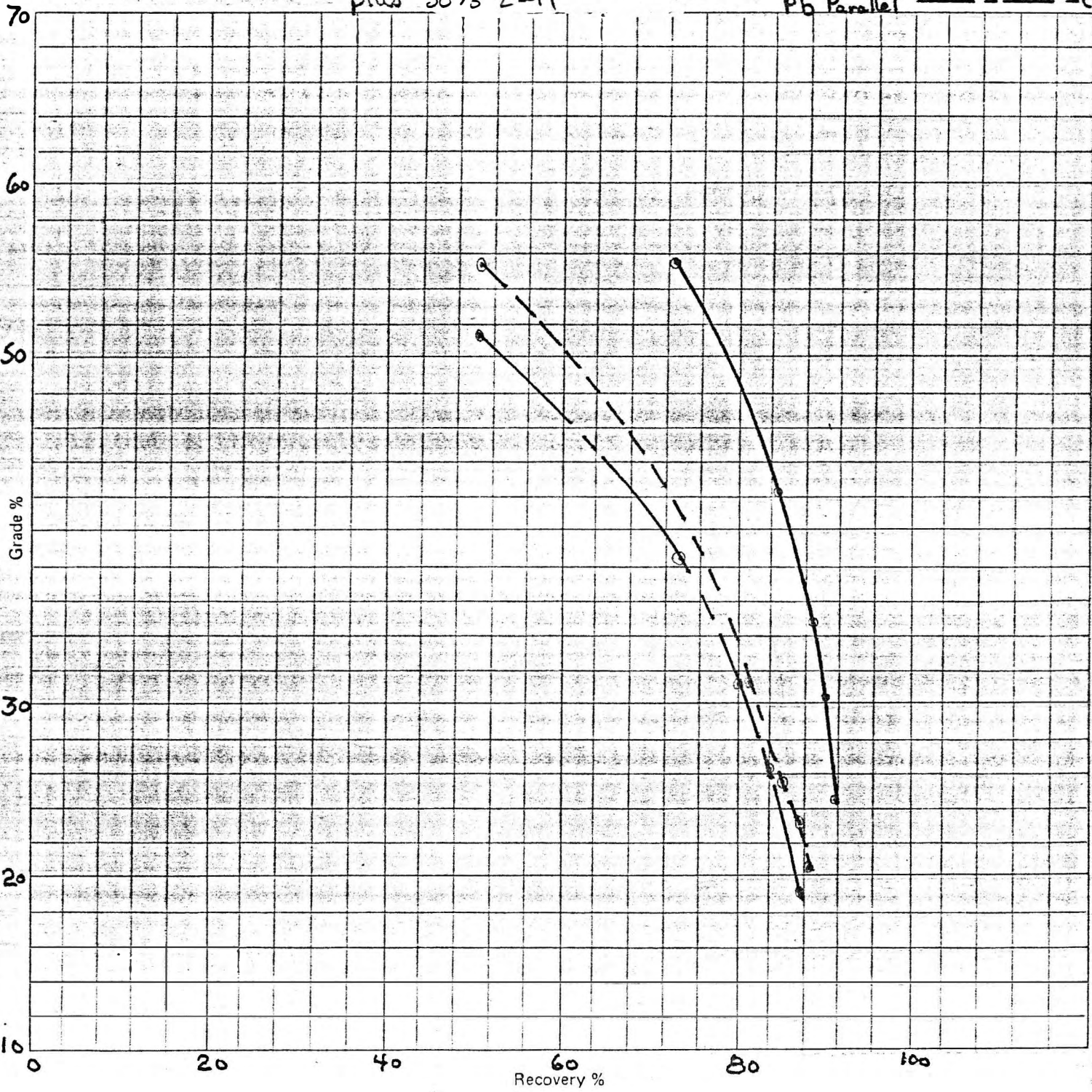


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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #9610 2 BCD OAE  
 Objective: 2 BCD COND. By Size Test No.  
 Reagents: 4 min conditioning tested for Pb cct  
 plus 50% Zn

Date: January 4th, 1984  
 Key: Pb Std. \_\_\_\_\_ (13)  
 Pb Cond. By Size - - - - (9)  
 Pb Parallel - - - - (10)



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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #11 & 12 2 B.C.D ORE (Rougher)

Date: January 4th, 1984

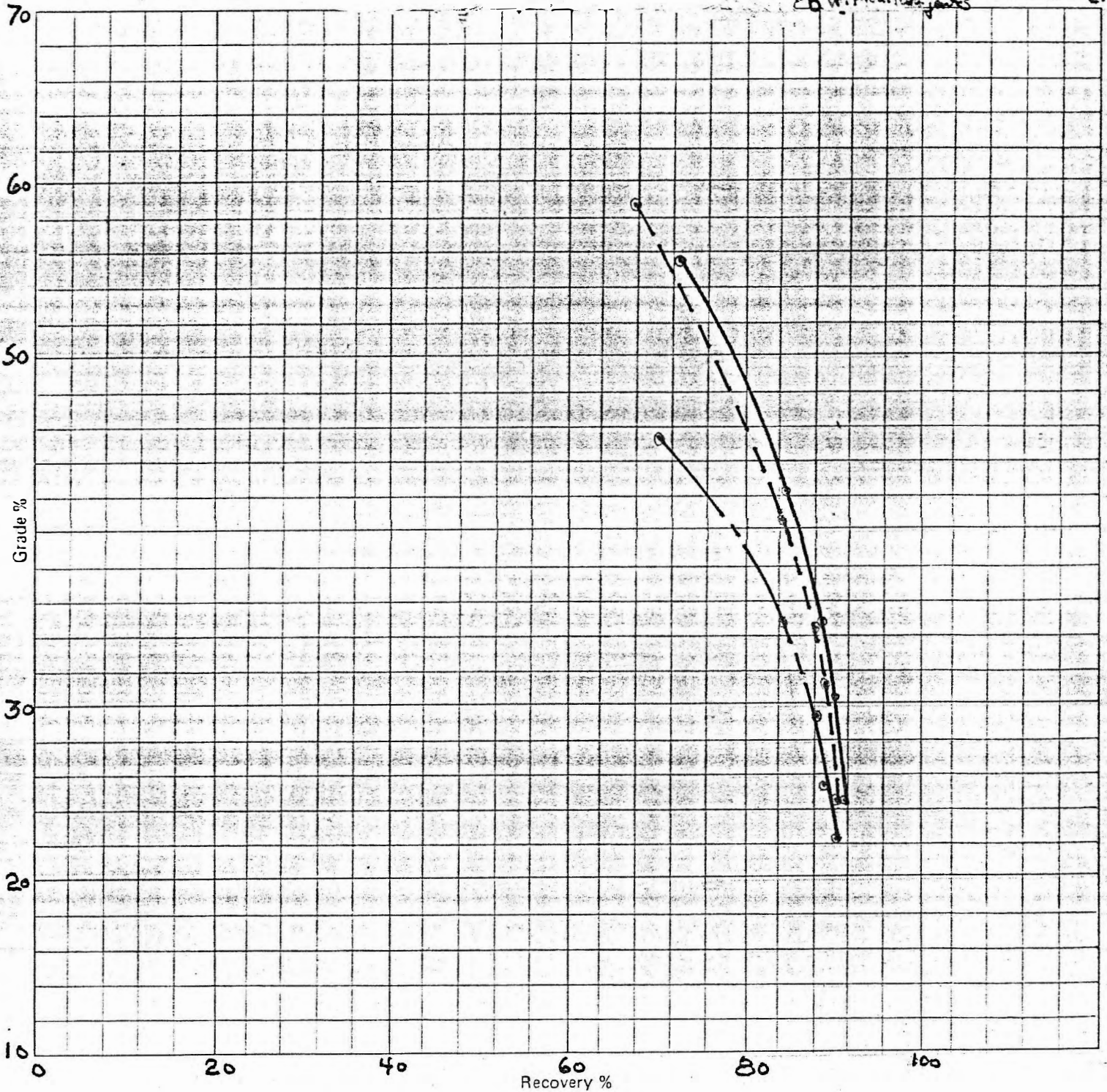
Objective: reagent optimization

Key: Pb Std. \_\_\_\_\_ (13)

Reagents: for Pb cat

Pb Ro with  $\text{Na}_2\text{SO}_3$  --- (11)

Pb without reagents --- (12)

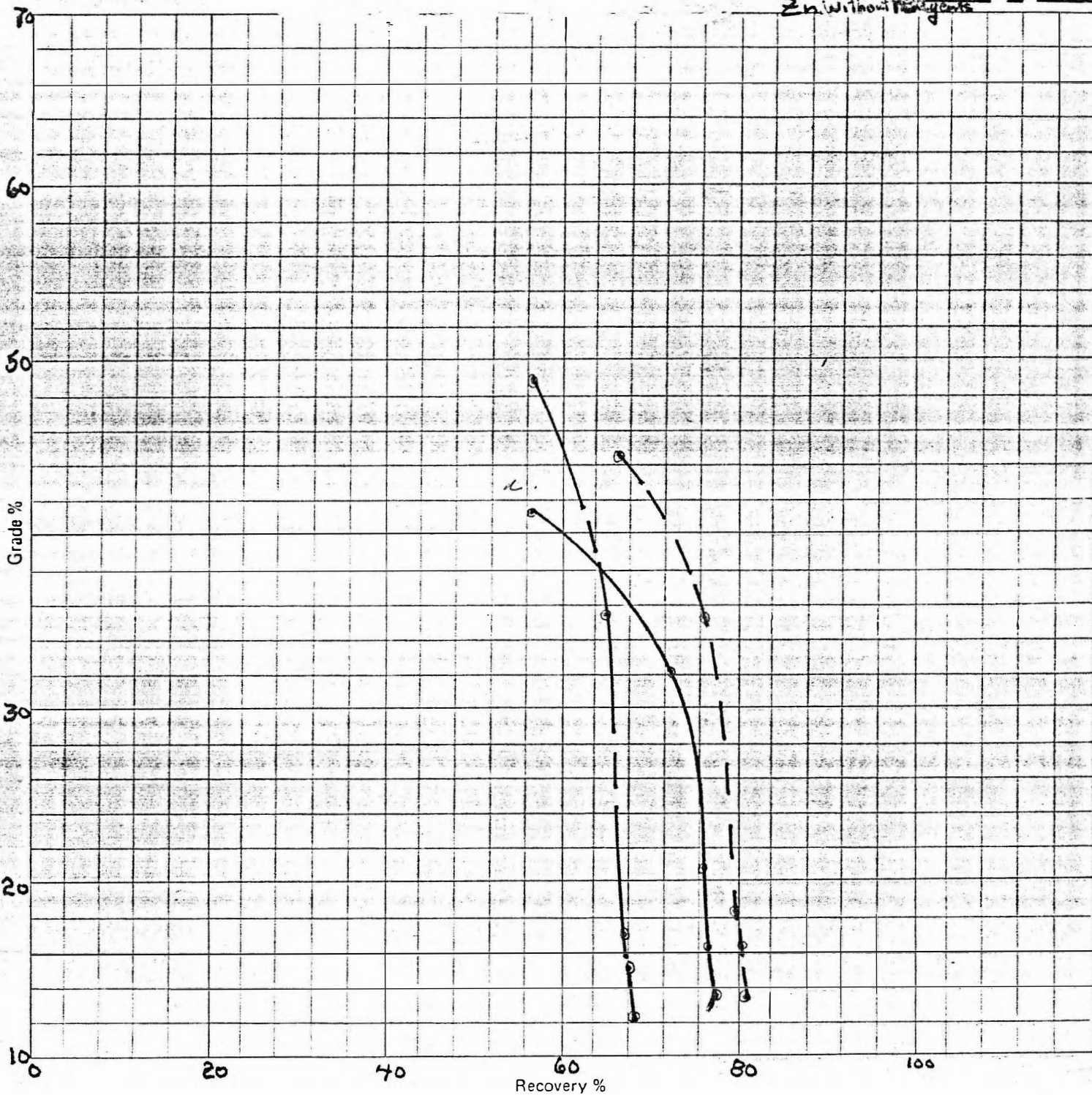


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METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #11 & 12 2BCD ORE (Rougher)  
Objective: reagent optimization  
Reagents: for zinc

Date: January 4th, 1984  
Key: Zn Std. (13)  
Zn Ro with  $\text{Na}_2\text{S}_3$  (11)  
Zn without reagents (12)

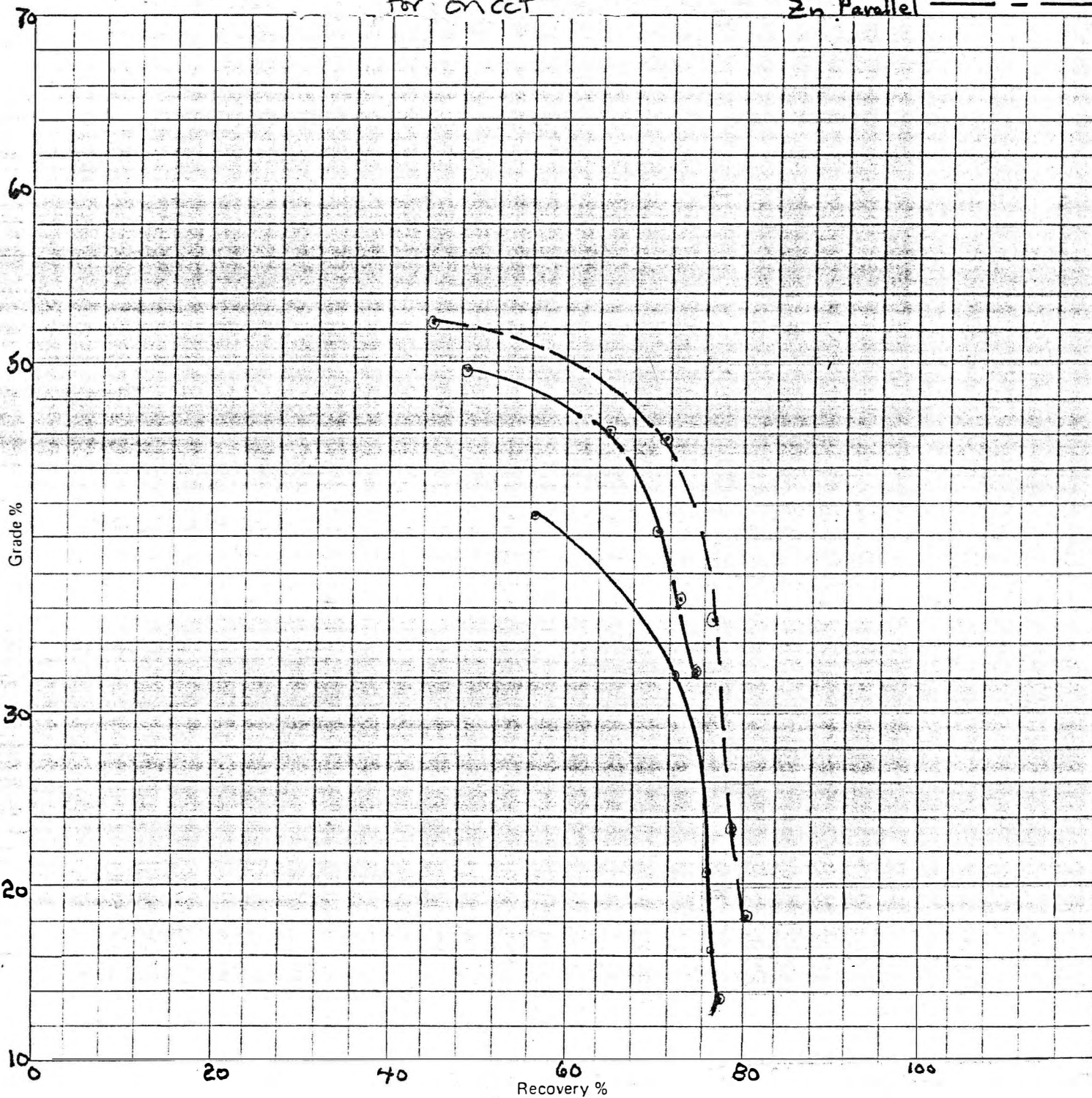


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #14 & 15 2 BCD ORE  
Objective: 2 BCD CONVD. By Size Test Ra.  
Reagents: 8 min conditioning tested for Zn cct

Date: January 4th, 1984  
Key: Zn Std. ————— (13)  
Zn Cond. By Size — — — — (14)  
Zn Parallel — — — — (1)

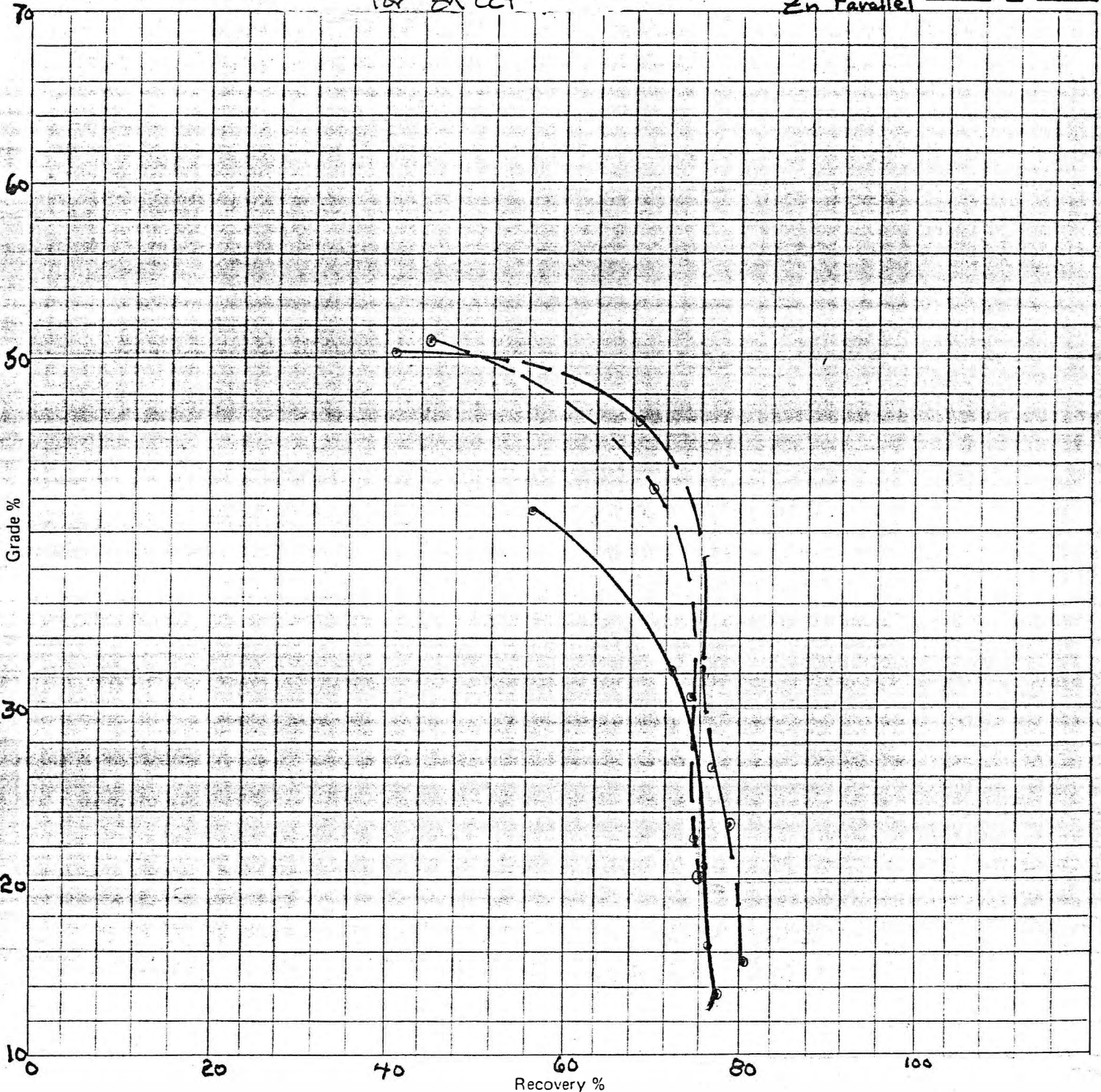


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #16 & 17 2BCD ORE  
Objective: 2BCD COND. By Size Test Rn.  
Reagents: 6 min conditioning tested  
for Zn cct

Date: January 4th, 1984  
Key: Zn Std. ——— (13)  
Zn Cond. By Size — — — — (16)  
Zn Parallel — — — — (1)

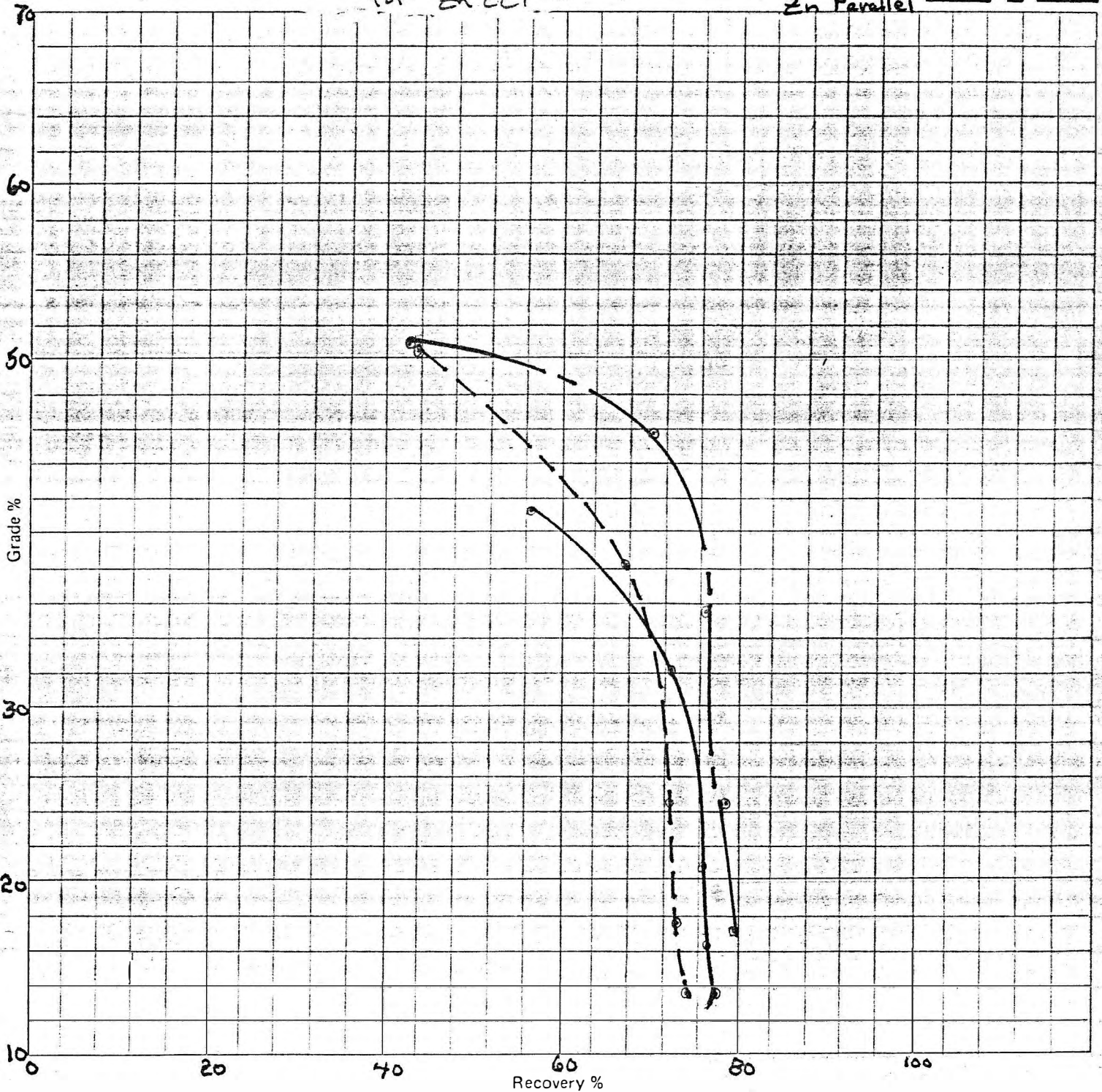


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #18419 2DCD ORE  
Objective: 2DCD CONVD. By Size Test Rn.  
Reagents: 4 min conditioning tested for Zn oct.

Date: January 4th, 1984  
Key: Zn Std. (13)  
Zn Cond. By Size (18)  
Zn Parallel (1)

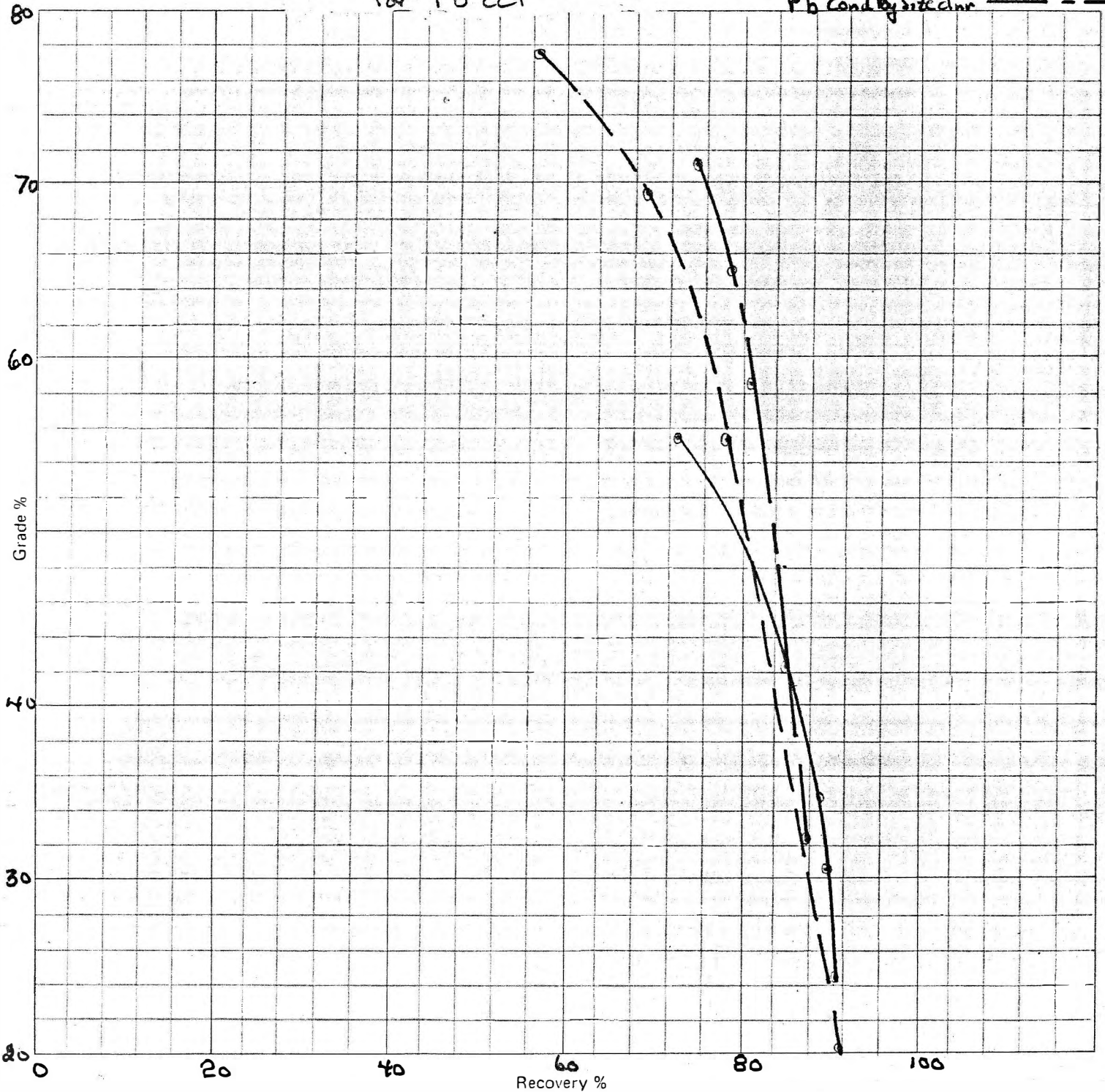


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #20921 BCD ORE  
 Objective: 2 BCD cond by size cleaner  
 Reagents: 5 min conditioning tested for Pb cct

Date: January 4th, 1983  
 Key: Pb Std. (13)  
 Pb Std cleaner --- (20)  
 Pb cond by size clnr --- (21)



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #22 & 23 2 BCD ORE

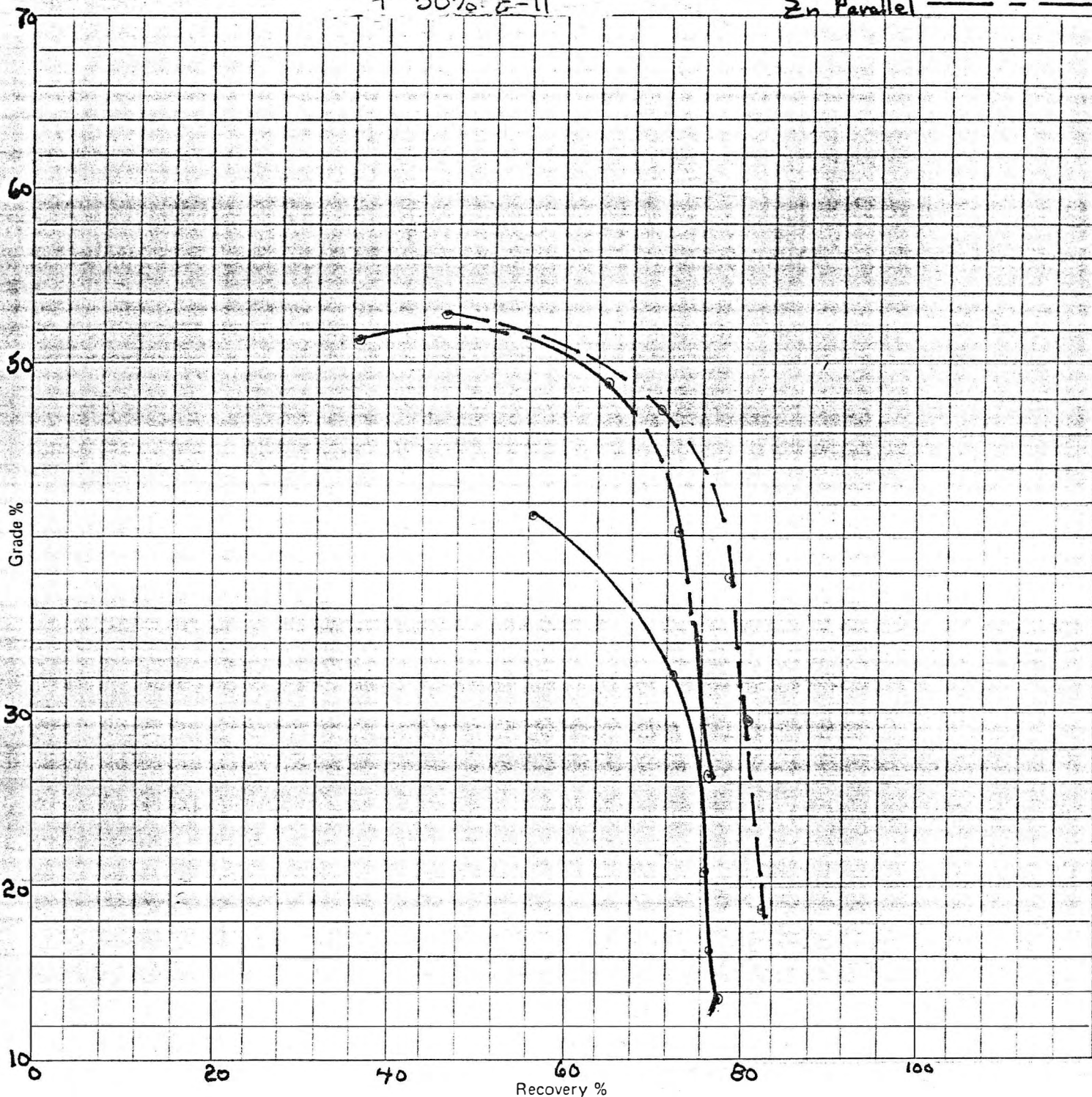
Date: January 4th, 1984

Objective: 2 BCD COND. By Size Test No.

Key: Zn Std. (13)

Reagents: 8 min conditioning tested, for Zn cct + 50% Z-11

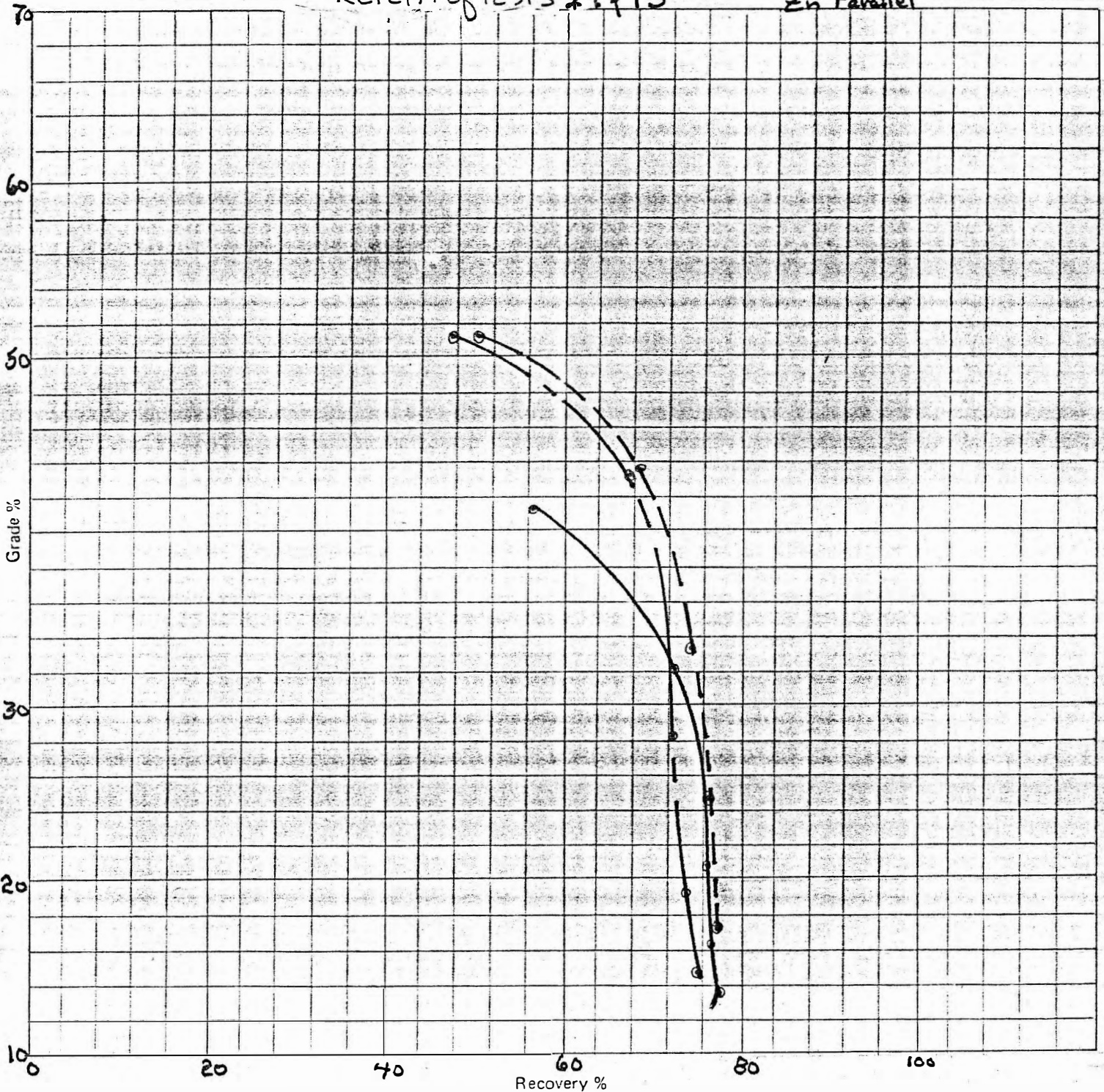
Zn Cond. By Size (22)  
Zn Parallel (10)



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: #24425 2 BCD ORE (Repeat of 4415) Date: January 4th, 1984  
Objective: 2 BCD COND. By Size Test Key: Zn Std. (13)  
Reagents: 8 min conditioning, tested for Zn test Zn Cond. By Size (24)  
REPEAT of TESTS 24415 Zn Parallel (1)

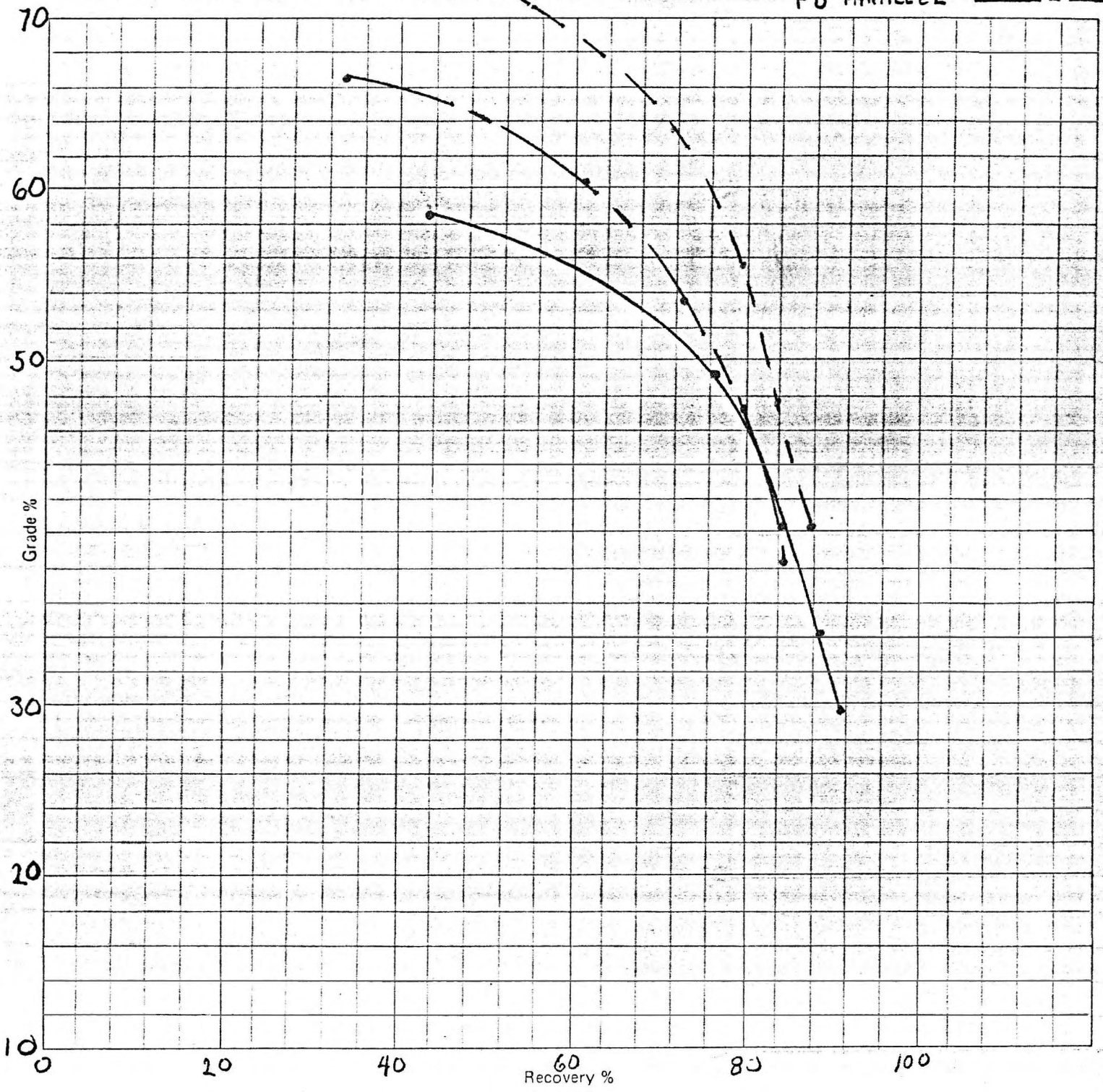


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TESTS #2,3  
Objective: 2 BEFORE COND. BY SIZE TEST (P<sub>80</sub>)  
Reagents: 5 MIN. CONDITIONING for Pb<sub>act</sub>

Date: 89-04-01  
Key: Pb STD. ————— (1)  
Pb COND. BY SIZE - - - - - (2)  
Pb PARALLEL — - - - - (3)



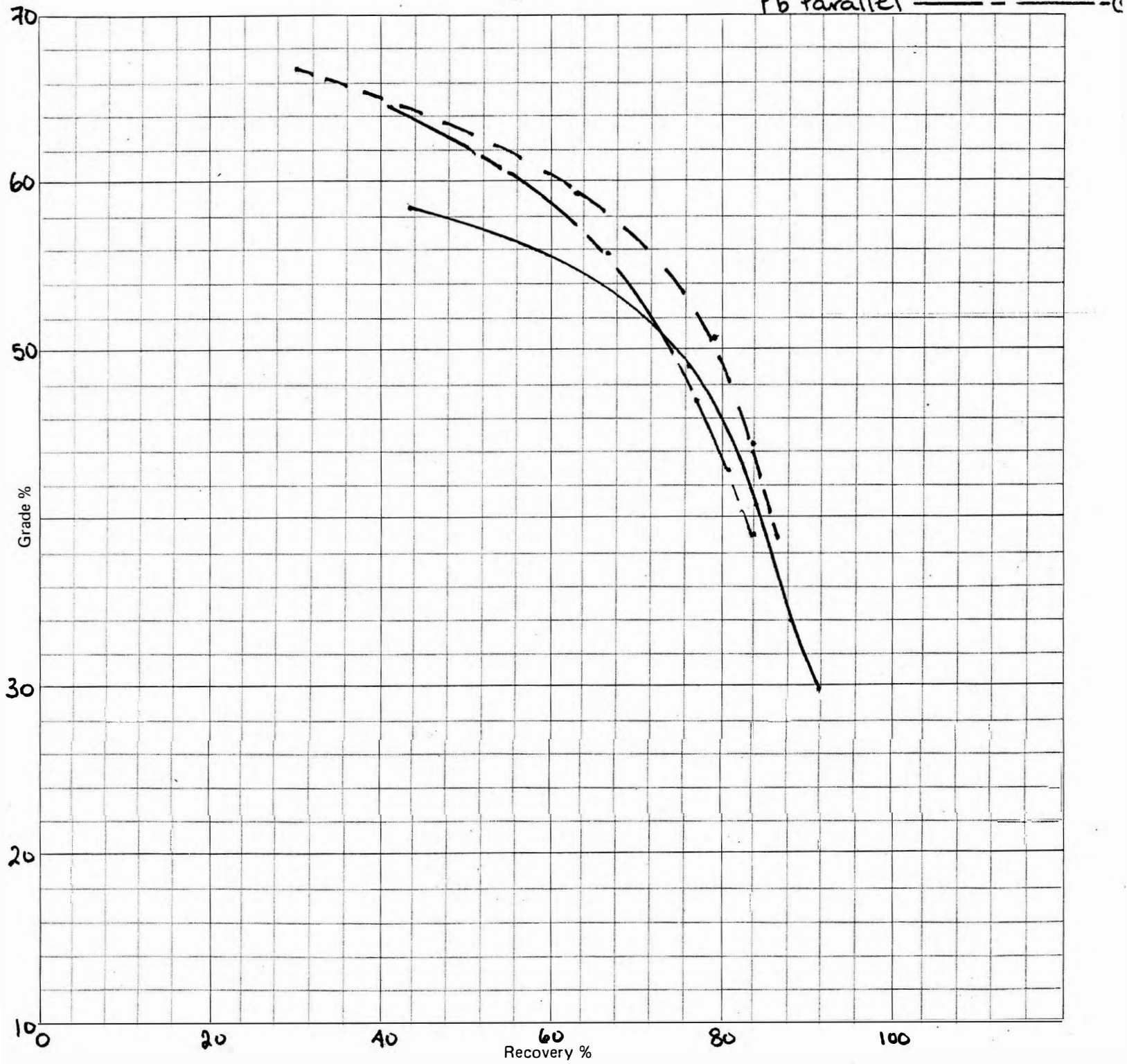
replace previous graph

Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: 4 and 5  
Objective: 2EF Ore Cond by Size Rougher  
Reagents: 2.5 min. conditioning for Pb cct

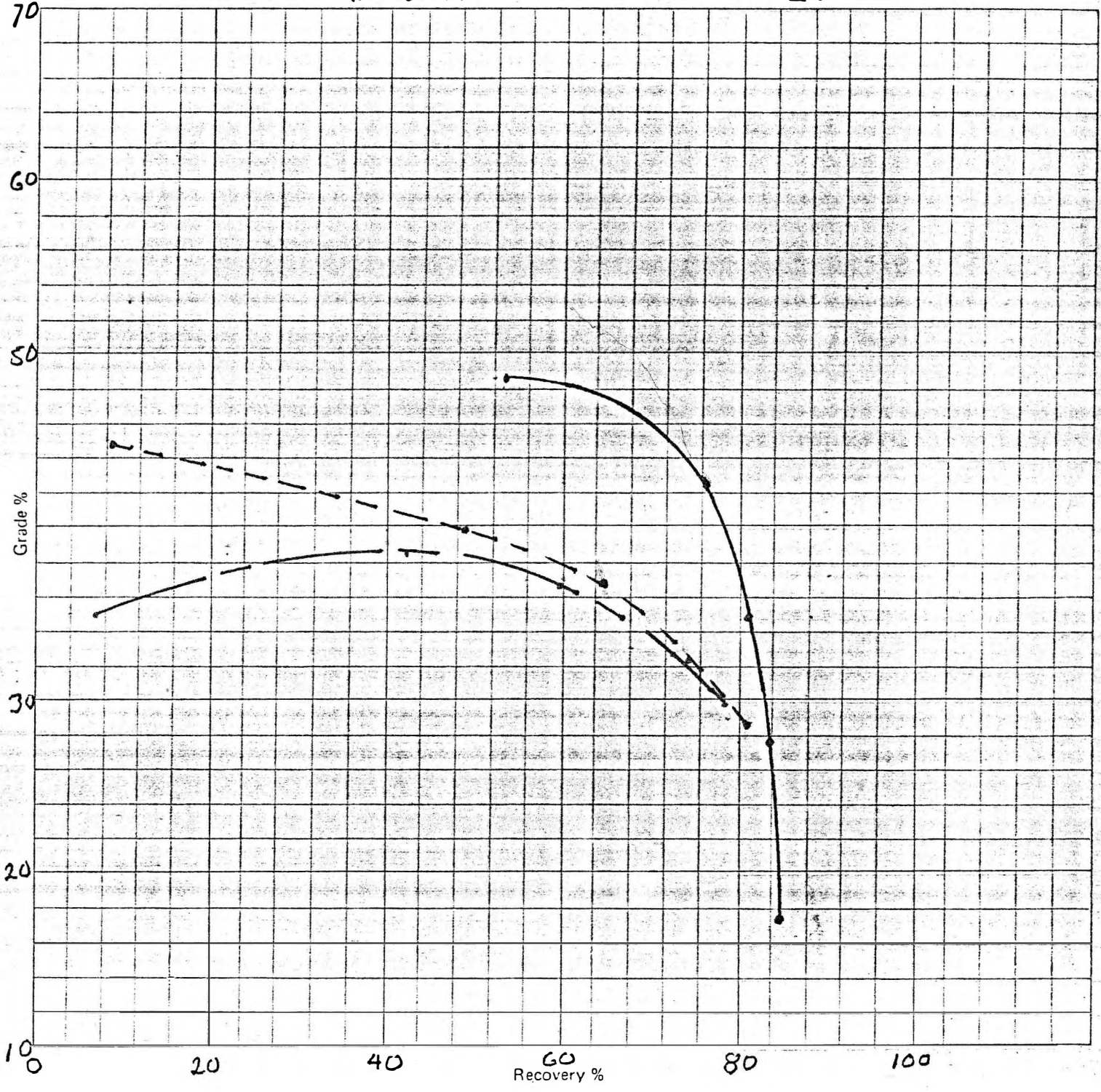
Date: 84-04-01  
Key: Pb Std. \_\_\_\_\_ (1)  
Pb Cond. by Size - - - - - (4)  
Pb Parallel - - - - - (6)



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

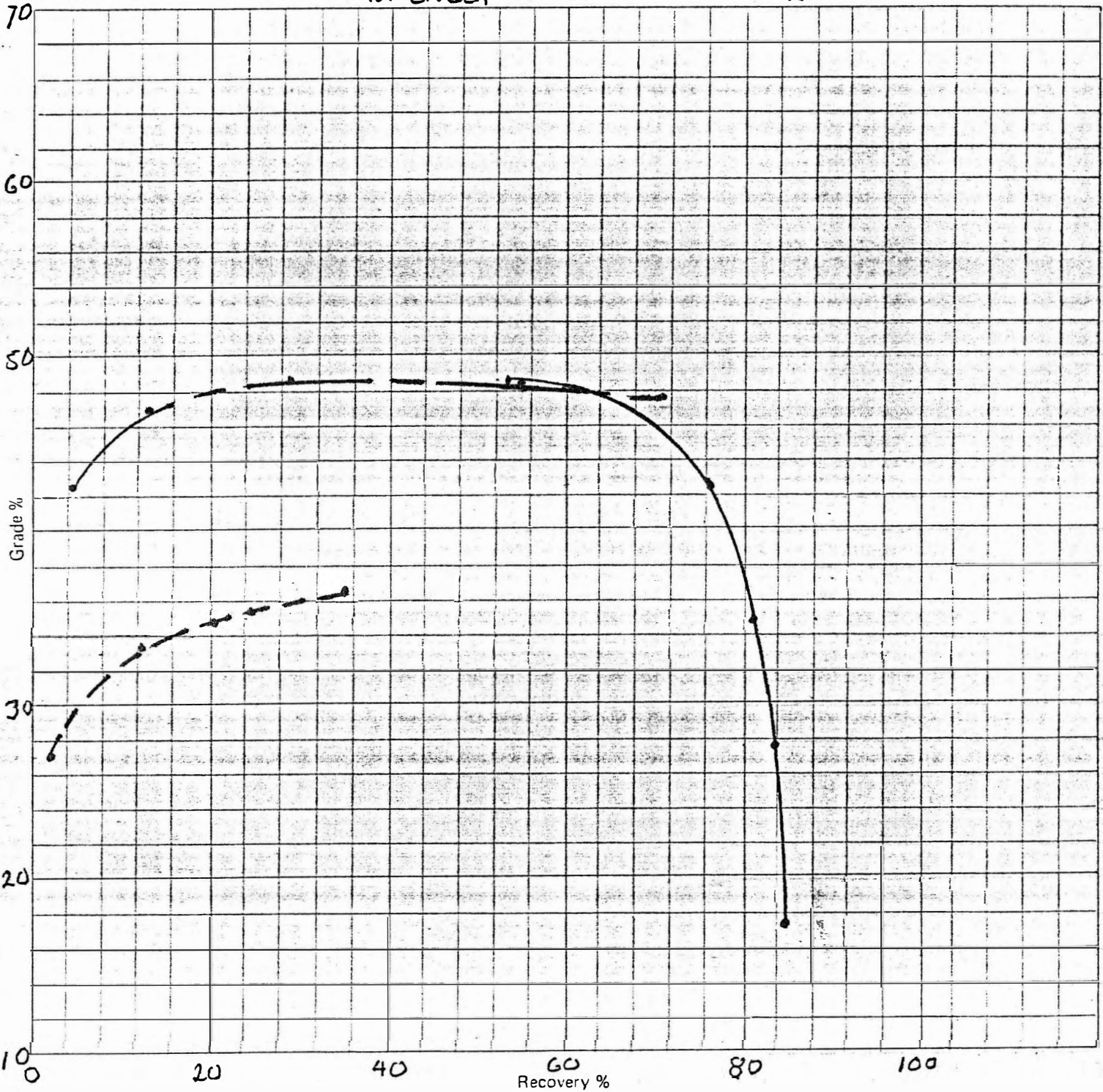
Test No.: TEST # 6,7 Date: 84-04-01  
Objective: 2 BEFORE COND. BY SIZE TEST (Ro) Key: ZN STD. \_\_\_\_\_ (1)  
Reagents: 8 MIN. CONDITIONING ZN COND. BY SIZE - - - - - (2)  
for Zn cct ZN PARALLEL - - - - - (3)



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TEST # 8, 9 Date: 84-04-01  
Objective: 2 EF ORE COND. BY SIZE TEST (R<sub>0</sub>) Key: ZN STD. ————— (1)  
Reagents: 6 MIN. COND., 30/70 CuSO<sub>4</sub> SPLIT ZN COND. BY SIZE - - - - - (3)  
for Zn cct ZN PARALLEL - - - - - (9)



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TEST #10, 11

Date: 84-04-01

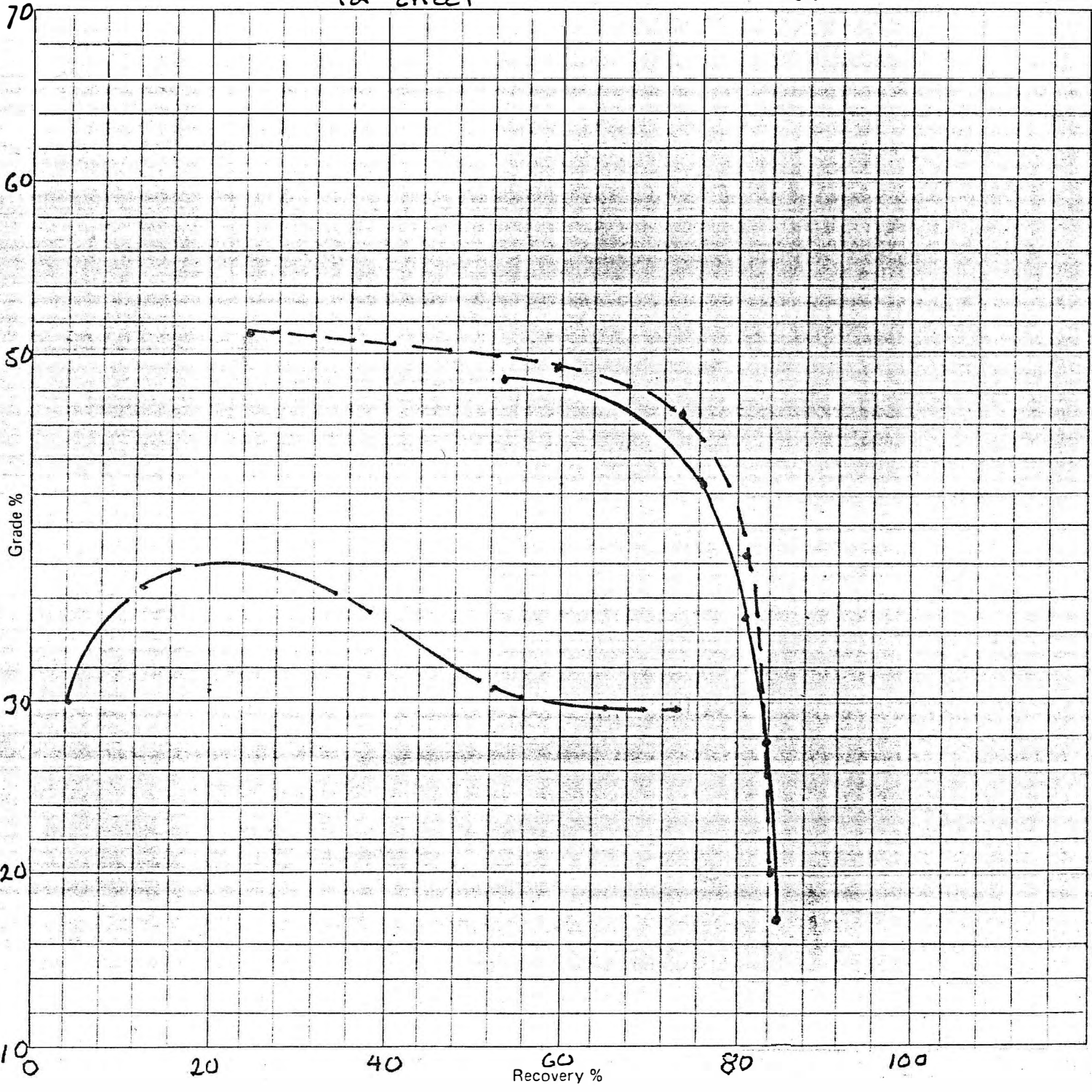
Objective: 2EF ORE COND. BY SIZE TEST (Ro)

Key: ZN STD. ——— (1)

Reagents: 8 MIN. COND. + 50% 2-11  
for Znct

ZN COND. BY SIZE - - - - (1)

ZN PARALLEL - - - - (1)

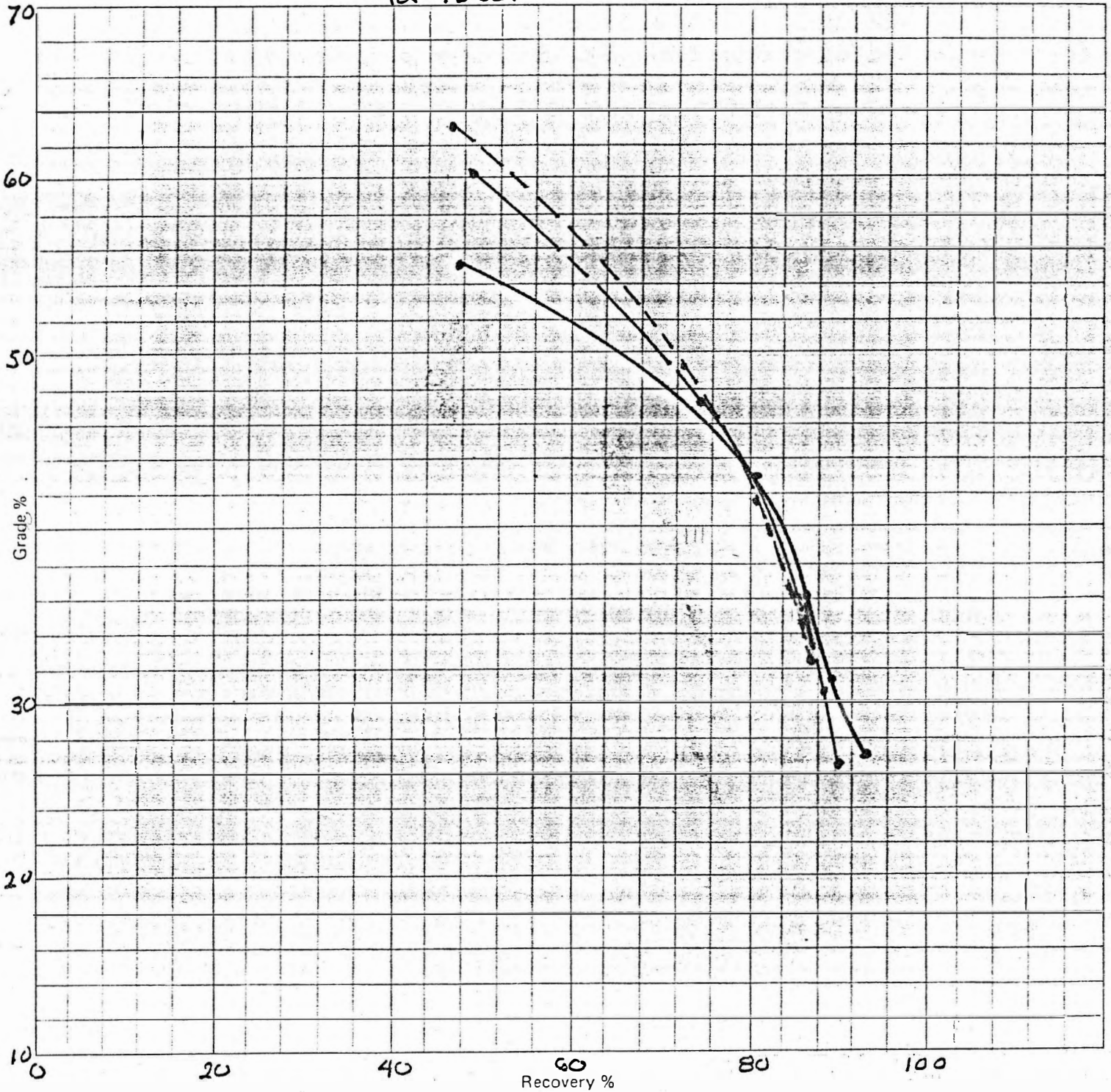


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TEST # 2,3  
Objective: 2H ORE COND. BY SIZE TEST (R<sub>0</sub>)  
Reagents: 5 MIN. CONDITIONING  
for Pb cct

Date: 84-04-01  
Key: Pb STO. \_\_\_\_\_  
Pb COND. BY SIZE - - - - -  
Pb PARALLEL - - - - -

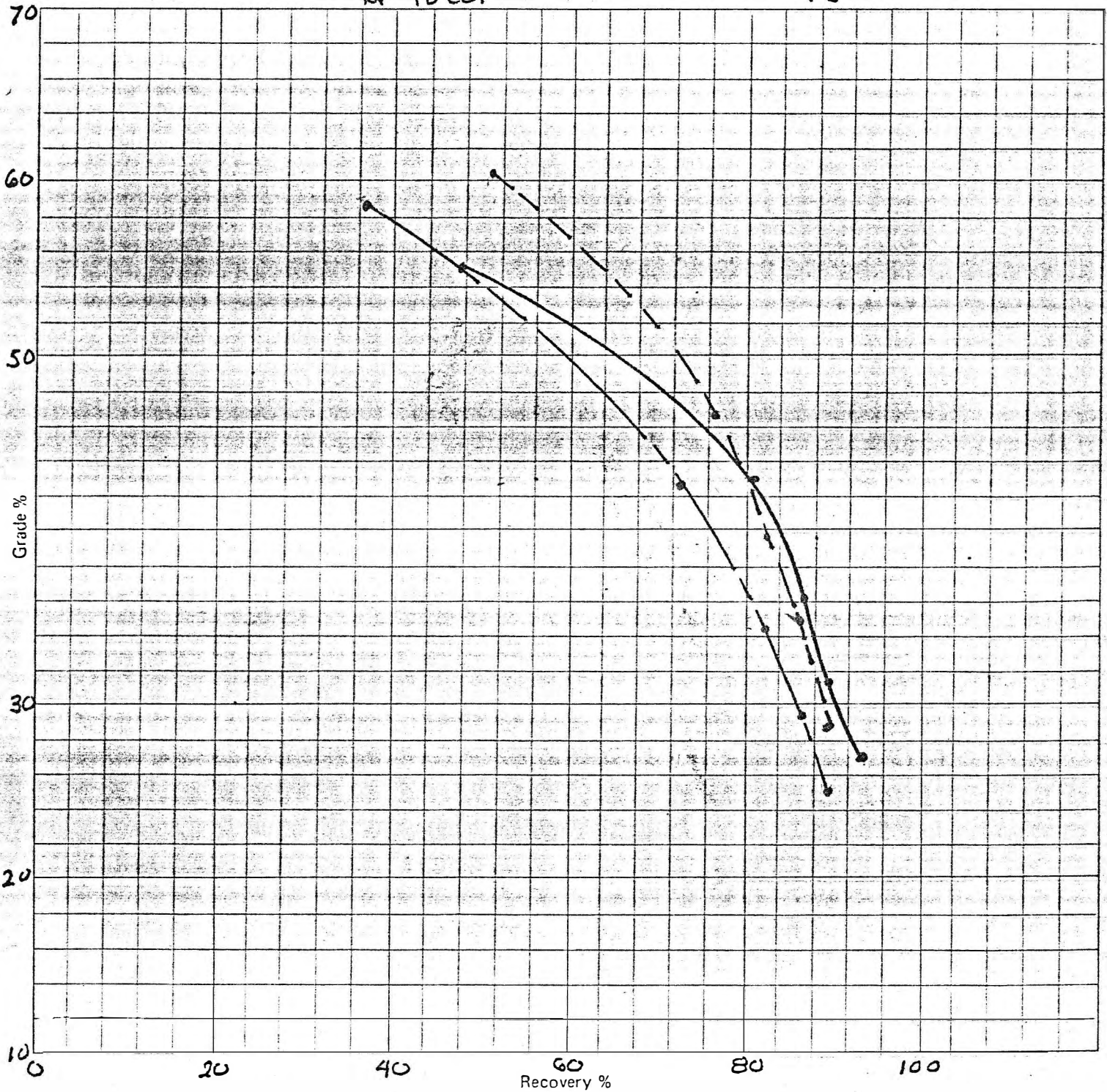


Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TEST #4,5  
Objective: 2H ORE COND. BY SIZE TEST (A<sub>0</sub>)  
Reagents: 2.5 MIN. CONDITIONING  
for Pb cct

Date: 84-09-01  
Key: Pb STO. —————  
Pb COND. BY SIZE - - - - -  
Pb PARALLEL - - - - -



Cyprus Anvil Mining Corporation  
METALLURGICAL TEST REPORT

Grade-Recovery Curve

Test No.: TEST #67  
Objective: 2H ORE COND. BY SIZE TEST (R6)  
Reagents: 8 MIN. CONDITIONING  
for Zn cct

Date: 84-04-01  
Key: ZN STO.  
ZN COND. BY SIZE - - - - -  
ZN PARALLEL - - - - -

