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Item 47

Report on

Cyanidation Leach Studies of Silver State Mine Silver Ore

for

J. C. CARLILE CORPORATION

Project No. 250415 May 27, 1965

Report on

Cyanidation Leach Studies of Silver State Mine Silver Ore

Prepared for

J. C. CARLILE CORPORATION
320 COOPER BUILDING
DENVER, COLORADO 80202

By

Colorado School of Mines Research Foundation, Inc.
Golden, Colorado

Project No. 250415

May 27, 1965

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INTRODUCTION

The J. C. Carlile Corporation was engaged by the Silver State Consolidated Mines, Inc., to design a cyanidation plant for their property near Rochester, Pershing County, Nevada. The J. C. Carlile Corporation engaged the Colorado School of Mines Research Foundation, Inc., to perform the necessary metallurgical test work.

The program was developed by the Research Ftd. personnel in discussion with Mr. George Smith of Silver State Consolidated Mines, Inc., and Messrs. J. C. Carlile, E. E. Bartlett, David Clow, Jr., and Clyde E. Osborn of the J. C. Carlile Corporation. This project was authorized by Mr. J. C. Carlile on April 13, 1965.

Close communication was maintained between the Research Foundation and the J. C. Carlile Corporation to furnish test data as it became available so that design work could proceed without undue delay.

OBJECTIVE AND SCOPE

The objective of this project was to determine the probable metallurgical results of cyanidation leaching of this ore and to establish certain design parameters.

The scope of the program to be conducted by the Research Foundation was as follows:

1. Sample and assay the three lots of ore submitted.

2. Prepare a composite sample of the ores for test work.

3. Make a cursory petrographic examination of the ore in an effort to identify the silver minerals and major detrimental minerals.

4. Conduct a series of cyanidation leach tests to evaluate mesh of grind required, leach time, solution strength, and reagent consumption.

5. Conduct the necessary settling tests for thickener design requirements.

6. Conduct laboratory filtration tests to provide design data and probable plant processing results.

7. Make a Bond ball mill grindability test to provide information on grinding power requirements and grinding mill size.

SUMMARY OF RESULTS

The following results were obtained from the samples submitted by the Sponsor.

1. The three samples of ore had the following average analysis:

	Au oz/ton	Ag oz/ton
No. 1 Blizzard	0.050	15.40
No. 2 Mohawk	0.080	25.36
No. 3 Stokley	0.65	20.57

0.065 – see page 6

2. The equal part composite ore sample had the following average analysis:

Au oz/ton	Ag oz/ton
0.070	20.35

3. The only identifiable silver mineral was ruby silver.

4. The probable effective plant cyanide leaching extraction was:

86.7% Au
88.0% Ag

5. The following cyanide leaching conditions were indicated to be effective:

(a) Mesh of grind: 88.5% minus 200 mesh size.

(b) Leach time: 48 hours.

(c) Cyanide solution strength of about 1.9 pounds per ton of solution.

(d) Approximately 3 pounds of 100 per cent NaCN consumed per ton of ore.

(e) Lime consumption of 7 to 8 pounds per ton of ore of 100 per cent CaO equivalent.

6. The design basis for the thickeners should be:

(a) Thickener following grinding, 2.8 square feet per ton of dry solids per 24 hours.

(b) Thickener following leaching, 3.7 square feet per ton of dry solids per 24 hours.

7. The filter basis should be 2,400 pounds per square foot per 24 hours of dry solids plus a safety factor.

8. The ball mill grinding requirement to grind minus 3/8-inch ore to 88.5 per cent minus 200 mesh size at a rate of 200 tons per day is 205 horsepower. A mill capable of drawing 250 hp should be used.

DISCUSSION

This investigation of Silver State Consolidated Mines, Inc., silver ore from the Rochester District, Pershing County, Nevada, was undertaken to determine the probable metallurgical results using the cyanidation process to recover the gold and silver. Also, certain design parameters were to be obtained which were required for the design of the cyanidation treatment plant.

Others had done laboratory test work indicating that cyanidation would satisfactorily extract the gold and silver from the ore. The work done by the Research Foundation was a continuation of this previous work to verify the metallurgical results and provide additional detail information. The starting point had been established and the work was carried forward to obtain the necessary information to bring the program to a final design stage. Previous work had shown that agitation cyanidation leaching followed by filtration could be used with satisfactory extraction of the gold and silver.

DISCUSSION (continued)

Sample

Three samples of ore were submitted by the Sponsor. These were samples from the Blizzard, Mohawk, and Stokley veins. Each of these samples were crushed, sampled, and assayed. Equal portions of each of the crushed samples were blended together as a composite sample for the test work. All of the head samples were fire assayed for gold and silver using duplicate samples to indicate accuracy of sampling and assaying. The following table summarizes these results.

CSMRF Sample No.	Designation	Sample	Fire Assay Au oz/ton	Fire Assay Ag oz/ton
1	Blizzard	Original	0.050	15.41
		Duplicate	0.055	15.40
2	Mohawk	Original	0.075	25.27
		Duplicate	0.090	25.46
3	Stokley	Original	0.070	20.87
		Duplicate	0.065	20.27
	Average 1, 2, 3	Original	0.065	20.52
		Duplicate	0.070	20.38
4	Composite	Original	0.070	20.71
		Duplicate	0.075	19.99

The results indicate that satisfactory sampling, assaying, and compositing were obtained.

DISCUSSION (continued)

The details of the samples and their preparation are in Exhibit 1 of the Appendix.

Petrographic Examination

The heavy minerals, plus 3.25 specific gravity, were studied to determine the occurrence of silver and other heavy minerals in the ore. Ruby silver was the only silver mineral identified. Other heavy minerals identified were pyrite, goethite, sphalerite, galena, covellite, and tetrahedrite-tennantite. Of the heavy minerals, 97 per cent were pyrite, sphalerite, and goethite with covellite, tetrahedrite-tennantite, galena, and ruby silver as minor constituents occurring as less than 3 per cent.

The detailed petrographic examination is presented in Exhibit 2 of the Appendix.

Cyanidation

Cyanidation tests were made in an effort to determine several factors as follows: probable recovery of gold and silver, grinding mesh size for acceptable extraction, required leaching time, pulp density, cyanide solution concentration, cyanide consumption, lime consumption, settling, and filtering characteristics.

All of the cyanidation tests were made using the rolling bottle technique. This is a technique long used in laboratory testing of gold and silver ores by cyanidation. The results obtained by this technique can be translated into continuous agitation leaching practice. The rolling bottle technique, as its name implies, uses a bottle with an air opening in one end in which the ore and leach solution are agitated by rolling, using a set of mechanically driven rolls. Essentially, it is a laboratory means to mechanically agitate and aerate the pulp under controlled conditions for a prescribed length of time.

The details of the cyanidation tests are presented in Exhibit 3 of the Appendix.

Gold and Silver Recovery

The recovery of gold and silver based on laboratory work must be considered on two bases, i.e., as maximum test recovery and as probable plant recovery. Most of the tests were made in a manner in which all of the soluble

DISCUSSION (continued)

gold and silver values were thoroughly washed free from the solids. In practice, however, this is impractical to achieve.

Changes in ore grade could greatly affect recovery or extraction. If the ore type were to remain the same but contain less gold and silver, the tailing could likely contain about the same amount of gold and silver but the recovery would be lower. Conversely, higher gold and silver content of the ore could produce higher recoveries.

It necessarily follows that the recoveries obtained in this program are based on the ore samples submitted. Plant recoveries should be comparable if the samples were representative of the orebody. The following table summarizes the gold and silver recoveries obtained.

Cyanidation Test No.	Fire Assay Tailing		Per Cent Recovery or Extraction	
	Au oz/ton	Ag oz/ton	Au	Ag
11	0.005	1.45	92.9	93.0
19	0.010	2.33	86.7	88.0

Test No. 11 was made with thorough washing and indicates maximum practical laboratory recovery. Test No. 19 was made with laboratory test leaf filtration and washing, and indicates more probable plant practice recovery. The recoveries were a computation based on head and tailing assays with the solution extraction obtained by difference.

DISCUSSION (continued)

Grind-Mesh Size

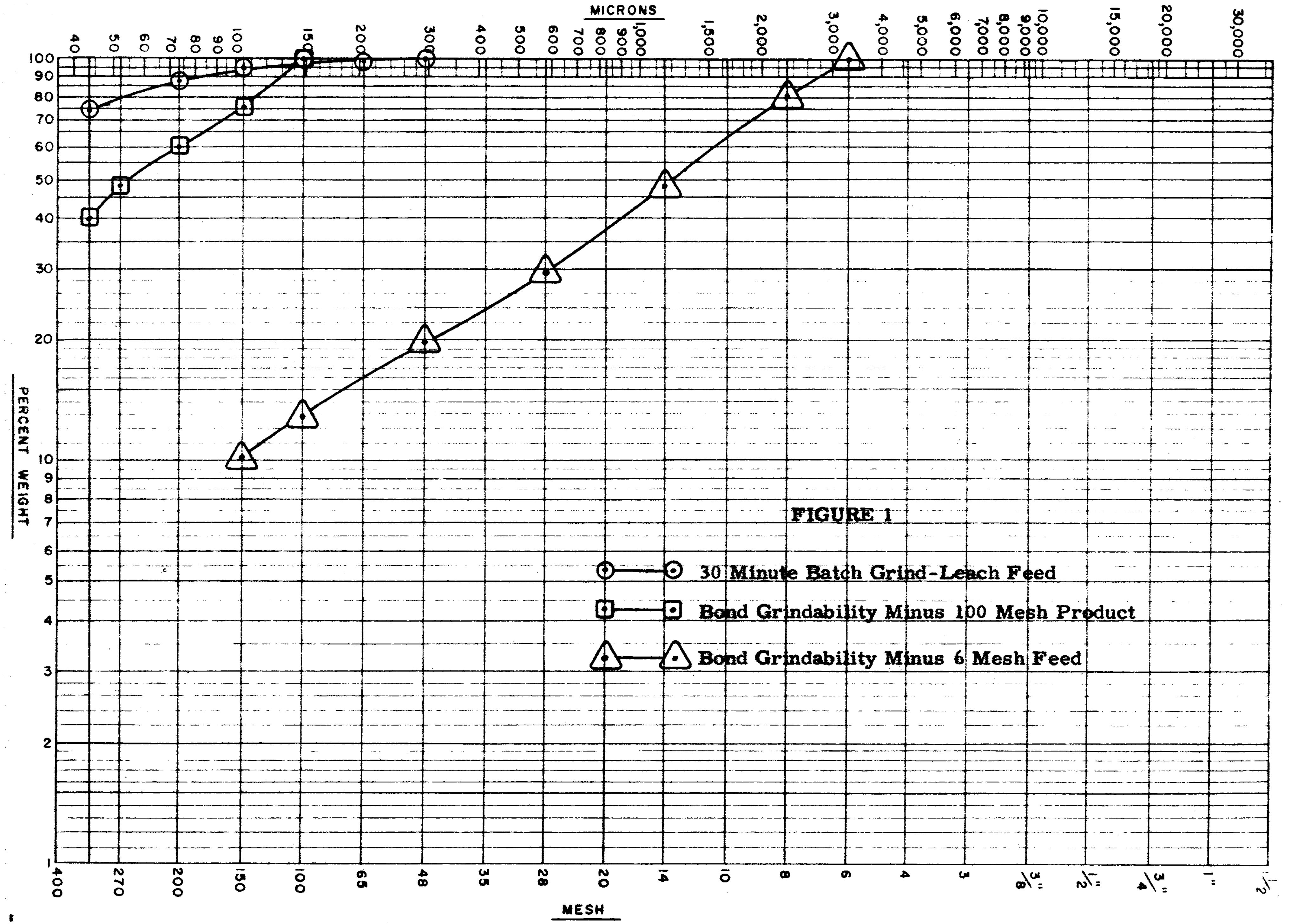
Several tests were made on various sizes of ore to determine the best grind to obtain acceptable recovery of gold and silver. The ore was crushed to minus 20 mesh size and cyanidation tests were made on this material. Batches of minus 20 mesh size ore were ground in a laboratory ball mill for 5, 10, and 30 minutes to obtain a range of product sizes for cyanidation testing. The following table illustrates the effect of grinding size on extraction of gold and silver.

Cyanidation Test No.	Grinding Time min	Per Cent Passing 200 Mesh Size	Per Cent Extraction	
			Au	Ag
1	0	17.9	78.6	72.7
7	5	40.2	92.9	80.9
3	10	53.4	85.7	86.5
5	30	88.5	92.9	91.6

The finer the grind the higher the extraction of gold and silver. There was one anomaly in gold extraction in Test No. 7 but this result was not supported by other test work.

There was one other aspect to the grinding size which needs to be discussed, and that was size distribution. In general, plant practice will use a closed circuit grinding system for fine ball mill grinding. This is the most efficient means to obtain optimum liberation or exposure of minerals. The laboratory batch ball mill grinding procedure more closely approaches an open circuit grinding operation since there is no classification and recycle. The batch cyanidation tests indicated that a nominal minus 100 mesh size and about 88.5 per cent minus 200 mesh size product was required for good leaching. A Bond grindability test was made to produce a 100 per cent passing minus 100 mesh size product. This test uses a highly efficient closed circuit grinding operation. The size consist of this product was entirely different from that obtained in the batch ball mill. Figure 1 shows the size distribution of a batch ball mill grind for a cyanidation test, and the feed and products from the Bond grindability test. The curves for the Bond test were nearly parallel indicating probable size distribution slope for a closed circuit crushing or grinding operation. The actual plant grinding mill product will probably have a size distribution somewhere between the batch grind product and the Bond grind product but more closely approaching the Bond product.

Cyanidation Test No. 5 (batch grind) had 88.5 per cent minus 200 mesh size material while the Bond grindability test had only 59.5 per cent minus 200 mesh size material. Both were essentially all minus 100 mesh size. Cyanidation Test No. 18 was run on the Bond grindability test product and is compared to a batch grind product in Cyanidation Test No. 5 as follows.


MICRONS
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30,000
PERCENT WEIGHT
MESH
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270
200
150
100
65
48
35
28
20
14
10
8
6
4
3
3/8"
1/2"
3/4"
1"
1 1/2
30 Minute Batch Grind-Leach Feed
Bond Grindability Minus 100 Mesh Product
Bond Grindability Minus 6 Mesh Feed

FIGURE 1

Cyanidation Test No.	Per Cent Passing 200 Mesh Size	Per Cent Extraction	
		Au	Ag
5	88.5	92.9	91.6
18	59.5	73.3	53.8

The 100 per cent passing 100 mesh size in closed circuit grinding, as shown by Test No. 18, is not a fine enough grind. A grind of about 88.5 per cent minus 200 mesh size will be required. This will be a grind of about 100 per cent minus 90 micron size or slightly finer than a 150 mesh size grind.

Leach Time

At least two tests were made at each grind size, one for 48 hours leach time and the other for 72 hours. The 48 hours leach time was indicated as being satisfactory from previous work. Information was desired on longer leaching time to be certain that the time factor was not being overlooked. The following data illustrate the effect of leach time.

Cyanidation Test No.	Leach Time hr	Per Cent Passing 200 Mesh Size	Per Cent Extraction	
			Au	Ag
1	48	17.9	78.6	72.7
2	72	17.9	78.6	75.5
5	48	88.5	92.9	91.6
6	72	88.5	92.9	91.3

On the coarse grind, Tests No. 1 and 2, there was a slight improvement in silver extraction with longer, 72 hour, leach time. The extraction, however, was not acceptable. The fine grind, Tests No. 5 and 6, indicated no improvement in leaching beyond 48 hours.

Pulp Density

The projected plant was to leach at 50 per cent solids so that minimum size agitation tanks could be used. This, however, had to be checked to determine whether or not a more dilute pulp would be beneficial. Tests were made on all grind sizes at 25 per cent solids and 50 per cent solids pulp. The following table demonstrates the effect of pulp per cent solids.

Cyanidation Test No.	Pulp Solids %	Per Cent Passing 200 Mesh Size	Per Cent Extraction	
			Au	Ag
1	50	17.9	78.6	72.7
9	25	17.9	71.4	74.2
5	50	88.5	92.9	91.6
11	25	88.5	92.9	93.0

At both grind sizes there was a slight improvement in silver extraction using the more dilute, 25 per cent, solids pulp. The improvement was not felt to be significant enough to warrant the longer agitation equipment that would be required.

Cyanide Solution Concentration

The strength or concentration of cyanide solution can have an affect on dissolution, especially silver. A series of tests were made to evaluate this factor. The following table covers all of the comparative tests.

Cyanidation Test No.	NaCN Strength lb/ton solution	Per Cent Passing 200 Mesh Size	Per Cent Extraction Au	Per Cent Extraction Ag
13	1.0	17.9	71.4	74.5
9	1.9	17.9	71.4	74.2
14	3.9	17.9	78.6	87.7
15	1.0	53.4	92.9	82.1
10	1.9	53.4	78.6	87.7
16	3.9	53.4	92.9	93.0

These test results indicate that the stronger the cyanide solution the greater the extraction, particularly with respect to silver. The gold extraction was in this order for the coarse grind, but an anomaly occurred between Tests No. 15 and 10. This was not pursued as the silver recovery was more significant. The silver extractions were in order with respect to solution strength.

The solution strength of 1.9 pounds per ton of solution was accepted as being reasonable and was used for subsequent test work. The higher strength solution could be used and certainly should be considered in an operating plant if extraction falls off. The higher solution strength, however, will result in greater cyanide losses in the filter cake and any bleed stream.

Cyanide Consumption

The cyanide consumption was computed for every test. The consumption ranged from 1.84 pounds per ton of ore to 3.46 pounds per ton of ore as 100 per cent sodium cyanide. The tests on fine grind ore, 88.5 and 93.0 per cent minus 200 mesh size, ranged from 2.30 to 3.08 pounds per ton of ore of 100 per cent sodium cyanide. This indicates that the probable consumption would be about 3 pounds of 100 per cent sodium cyanide per ton of ore.

Lime Consumption

The lime consumption was also determined for every test. This ranged from 3.93 to 7.42 pounds of CaO (100 per cent) per ton of ore. The fine grind ore tests had a range of 5.49 to 7.42 pounds of CaO (100 per cent) per ton of ore. A conservative basis would be to plan on 7 to 8 pounds of 100 per cent CaO equivalent per ton of ore. Using distilled water, this would give a pulp with a pH of 12 to 12.4. The actual plant water supply may change this lime consumption in either direction depending on its quality.

Settling Tests

Settling tests were made to provide design information for the proposed thickeners, one ahead of the leach tanks and one following the leach tanks. The details of these tests are reported in Exhibit 4 of the Appendix. Settling test data are presented in the Appendix for the four grinds tested. The important data are related to the fine ground ore which was the proposed leach size material.

Three tests were made to provide design data for the thickener following the grinding circuit and ahead of the leach tanks. The tests differ as to the per cent solids in the feed pulp. They were all on 30-minute wet ground ore sized at 93 per cent minus 200 mesh size. The following table summarizes these results.

Settling Test No.	Feed Solids %	19-Hour Compaction Solids %	Settling Rate ft/hr	Area sq ft/ton dry solids/24 hr(1)
5	10.3	58.8	7.0	1.90
6	17.6	59.8	3.7	1.80
7	26.0	61.0	1.29	2.84

1/ Area computed with a 25 per cent safety factor.

This thickener should be designed on the basis of 2.8 square feet per ton of dry solids per 24 hours. A solids residence time of less than the conventional 19 hours would be satisfactory as the desired underflow was only 50 per cent solids. Settling Test No. 3 gave a 48.1 per cent solids underflow in 30 minutes settling time.

To determine the thickener design basis for the proposed thickener following the leach tanks and ahead of the filters, three tests were made. These tests were on three levels of feed pulp density. These were made on pulp used in the first series of filter tests, and the grind was 93 per cent minus 200 mesh size. The following table presents the main test data.

Settling Test No.	Feed Solids %	19-Hour Compaction Solids %	Settling Rate ft/hr	Area sq ft/ton dry solids/24 hr(1)
8	32.9	65.9	0.75	3.38
9	41.8	67.3	0.41	3.70
10	48.6	68.1	0.27	3.64

1/ Area was computed with a 25 per cent safety factor.

The design area basis should be 3.7 square feet per ton of dry solids per 24 hours. These tests show that a feed of about 65 per cent solids to filter could be obtained.

Filtration

One of the key operations in the proposed plant will be the filtration section. The efficiency of the filters will determine the final recovery of the soluble gold and silver and the loss of cyanide and lime.

Two series of laboratory test leaf filtration tests were made to provide the necessary data for filter design. The first series of tests were made using two filter stages with fresh wash water only on the second stage. In a second series of tests, two stages of filtration again were used; however, the first stage filter cake was washed with pH 12 lime water to simulate a barren solution wash. The first stage filter cake was repulped with pH 12 lime water, simulated barren solution, and filtered on a second stage. The second stage cake was washed with fresh water.

The pulp used for the filtration tests was from a 48-hour cyanide leach test using about 1.9 pounds NaCN per ton of solution strength and a 93 per cent minus 200 mesh size grind. The details of all of the filtration tests are shown in Exhibit 5 of the Appendix.

To illustrate the effectiveness of filtration and washing with a simulated barren solution, the following data are tabulated.

DISCUSSION (continued)

Filtration Test No.	Filter Stage	Washing	Per Cent Extraction Au	Per Cent Extraction Ag
14	1st	No	46.7	67.2
17	1st	Yes	73.3	85.8
20	2nd	Yes	86.7	88.0

The difference between Tests No. 14 and 17 demonstrate the effectiveness of first stage washing. Test No. 20 shows the probable plant operational results.

The principal design information obtained in these tests was the filter rate or capacity data. The tests were conducted with a 0.1 square foot test leaf using a drum filter cycle and with 20 to 21 inches of mercury vacuum. Several filter cycles were used with a 2 rpm normal pickup cycle appearing to be the best. The following table shows average cake rates of similar tests but of varying pulp density using Cotton Duck No. 33 filter cloth.

Filtration Test No.	Filter Stage	Feed Pulp Solids %	Average Filter Rate Solids lb/sq ft/24 hr(1)
1, 2, 4	1st	50	2602
5 thru 9	2nd	46.8	1519
13	2nd	68.3	5160
14 thru 17	1st	50	2392
18 thru 21	2nd	48.7	2085

1/ Test rates are without a safety factor.

These results indicate the beneficial effect of higher pulp density on filter rate solids capacity. The preceding data are also presented in Figure 2. This graphical representation of the data indicates a nearly straight line relationship between filter rate and feed per cent solids in the area of plant design. Based on the test work, it is recommended that the plant filters be designed on a feed of 50 per cent solids to both filters. Thus, a filter cake rate of 2400 dry pounds of solids per square foot per 24 hours plus a safety factor could be used as a design basis. The known safety factors recommended by filter manufacturers range from 0.65 to 0.80 of the test capacity.

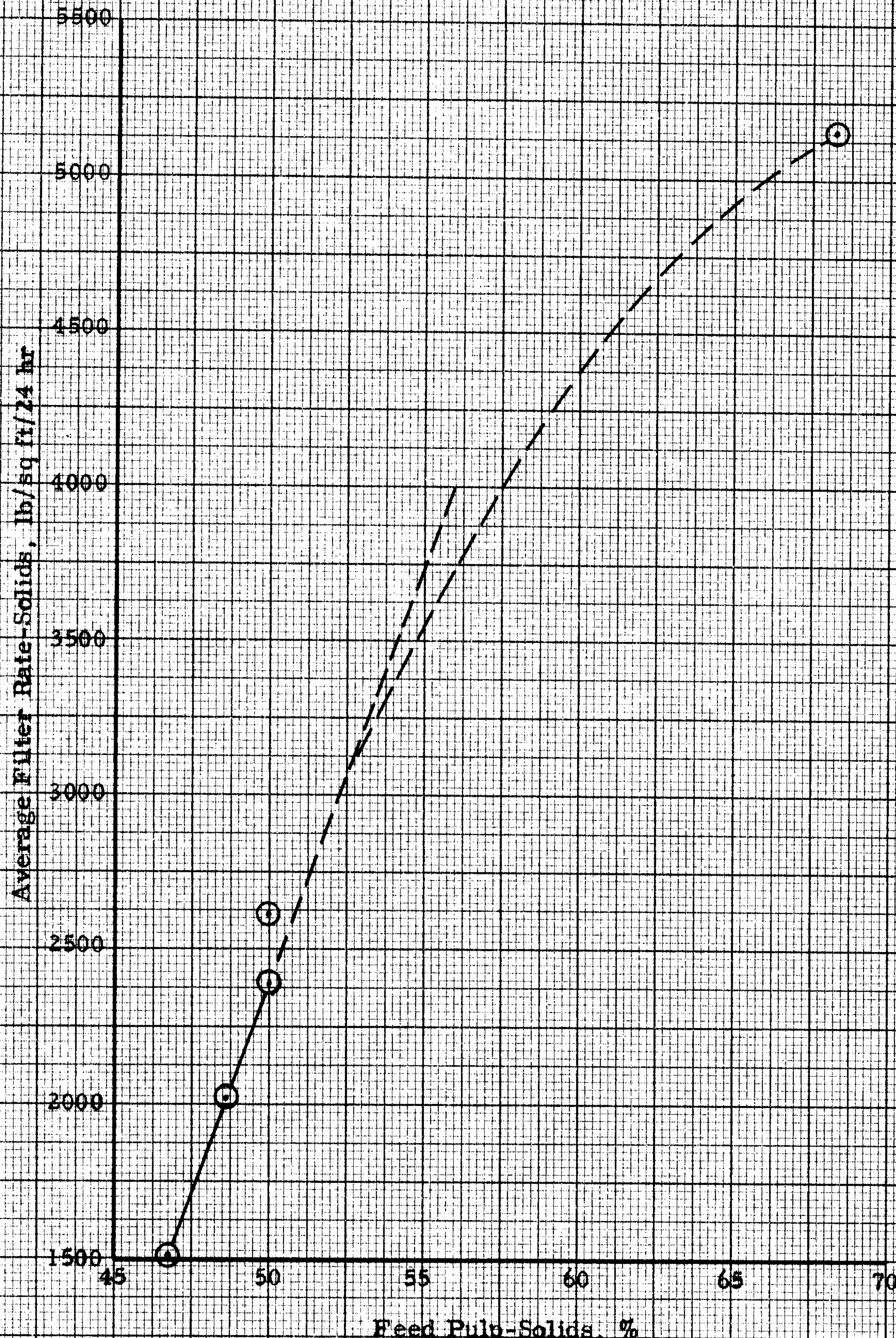
Test No. 13 shows that an exceptionally high filter rate can be obtained with feed pulp density of about 68 per cent solids. This fact can provide an additional margin of safety in plant operating capacity, and settling tests indicate that pulp densities this high can be obtained as a thickener underflow. However, washing efficiency with high pulp density feed material of about 68 per cent solids was not as good as it was at 50 per cent solids pulp as shown by the following table.

Filtration Test No.	Feed Pulp Solids %	Per Cent Extraction	
		Au	Ag
12	46.8	85.7	86.7
13	68.3	71.4	82.4

These were both second stage filter tests with washing.

FIGURE 2

Filter Rate versus Feed Pulp



Bond Grindability Test

A Bond ball mill grindability test was made to determine the power and size of the ball mill required for the proposed plant. The Bond grindability test used a laboratory ball mill grinding technique which develops a work index number. The work index number is empirical and can be translated to grinding power requirements and grinding mill size. A Bond ball mill work index "Wi" of 14.49 for a minus 100 mesh size grind was obtained. This work index number can, in general, be used for a limited range of grind sizes finer or coarser than the test grind. The details of this test are given in Exhibit 6 of the Appendix.

The projected plant was 200 tons per day of feed ore with a minus 3/8 inch feed to the ball mill and an 88.5 per cent minus 200 mesh size product. The computed power requirement was 205 hp. Using a conservative basis, this would call for a 250 hp motor which is obtainable with an 8-foot by 6-foot mill. Some manufacturers provide a nominal 7-foot diameter mill which is reported to be capable of drawing 250 hp.

Screen Tests

The various test products were screened to determine their size distribution. The significance of the screen data was related directly to the particular test. These screen tests are presented in Exhibit 7 of the Appendix.

Report on

Cyanidation Leach Studies of Silver State Mine Silver Ore

APPENDIX

Project No. 250415

May 27, 1965

EXHIBIT 1

SAMPLE DESCRIPTION AND PREPARATION

CSMRF Sample No. 1

Sponsor's Designation of Sample:	No. 1 Blizzard.
Date Received at Foundation:	April 14, 1965.
Sample Weight:	52 lb.
Container:	Paper bag.
Sample Description:	The ore was about -3" size, slightly damp, but not wet.
Method of Preparation:	The total sample was crushed to -6M and about 5.5 kg split out. It was crushed in a jaw crusher to -6M. The 5.5 kg split was crushed to -20M size and dried. A head sample, petrographic sample, and composite sample were split out of this -20M material.

	Chemical Analysis		
	Au oz/ton	Ag oz/ton	Moisture %
Head	0.050	15.41	0.58
Duplicate Head	0.055	15.40	

EXHIBIT 1

CSMRF Sample No. 2

Sponsor's Designation of Sample: No. 2 Mohawk.

Date Received at Foundation: April 14, 1965.

Sample Weight: 49 lb.

Container: Paper bag.

Sample Description: This ore was about -3" size, slightly damp but not wet.

Method of Preparation: Same as for Sample No. 1.

	Chemical Analysis		
	Au oz/ton	Ag oz/ton	Moisture %
Head	0.075	25.27	0.36
Duplicate Head	0.090	25.46	

EXHIBIT 1

CSMRF Sample No. 3

Sponsor's Designation of Sample:	No. 3 Stokley.
Date Received at Foundation:	April 14, 1965.
Sample Weight:	64 lb.
Container:	Paper bag.
Sample Description:	The ore was about -3" size, slightly damp, but not wet.
Method of Preparation:	Same as for Sample No. 1

	Chemical Analysis		
	Au oz/ton	Ag oz/ton	Moisture %
Head	0.070	20.87	0.46
Duplicate Head	0.065	20.27	

EXHIBIT 1

CSMRF Sample No. 4

Sample Description: Composite of Samples No. 1, 2, and 3, -20M size.

Method of Preparation: From each of Samples No. 1, 2, and 3, 4,000 grams were split out and combined for a composite head sample. The composite was rolled 50 times for blending and a head sample and test samples were split out, all splitting was with a Jones splitter.

Chemical Analysis

	Au oz/ton	Ag oz/ton
Head	0.070	20.71
Duplicate Head	0.075	19.99

X-Ray Scan Analysis (Approximate)

Fe %	Pb %	As %	Cu %	Zn %	Ca %
5-10	1	0.3	0.1	0.3	0.1

EXHIBIT 1

CSMRF Sample No. 5

Sample Weight:	16.8 kg.
Sample Description:	Composite of Samples No. 1, 2, and 3, -6M.
Method of Preparation:	From each of samples No. 1, 2, and 3, 5600 grams of -6M ore was split out and blended. The required samples were split out for the Bond Grindability Test No. 1 and Cyanidation Tests No. 18 and 19.

	Chemical Analysis	
	Au oz/ton	Ag oz/ton
Head	0.075	19.39

EXHIBIT 2

MINERALOGRAPHIC EXAMINATION OF SILVER ORE

Introduction

Three samples were submitted for a petrographic study to determine mineral content of opaque minerals, approximate percentage, and approximate size of any silver-bearing minerals present. Part of each sample was ground and subjected to a heavy liquid separation using methylene iodide (SG = 3.25). The heavy portion was then made into polished sections for the mineralographic study. A slab was cut from each of the rock fragments and a polished section made from these to be used with the polished sections of the grains in the study.

Results

The polished sections were studied under the metallographic microscope and the following results were found. The percentages in this report are based on a purely visual estimate.

Sample No. 1 was found to contain pyrite, goethite, sphalerite, galena, covellite, tetrahedrite-tennantite, and ruby silver as the ore minerals.

Covellite was found as incorporated with the gangue minerals and locked with tetrahedrite-tennantite in the rock slab polished section. None was found in the polished section of the heavy liquid concentrate; therefore it is difficult to give an accurate percentage of this mineral, but it occurs as less than 5%.

In the grain mount, tetrahedrite-tennantite was found locked in pyrite. It occurred in less than 1% of the sample. Galena was found both as discrete particles and locked with sphalerite and made up less than 1% of the sample. Pyrite, sphalerite, and goethite make up the major portion of the sample with pyrite composing approximately 45 to 48%, goethite 30%, and sphalerite 20%. One grain of ruby silver was found occurring as a discrete particle of 0.055 mm size.

Sample No. 2 consists of pyrite, sphalerite, goethite, hematite, covellite, tetrahedrite-tennantite, galena, and ruby silver.

Mineralographic Examination of Silver Ore (continued)

The major portion of the sample is composed of pyrite, sphalerite, and goethite. Pyrite comprises 40% of the sample occurring both as discrete particles, occasionally locked with sphalerite, and a few grains locked with tetrahedrite-tennantite; the sphalerite, 20 to 25% of the sample and occurring as discrete particles and occasionally with locked galena; the goethite comprises 30 to 35%. The hematite comprises less than 5% of the sample.

Covellite, tetrahedrite-tennantite, galena, and the ruby silver comprise less than 3% of the sample. Covellite is found as discrete grains and locked with tetrahedrite-tennantite. The ruby silver ranges in size from a particle of 0.041 mm to 0.112 mm occurring as discrete grains and one grain found locked with sphalerite. The ruby silver appears to be proustite.

Sample No. 3 consists of pyrite, sphalerite, goethite, galena, covellite, tetrahedrite-tennantite, and ruby silver.

A few grains of pyrite locked with sphalerite were observed, but the majority occur as discrete particles. The pyrite makes up approximately 35 to 40% of the ore minerals, with sphalerite 30% and goethite 30%.

Tetrahedrite-tennantite, covellite, galena, and ruby silver make up less than 3% of the ore minerals. The tetrahedrite-tennantite occurs locked with covellite and occasionally with pyrite. The galena occurs as discrete particles and occasionally small grains are locked with sphalerite. The ruby silver was found occurring as discrete particles in sizes ranging as large as 0.112 mm.

Conclusions

The ore minerals in the three samples are composed of pyrite, sphalerite, goethite, covellite, tetrahedrite-tennantite, galena, and ruby silver. The pyrite, sphalerite, and goethite make up 97% of the sample with covellite, tetrahedrite-tennantite, galena, and ruby silver as minor constituents occurring as less than 3%.

The covellite occurs as discrete particles and also locked with tetrahedrite-tennantite. The ruby silver occurs as discrete particles. Sample No. 2 contains a larger percentage of the ruby silver but still less than 1% of the sample.

EXHIBIT 3

CYANIDATION TESTS

Cyanidation Test No. 1

Purpose: To run a series of tests to determine the best grind size for cyanidation at 48 hr leach time.

Sample: Composite Sample No. 4, 17.9% -200M, 200 grams, see Screen Test No. 1.

Procedure: The sample was leached for 48 hr using about 1.9 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.015	5.66	21.4	27.3
Solution(1)				78.6	72.7

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 1 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	2.14	1.88	1.60	
CaO(1) Consumed, lb/ton ore	--	6.00	.00	0.03	6.03
NaCN(2) Added, gm	0.2	0.125	0.105	--	
NaCN(3) Added, lb/ton solution	1.94	1.21	1.02	--	
NaCN(3) Added, lb/ton ore	1.94	1.21	1.02	--	
NaCN(3) Solution Strength, lb/ton	1.94	2.01	1.95	1.46	
NaCN(3) Consumed, lb/ton ore	--	1.02	0.95	0.49	2.46
Pulp pH	--	12.5	12.2	12.1	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	10.7	9.4	8.0	
CaO(1), gm in solution	--	0.214	0.188	0.160	
$AgNO_3$ Titration, ml	--	4.6	5.3	7.3	
NaCN(3), gm in solution	--	0.092	0.106	0.146	
H_2O Added, ml	--	25	25	25	
CaO(1) Removed Sample, lb/ton ore	--	0.24	0.24	0.20	
NaCN(3) Removed Sample, lb/ton ore	--	0.12	0.13	0.18	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 2

Purpose: Same as Cyanidation Test No. 1 with a longer leach time of 72 hr.

Sample: Composite Sample No. 4, 17.9% -200M, 200 grams, see Screen Test No. 1.

Procedure: The sample was leached for 72 hr using about 1.9 lb/ton NaCN solution at 50% solids using the rolling bottle technique. The pulp was not sampled during the test and was considered as leaching the same as Test No. 1.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.015	5.08	21.4	24.5
Solution(1)				78.6	75.5

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 2 (continued)

DATA:

Time, hr	0	4	24	48	72	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	--	--	--	1.54	
CaO(1) Consumed, lb/ton ore	--	--	--	--	6.60	6.60
NaCN(2) Added, gm	0.2	0.1	0.08	0.05	--	
NaCN(3) Added, lb/ton solution	1.94	0.97	0.78	0.49	--	
NaCN(3) Added, lb/ton ore	1.94	0.97	0.78	0.49	--	
NaCN(3) Solution Strength, lb/ton	1.94	--	--	--	1.48	
NaCN(3) Consumed, lb/ton ore	--	--	--	--	2.69	2.69
Pulp pH	--	--	12.2	12.1	12.1	
Sample Volume Removed, ml	--	--	--	--	25	
Oxalic Acid Titration, ml	--	--	--	--	7.7	
CaO(1), gm in solution	--	--	--	--	0.154	
$AgNO_3$ Titration, ml	--	--	--	--	7.4	
NaCN(3), gm in solution	--	--	--	--	0.148	
H_2O Added, ml	--	--	--	--	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 3

Purpose: Same as Cyanidation Test No. 1, 48 hr leach.

Sample: Composite Sample No. 4, 53.4% -200M, 200 grams, see Screen Test No. 2.

Procedure: A 500-gram charge at -20M ore was dry ground in a laboratory ball mill for 10 min, 12,000 gram ball charge. The sample was split for feed to Cyanidation Tests No. 3 and 4 and the screen test.

The sample was leached for 48 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.010	2.80	14.3	13.5
Solution(1)				85.7	86.5

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 3 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	1.88	1.60	1.54	
CaO(1) Consumed, lb/ton ore	--	6.26	0.04	+0.00	6.30
NaCN(2) Added, gm	0.2	0.165	0.125	--	
NaCN(3) Added, lb/ton solution	1.94	1.61	1.21	--	
NaCN(3) Added, lb/ton ore	1.94	1.61	1.21	--	
NaCN(3) Solution Strength, lb/ton	1.94	2.22	2.05	1.78	
NaCN(3) Consumed, lb/ton	--	1.24	1.26	0.27	2.77
Pulp pH	--	12.4	12.2	12.1	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	9.4	8.0	7.0	
CaO(1), gm in solution	--	0.188	0.160	0.154	
$AgNO_3$ Titration, ml	--	3.5	4.8	8.9	
NaCN(3), gm in solution	--	0.070	0.096	0.178	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.24	0.20	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.09	0.12	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 4

Purpose: Same as Cyanidation Test No. 3 except 72 hr leach.

Sample: Composite Sample No. 4, 53.4% -200M, 200 grams, see Screen Test No. 2.

Procedure: See Cyanidation Test No. 3 for ore grinding.

The sample was leached for 72 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The pulp was not sampled during the test and was considered as leaching the same as Test No. 3.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis		Per Cent Distribution	
		Au oz/ton	Ag oz/ton	Au	Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	99.9	0.010	2.63	14.3	12.7
Solution(1)				85.7	87.3

1/ Computed by difference.

EXHIBIT 3

Cynidation Test No. 4 (continued)

DATA:

Time, hr	0	4	24	48	72	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	--	--	--	1.58	
CaO(1) Consumed, lb/ton ore	--	--	--	--	6.56	6.56
NaCN(2) Added, gm	0.2	0.14	0.10	--	--	
NaCN(3) Added, lb/ton solution	1.94	1.36	0.97	--	--	
NaCN(3) Added, lb/ton ore	1.94	1.36	0.97	--	--	
NaCN(3) Solution Strength, lb/ton	1.94	--	--	--	1.42	
NaCN(3) Consumed, lb/ton ore	--	--	--	--	2.85	2.85
Pulp pH	--	--	12.2	12.1	12.1	
Sample Volume Removed, ml	--	--	--	--	25	
Oxalic Acid Titration, ml	--	--	--	--	7.9	
CaO(1), gm in solution	--	--	--	--	0.158	
$AgNO_3$ Titration, ml	--	--	--	--	7.1	
NaCN(3), gm in solution	--	--	--	--	0.142	
H_2O Added, ml	--	--	--	--	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 5

Purpose: Same as Cyanidation Test No. 1, 48 hr leach.

Sample: Composite Sample No. 4, 88.2% -200M, 200 grams, see Screen Test No. 3.

Procedure: A 500-gram charge of -20M ore was dry ground in a laboratory ball mill for 30 min, 12,000 gram ball charge. The sample was split for feed to Cyanidation Tests No. 5 and 6 and for screen test.

The sample was leached for 48 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	1.73	7.1	8.4
Solution(1)				92.9	91.6

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 5 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	1.40	1.28	0.56	
CaO(1) Consumed, lb/ton	--	6.74	0.06	0.40	7.08
NaCN(2) Added, gm	0.2	0.165	0.160	--	
NaCN(3) Added, lb/ton solution	1.94	1.60	1.55	--	
NaCN(3) Added, lb/ton ore	1.94	1.60	1.55	--	
NaCN(3) Solution Strength, lb/ton	1.94	2.14	2.19	1.96	
NaCN(3) Consumed, lb/ton	--	1.32	1.28	0.23	2.83
Pulp pH	--	12.3	12.1	12.0	
Sample Volume Removed, ml	--	25	50	25	
Oxalic Acid Titration, ml	--	7.0	6.4	2.8	
CaO(1), gm in solution	--	0.140	0.128	0.056	
$AgNO_3$ Titration, ml	--	3.1	4.3	9.8	
NaCN(3), gm in solution	--	0.062	0.086	0.196	
H_2O Added, ml	--	25	50	--	
CaO(1) Removed Sample, lb/ton ore	--	0.18	0.32	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.08	0.22	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 6

Purpose: Same as Cyanidation Test No. 5 except 72 hr leach.

Sample: Composite Sample No. 4, 88.5% -200M, 200 grams, see Screen Test No. 3.

Procedure: See Cyanidation Test No. 5 for ore grinding.

The sample was leached for 72 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The pulp was not sampled during the test and was considered as leaching the same as Test No. 5.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	1.80	7.1	8.7
Solution(1)				92.9	91.3

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 6

DATA:

Time, hr	0	4	24	48	72	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	--	--	--	1.20	
CaO(1) Consumed, lb/ton ore	--	--	--	--	6.94	6.94
NaCN(2) Added, gm	0.2	0.14	0.11	--	--	
NaCN(3) Added, lb/ton solution	1.94	1.36	1.07	--	--	
NaCN(3) Added, lb/ton ore	1.94	1.36	1.07	--	--	
NaCN(3) Solution Strength, lb/ton	1.94	--	--	--	1.40	
NaCN(3) Consumed, lb/ton	--	--	--	--	2.97	2.97
Pulp pH	--	--	12.2	12.1	12.0	
Sample Volume Removed, ml	--	--	--	--	25	
Oxalic Acid Titration, ml	--	--	--	--	6.0	
CaO(1), gm in solution	--	--	--	--	0.120	
$AgNO_3$ Titration, ml	--	--	--	--	7.0	
NaCN(3), gm in solution	--	--	--	--	0.140	
H_2O Added, ml	--	--	--	--	--	

1/ As 100% NaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 7

Purpose: Same as Cyanidation Test No. 1, 48 hr leach.

Sample: Composite Sample No. 4, 40.2% -200M, 200 grams, see Screen Test No. 4.

Procedure: A 500-gram charge of -20M ore was dry ground in a laboratory ball mill for 5 min, 12,000-gram ball charge. The sample was split for feed to Cyanidation Tests No. 7 and 8 and for screen test.

The sample was leached for 48 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	3.96	7.1	19.1
Solution(1)				92.9	80.9

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 7 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	1.86	1.70	0.60	
CaO(1) Consumed, lb/ton ore	--	6.28	0.07	0.89	7.10
NaCN(2) Added, gm	0.2	0.145	0.125	--	
NaCN(3) Added, lb/ton solution	1.94	1.41	1.21	--	
NaCN(3) Added, lb/ton ore	1.94	1.41	1.21	--	
NaCN(3) Solution Strength, lb/ton	1.94	2.13	2.05	2.04	
NaCN(3) Consumed, lb/ton	--	1.12	1.17	0.01	2.30
Pulp pH	--	12.4	12.3	12.0	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	9.3	8.5	3.0	
CaO(1), gm in solution	--	0.186	0.170	0.060	
$AgNO_3$ Titration, ml	--	4.1	4.8	10.2	
NaCN(3), gm in solution	--	0.082	0.096	0.204	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.23	0.21	--	
NaCN(3) Removed Sample lb/ton ore	--	0.10	0.12	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 8

Purpose: Same as Cyanidation Test No. 7 except 72 hr leach.

Sample: Composite Sample No. 4, 40.2% -200M, 200 grams, see Screen Test No. 4.

Procedure: See Cyanidation Test No. 7 for ore grinding.

The sample was leached for 72 hr using about 2.0 lb/ton NaCN solution at 50% solids using the rolling bottle technique.

The pulp was not sampled during the test and was considered as leaching the same as Test No. 7.

The cake was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.015	3.69	21.4	17.8
Solution(1)				78.6	82.2

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 8 (continued)

DATA:

Time, hr	0	4	24	48	72	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	--	
CaO(1) Added, lb/ton solution	8.14	--	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	--	
CaO(1) Solution Strength, lb/ton	8.14	--	--	--	0.72	
CaO(1) Consumed, lb/ton	--	--	--	--	7.42	7.42
NaCN(2) Added, gm	0.2	0.12	0.10	--	--	
NaCN(3) Added, lb/ton solution	1.94	1.16	0.97	--	--	
NaCN(3) Added, lb/ton ore	1.94	1.16	0.97	--	--	
NaCN(3) Solution Strength, lb/ton	1.94	--	--	--	1.50	
NaCN(3) Consumed, lb/ton	--	--	--	--	2.57	2.57
Pulp pH	--	--	12.2	12.1	11.9	
Sample Volume Removed, ml	--	--	--	--	25	
Oxalic Acid Titration, ml	--	--	--	--	3.6	
CaO(1), gm in solution	--	--	--	--	0.072	
$AgNO_3$ Titration, ml	--	--	--	--	7.5	
NaCN(2), gm in solution	--	--	--	--	0.150	
H_2O Added, ml	--	--	--	--	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 9

Purpose: To make a more dilute pulp test as compared to Test No. 1.

Sample: Composite Sample No. 4, 17.9% -200M, 200 grams.

Procedure: The sample was leached for 48 hr using about 1.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.020	5.34	28.6	25.8
Solution[1]				71.4	74.2

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 9(continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, lb/ton solution	2.71	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	2.71	1.88	1.50	1.06	
CaO(1) Consumed, lb/ton ore	--	2.50	0.90	1.13	4.53
NaCN(2) Added, gm	0.6	0.15	0.09	--	
NaCN(3) Added, lb/ton solution	1.94	0.49	0.21	--	
NaCN(3) Added, lb/ton ore	5.82	1.46	0.87	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.86	1.84	1.78	
NaCN(3) Consumed, lb/ton ore	--	1.50	0.74	0.21	2.45
Pulp pH	--	12.3	12.0	12.0	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	9.4	7.5	5.3	
CaO(1), gm in solution	--	0.564	0.450	0.318	
$AgNO_3$ Titration, ml	--	7.2	8.1	8.9	
NaCN(3), gm in solution	--	0.432	0.486	0.534	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.24	0.19	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.18	0.20	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 10

Purpose: To make a more dilute pulp test as compared to Test No. 3.

Sample: Composite Sample No. 4, 53.4% -200M, 200 grams, 10 min dry grind.

Procedure: The sample was leached for 48 hr using about 1.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	99.7	0.015	2.55	21.4	12.3
Solution(1)				78.6	87.7

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 10 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, gm	0.814	--	--	--	
CaO(1) Added, lb/ton solution	2.71	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	2.71	1.68	1.40	1.02	
CaO(1) Consumed, lb/ton ore	--	3.10	0.63	0.96	4.69
NaCN(2) Added, gm	0.6	0.19	0.09	--	
NaCN(3) Added, lb/ton solution	1.94	0.614	0.291	--	
NaCN(3) Added, lb/ton ore	5.82	1.84	0.87	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.86	1.84	1.48	
NaCN(3) Consumed, lb/ton ore	--	1.92	0.72	0.07	2.71
Pulp pH	--	12.2	12.1	12.0	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	8.4	7.0	5.1	
CaO(1), gm in solution	--	0.504	0.420	0.306	
$AgNO_3$ Titration, ml	--	6.5	8.1	9.1	
NaCN(3), gm in solution	--	0.390	0.486	0.546	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.21	0.18	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.16	0.20	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 11

Purpose: To make a more dilute pulp test as compared to Test No. 5.

Sample: Composite Sample No. 4, 88.5% -200M, 200 grams, 30 min dry grind.

Procedure: The sample was leached for 48 hr using about 1.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.00	0.070	20.71	100.0	100.0
Tail	99.75	0.005	1.45	7.1	7.0
Solution(1)				92.9	93.0

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 11 (continued)

DATA:

Time, hr	0	3	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, gm	0.814	--	--	--	
CaO(1) Added, lb/ton solution	2.71	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	2.71	1.44	1.06	0.84	
CaO(1) Consumed, lb/ton ore	--	3.82	0.96	0.53	5.31
NaCN(2) Added, gm	0.6	0.19	0.10	--	
NaCN(3) Added, lb/ton solution	1.94	0.61	0.32	--	
NaCN(3) Added, lb/ton ore	5.82	1.84	0.97	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.86	1.86	1.80	
NaCN(3) Consumed, lb/ton ore	--	1.92	0.78	0.17	2.87
Pulp pH	--	12.1	12.0	11.9	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	7.2	5.3	4.2	
CaO(1), gm in solution	--	0.432	0.318	0.252	
$AgNO_3$ Titration, ml	--	6.5	8.0	9.0	
NaCN(3), gm in solution	--	0.39	0.48	0.54	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.18	0.13	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.16	0.20	--	

1/ As 100 % CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 12

Purpose: To make a more dilute pulp test as compared to Test No. 7.

Sample: Composite Sample No. 4, 40.2% -200M, 200 grams, 5 min dry grind.

Procedure: The sample was leached for 48 hr using about 1.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	3.70	7.1	17.9
Solution(1)				92.9	82.1

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 12 (continued)

DATA:

Time, hr	0	3	24	48	Total
$Ca(OH)_2$ Added, gm	1.2	--	--	--	
CaO(1) Added, gm	0.814	--	--	--	
CaO(1) Added, lb/ton solution	2.71	--	--	--	
CaO(1) Added, lb/ton ore	8.14	--	--	--	
CaO(1) Solution Strength, lb/ton	2.71	1.74	1.08	0.74	
CaO(1) Consumed, lb/ton ore	--	2.92	1.76	0.88	5.56
NaCN(2) Added, gm	0.6	0.14	0.12	--	
NaCN(3) Added, lb/ton solution	1.94	0.45	0.39	--	
NaCN(3) Added, lb/ton ore	5.82	1.36	1.16	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.87	1.84	1.84	
NaCN(3) Consumed, lb/ton ore	--	1.38	1.05	0.01	2.44
Pulp pH	--	12.2	12.1	11.9	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	8.7	5.4	3.7	
CaO(1), gm in solution	--	0.522	0.324	0.222	
$AgNO_3$ Titration, ml	--	7.4	7.6	9.5	
NaCN(3), gm in solution	--	0.444	0.456	0.552	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.22	0.14	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.19	0.19	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 13

Purpose: To determine the effect of lower NaCN solution strength as compared to Tests No. 1 and 9.

Sample: Composite Sample No. 4, 17.9% -200M, 200 grams.

Procedure: The sample was leached for 48 hr using about 1.0 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.020	5.34	28.6	25.8
Solution(1)				71.4	74.2

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 13 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.0	--	--	--	
CaO(1) Added, lb/ton solution	2.26	--	--	--	
CaO(1) Added, lb/ton ore	6.78	--	--	--	
CaO(1) Solution Strength, lb/ton	2.26	1.58	1.12	0.76	
CaO(1) Consumed, lb/ton ore	--	2.04	1.18	0.94	4.16
NaCN(2) Added, gm	0.3	0.08	0.07	--	
NaCN(3) Added, lb/ton solution	0.97	0.259	0.226	--	
NaCN(3) Added, lb/ton ore	2.91	0.776	0.679	--	
NaCN(3) Solution Strength, lb/ton	0.97	0.95	0.96	0.78	
NaCN(3) Consumed, lb/ton ore	--	0.75	0.566	0.524	1.84
Pulp pH	--	12.2	11.6	11.7	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	7.9	5.6	3.8	
CaO(1), gm in solution	--	0.474	0.336	0.228	
$AgNO_3$ Titration, ml	--	3.6	3.8	3.9	
NaCN(3), gm in solution	--	0.216	0.228	0.234	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.20	0.14	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.09	0.095	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 14

Purpose: To determine the effect of a stronger NaCN solution strength as compared to Tests No. 1 and 9.

Sample: Composite Sample No. 4, 17.9% -200M, 200 grams.

Procedure: The sample was leached for 48 hr using about 3.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.015	2.55	21.4	12.3
Solution(1)				78.6	87.7

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 14 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.0	--	--	--	
CaO[1] Added, lb/ton solution	2.26	--	--	--	
CaO[1] Added, lb/ton ore	6.78	--	--	--	
CaO[1] Solution Strength, lb/ton	2.26	1.64	1.08	0.66	
CaO[1] Consumed, lb/ton ore	--	1.86	1.47	1.12	4.45
NaCN[2] Added, gm	1.2	0.2	0.11	--	
NaCN[3] Added, lb/ton solution	3.88	0.647	0.356	--	
NaCN[3] Added, lb/ton ore	11.64	1.94	1.07	--	
NaCN[3] Solution Strength, lb/ton	3.88	3.89	3.90	3.86	
NaCN[3] Consumed, lb/ton ore	--	1.50	0.57	0.12	2.19
Pulp pH	--	12.0	11.6	11.7	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	8.2	5.4	3.3	
CaO[1], gm in solution	--	0.492	0.324	0.198	
$AgNO_3$ Titration, ml	--	16.9	18.5	19.3	
NaCN[3], gm in solution	--	1.014	1.110	1.158	
H_2O Added, ml	--	25	25	--	
CaO[1] Removed Sample, lb/ton ore	--	0.21	0.14	--	
NaCN[3] Removed Sample, lb/ton ore	--	0.42	0.46	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 15

Purpose: To determine the effect of a lower NaCN solution strength as compared to Tests No. 3 and 10.

Sample: Composite Sample No. 4, 53.4% -200M, 200 grams, 10 min dry grind.

Procedure: The sample was leached for 48 hr using about 1.0 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	3.70	7.1	17.9
Solution(1)				92.9	82.1

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 15 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.0	--	--	--	
CaO[1] Added, lb/ton solution	2.26	--	--	--	
CaO[1] Added, lb/ton ore	6.78	--	--	--	
CaO[1] Solution Strength, lb/ton	2.26	1.44	1.12	0.80	
CaO[1] Consumed, lb/ton ore	--	2.46	0.78	0.82	4.06
NaCN[2] Added, gm	0.3	0.13	0.12	--	
NaCN[3] Added, lb/ton solution	0.97	0.42	0.39	--	
NaCN[3] Added, lb/ton ore	2.91	1.26	1.16	--	
NaCN[3] Solution Strength, lb/ton	0.97	0.98	0.98	0.82	
NaCN[3] Consumed, lb/ton ore	--	1.17	1.07	0.49	2.73
Pulp pH	--	12.0	11.5	11.7	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	7.2	5.6	4.0	
CaO[1], gm in solution	--	0.432	0.336	0.240	
$AgNO_3$ Titration, ml	--	2.9	3.1	4.1	
NaCN[3], gm in solution	--	0.174	0.186	0.246	
H_2O Added, ml	--	25	25	--	
CaO[1] Removed Sample, lb/ton ore	--	0.18	0.14	--	
NaCN[3] Removed Sample, lb/ton ore	--	0.07	0.08	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 16

Purpose: To determine the effect of a stronger NaCN solution strength as compared to Tests No. 3 and 10.

Sample: Composite Sample No. 4, 53.4% -200M, 200 grams, 10 min dry grind.

Procedure: The sample was leached for 48 hr using about 3.9 lb/ton NaCN solution at 25% solids using the rolling bottle technique.

The sample was thoroughly washed on a bench filter.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail	100.0	0.005	1.45	7.1	7.0
Solution(1)				92.9	93.0

1/ Computed by difference.

EXHIBIT 3

Cyanidation Test No. 16 (continued)

DATA:

Time, hr	0	4	24	48	Total
$Ca(OH)_2$ Added, gm	1.0	--	--	--	
CaO(1) Added, lb/ton solution	2.26	--	--	--	
CaO(1) Added, lb/ton ore	6.78	--	--	--	
CaO(1) Solution Strength, lb/ton	2.26	1.54	1.14	0.84	
CaO(1) Consumed, lb/ton ore	--	2.16	1.01	0.76	3.93
NaCN(2) Added, gm	1.2	0.24	0.14	--	
NaCN(3) Added, lb/ton solution	3.88	0.776	0.453	--	
NaCN(3) Added, lb/ton ore	11.64	2.33	1.36	--	
NaCN(3) Solution Strength, lb/ton	3.88	3.88	3.90	3.86	
NaCN(3) Consumed, lb/ton ore	--	1.92	0.84	0.13	2.89
Pulp pH	--	12.0	11.6	11.7	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	7.7	5.7	4.2	
CaO(1), gm in solution	--	0.462	0.342	0.252	
$AgNO_3$ Titration, ml	--	16.2	18.0	19.3	
NaCN(3), gm in solution	--	0.972	1.08	1.158	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.19	0.14	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.41	0.45	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.

EXHIBIT 3

Cyanidation Test No. 17

Purpose: To make a cyanide wet grind test to provide feed for settling and filtration tests.

Sample: Composite Sample No. 4, -20M, 6000 grams.

Procedure: The ore was ground in a laboratory ball mill in 1000-gram batches at 50% solids using 1 gm/liter NaCN solution and 5 grams $Ca(OH)_2$/batch. The charge was ground for 30 min. The pulp was filtered and charged to a bottle at 50% solids. The filtrate was used for dilution. The bottles were rolled for 48 hr.

See Screen Test No. 5, 93.0% -325M.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.070	20.71	100.0	100.0
Tail(2)	100.0	0.01	2.69	14.3	13.0
Solution(1)				85.7	87.0

1/ Computed by difference.
2/ Best Filtration Test No. 6.

EXHIBIT 3

Cyanidation Test No. 17 (continued)

DATA:

Time, hr	0	4	24	48	Total
Total Ore, gm	6000	--	--	--	
Total Solution, ml(4)	6500	--	--	--	
$Ca(OH)_2$ Added, gm	30	--	--	--	
CaO(1) Added, gm	20.34	--	--	--	
CaO(1) Added, lb/ton solution	6.33	--	--	--	
CaO(1) Added, lb/ton ore	6.78	--	--	--	
CaO(1) Solution Strength, lb/ton	6.78(5)	1.44	1.18	1.16	
CaO(1) Consumed, lb/ton ore	--	5.205	0.254	0.015	5.47
NaCN(2) Added, gm	6.5	3.6	3.0	--	
NaCN(3) Added, lb/ton solution	1.94	1.164	0.97	--	
NaCN(3) Added, lb/ton ore	2.10	1.164	0.97	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.94	1.95	1.20	
NaCN(3) Consumed, lb/ton ore	--	1.235	0.964	0.750	2.95
Pulp pH	--	12.1	12.0	12.0	
Sample Volume Removed, ml	--	25(6)	25	25	
Oxalic Acid Titration, ml	--	7.2	5.9	5.8	
CaO(1), gm in solution	--	4.32	3.54	3.48	
$AgNO_3$ Titration, ml	--	3.9	4.9	6.0	
NaCN(3), gm in solution	--	2.34	2.94	3.60	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, gm	--	0.018	0.0145	--	
NaCN(3) Removed Sample, gm	--	0.00975	0.01225	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.
4/ Only 6000 ml used during leaching--extra volume was used to wash pulp from ball mill and leach bottles.
5/ Lime was added to ball mill and was this strength during grinding but was diluted on washing from ball mill.
6/ Computations on basis at 6000 ml solution in leach bottles.

EXHIBIT 3

Cyanidation Test No. 18

Purpose: To make a cyanide leach on a closed circuit grind product.

Sample: Composite Sample No. 5, Bond grindability product -100M, 1000 grams.

Procedure: The ore was leached in a rolling bottle at 50% solids using 1 gm/l NaCN solution and 5 gm/l $Ca(OH)_2$ solution.

The sample was washed on a bench laboratory filter.

See Screen Test No. 7 (Bond Grindability Test No. 1 product screen analysis).

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.075	19.39	100.0	100.0
Tail	100.0	0.02	8.96	26.7	46.2
Solution(1)				73.3	53.8

1/ Computed by difference.

Observations: After 2.5 hr leach, a peculiar ppt appeared on titration--probably foreign material got in ore from Bond grindability test.

EXHIBIT 3

Cyanidation Test No. 18 (continued)

DATA:

Time, hr	0	2.5	24	48	Total
$Ca(OH)_2$ Added, gm	5.0	--	--	--	
CaO(1) Added, lb/ton solution	6.78	--	--	--	
CaO(1) Added, lb/ton ore	6.78	---	--	--	
CaO(1) Solution Strength, lb/ton	6.78	2.06	1.64	--	
CaO(1) Consumed, lb/ton ore	--	4.72	0.328	0.0	5.05
NaCN(2) Added, gm	1.0	0.78	0.60	--	
NaCN(3) Added, lb/ton solution	1.94	1.51	1.16	--	
NaCN(3) Added, lb/ton ore	1.94	1.51	1.16	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.94	1.92	1.12	
NaCN(3) Consumed, lb/ton ore	--	1.50	1.16	0.80	3.46(4)
Pulp pH	--	12.4	12.2	12.1	
Sample Volume Removed, ml	--	25	25	25	
Oxalic Acid Titration, ml	--	10.3	8.4	8.2	
CaO(1), gm in solution	--	1.03	0.84	0.82	
$AgNO_3$ Titration, ml	--	2.2	3.9	5.6	
NaCN(3), gm in solution	--	0.22	0.39	0.56	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, lb/ton ore	--	0.052	0.042	--	
NaCN(3) Removed Sample, lb/ton ore	--	0.0055	0.0098	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.
4/ Probably excess consumption as the 2.5 hr consumption was abnormally high and a precipitate appeared during the titration.

EXHIBIT 3

Cyanidation Test No. 19

Purpose: To repeat Test No. 17 and provide feed pulp for additional filtration tests.

Sample: Composite Sample No. 5, -20M, 6000 grams.

Procedure: The ore was ground in a laboratory ball mill in 1000 gram batches at 50% solids using 1 gm/liter NaCN solution and 5 grams $Ca(OH)_2$/batch. The charge was ground for 30 min. The pulp was filtered and charged to a bottle at 50% solids. The filtrate was used for dilution. The bottles were rolled for 48 hr.

Results:

Product	Weight %	Chemical Analysis Au oz/ton	Chemical Analysis Ag oz/ton	Per Cent Distribution Au	Per Cent Distribution Ag
Head (assayed)	100.0	0.075	19.39	100.0	100.0
Tail(2)	100.0	0.01	2.33	13.3	12.0
Solution(1)				86.7	88.0

1/ Computed by difference.
2/ Best Filtration Tests No. 19 and 20.

EXHIBIT 3

Cyanidation Test No. 19 (continued)

DATA:

Time, hr	0	4	24	48	Total
Total Ore, gm	6000	--	--	--	
Total Solution, ml(4)	6340	--	--	--	
$Ca(OH)_2$ Added, gm	30.0	--	--	--	
CaO(1) Added, gm	20.34	--	--	--	
CaO(1) Added, lb/ton solution	6.42	--	--	--	
CaO(1) Added, lb/ton ore	6.78	--	--	--	
CaO(1) Solution Strength, lb/ton	6.78(5)	1.32	1.30	1.20	
CaO(1) Consumed, lb/ton ore	--	5.37	0.02	0.10	5.49
NaCN(2) Added, gm	6.34	4.38	3.48	--	
NaCN(3) Added, lb/ton solution	1.94	1.42	1.13	--	
NaCN(3) Added, lb/ton ore	2.05	1.42	1.13	--	
NaCN(3) Solution Strength, lb/ton	1.94	1.94	1.95	1.46	
NaCN(3) Consumed, lb/ton ore	--	1.47	1.12	0.49	3.08
Pulp pH	--	12.2	12.1	12.0	
Sample Volume Removed, ml	--	25(6)	25	25	
Oxalic Acid Titration, ml	--	6.6	6.5	6.0	
CaO(1), gm in solution	--	3.96	3.90	3.60	
$AgNO_3$ Titration, ml	--	2.6	4.1	7.3	
NaCN(3), gm in solution	--	1.56	2.46	4.38	
H_2O Added, ml	--	25	25	--	
CaO(1) Removed Sample, gm	--	0.0165	0.0163	--	
NaCN(3) Removed Sample, gm	--	0.0065	0.0103	--	

1/ As 100% CaO.
2/ NaCN 97% grade.
3/ As 100% NaCN.
4/ Only 6000 ml used during leaching--extra volume was used to wash pulp from ball mill and leach bottles.
5/ Lime was added to ball mill and was this strength during grinding but was diluted on washing from ball mill.
6/ Computations on basis of 6000 ml solution in leach bottles.

EXHIBIT 4

SETTLING TESTS

Settling Test No. 1

Purpose: To determine the settling rate of the pulp.

Sample: Pulp from Cyanidation Test No. 1, -20M.

Sample % Solids: 17.8.
Sample Temperature, °F: Ambient
Flocculant Added: None

Settling Time min	Inches of Cloudy Effluent
0	0
1	1.56
2	3.06
3	4.69
4	6.25
5	7.69
6	9.25
7	10.13
8	11.25
30	11.59

Compaction in 30 min, 57.5% solids.
R - Settling rate in feet per hour, 7.71.
F - Initial density (parts water to parts solids), 4.63:1.0.
D - Final density (parts water to parts solids), 0.74:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(4.63 - 0.74)}{7.71} = 0.67$$

Note: Pulp was diluted to 1000 ml. Coarse sand settled immediately with a 25% safety factor A = 0.84.

EXHIBIT 4

Settling Test No. 2

Purpose: To determine the settling rate of the pulp.

Sample: Pulp from Cyanidation Test No. 3, -35M.

Sample % Solids: 17.8.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Cloudy Effluent
0	0
1	1.06
2	2.06
3	3.00
4	4.00
5	4.94
6	5.88
7	6.82
8	7.75
9	8.63
10	9.50
11	10.00
12	10.31
30	11.50

Compaction in 30 min, 61.4% solids.
R - Settling rate in feet per hour, 4.90.
F - Initial density (parts water to parts solids), 4.63:1.0.
D - Final density (parts water to parts solids), 0.63:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(4.63 - 0.63)}{4.90} = 1.09$$

Note: Pulp was diluted to 1000 ml with a 25% safety factor A = 1.36.

EXHIBIT 4

Settling Test No. 3

Purpose: To determine the settling rate of the pulp.

Sample: Pulp from Cyanidation Test No. 5, -48M.

Sample % Solids: 17.8.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Cloudy Effluent
0	0
1	0.63
2	1.19
3	1.75
4	2.31
5	2.88
6	3.38
7	3.88
8	4.44
9	4.94
10	5.44
11	5.94
12	6.38
13	6.75
14	7.16
15	7.47
16	7.75
17	7.97
18	8.16
30	9.63

EXHIBIT 4

Settling Test No. 3 (continued)

Compaction in 30 min, 48.1% solids.
R - Settling rate in feet per hour, 2.72.
F - Initial density (parts water to parts solids), 4.61:1.0.
D - Final density (parts water to parts solids), 1.08:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(4.61 - 1.08)}{2.72} = 1.73$$

Note: Pulp was diluted to 1000 ml with a 25% safety factor A = 2.16.

EXHIBIT 4

Settling Test No. 4

Purpose: To determine the settling rate of the pulp.

Sample: Pulp from Cyanidation Test No. 7, -28M.

Sample % Solids: 17.9.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Cloudy Effluent
0	0
1	1.31
2	2.31
3	3.31
4	4.31
5	5.31
6	6.31
7	7.25
8	8.22
9	9.13
10	9.81
11	10.13
12	10.31
30	11.06

Compaction in 30 min, 62.1% solids.
R - Settling rate in feet per hour, 5.26.
F - Initial density (parts water to parts solids), 4.58:1.0.
D - Final density (parts water to parts solids), 0.61:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\ (F - D)}{R} = \frac{1.333\ (4.58 - 0.61)}{5.26} = 1.01$$

Note: Pulp was diluted to 1000 ml. Sand settled out immediately with a 25% safety factor A = 1.26.

EXHIBIT 4

Settling Test No. 5

Purpose: To determine the settling properties of a grinding circuit product at about 10% solids.

Sample: Composite Sample No. 4, 30 min wet grind, about -100M and 93% -200M.

Sample % Solids: 10.3.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
1	1.50
2	3.00
3	4.44
4	5.81
5	7.13
6	8.59
7	10.00
8	11.22
9	11.56
10	11.81
30	12.63
19 hr	12.75

Compaction in 19 hours, 58.8% solids.
R - Settling rate in feet per hour, 7.0.
F - Initial density (parts water to parts solids), 8.69:1.0.
D - Final density (parts water to parts solids), 0.70:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(8.69 - 0.70)}{7.0} = 1.52$$

Note: A portion of a 30 min laboratory 50% solids grind of -20M ore was repulped in 1 gm/liter NaCN solution with about 7 lb/ton CaO to provide test pulp. With a 25% safety factor A = 1.90.

EXHIBIT 4

Settling Test No. 6

Purpose: Same as Settling Test No. 5, only at about 17% solids.

Sample: Composite Sample No. 4, 30 min wet grind, about -100M and 93% -200M

Sample % Solids: 17.6.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
1	0.91
2	1.66
3	2.41
4	3.16
5	3.94
6	4.69
7	5.38
8	6.09
9	6.75
10	7.38
11	7.88
12	8.28
13	8.56
14	8.84
15	9.06
30	10.72
19 hr	11.13

EXHIBIT 4

Settling Test No. 6 (continued)

Compaction in 19 hours, 59.8% solids.
R - Settling rate in feet per hour, 3.7.
F - Initial density (parts water to parts solids), 4.67:1.0.
D - Final density (parts water to parts solids), 0.67:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(4.67 - 0.67)}{3.7} = 1.44$$

Note: With a 25% safety factor A = 1.80

EXHIBIT 4

Settling Test No. 7

Purpose: Same as Settling Test No. 5, only at about 25% solids.

Sample: Composite Sample No. 4, 30 min wet grind, about -100M and 93% -200M.

Sample % Solids: 26.0.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
2	0.69
4	1.25
6	1.72
8	2.41
10	2.97
12	3.53
14	4.06
16	4.59
18	5.09
20	5.56
22	6.03
24	6.44
26	6.81
28	7.16
30	7.47
32	7.78
34	8.03
36	8.25
60	9.66
19 hr	10.00

EXHIBIT 4

Settling Test No. 7 (continued)

Compaction in 19 hours, 61.0% solids.
R - Settling rate in feet per hour, 1.29.
F - Initial density (parts water to parts solids), 2.84:1.0.
D - Final density (parts water to parts solids), 0.64:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(2.84 - 0.64)}{1.29} = 2.27$$

Note: With a 25% safety factor A = 2.84.

EXHIBIT 4

Settling Test No. 8

Purpose: To determine the thickener area requirement for 48 hr leach pulp.

Sample: Diluted Cyanidation Test No. 17, 48 hr leach pulp.

Sample % Solids: 32.9.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
3	0.50
6	1.00
9	1.44
12	1.94
15	2.38
18	2.81
21	3.28
24	3.72
27	4.16
30	4.63
33	5.06
36	5.47
39	5.88
42	6.25
45	6.63
48	6.97
51	7.28
54	7.56
57	7.88
60	8.13
63	8.31
19 hr	8.81

EXHIBIT 4

Settling Test No. 8 (continued)

Compaction in 19 hours, 65.9% solids.
R - Settling rate in feet per hour, 0.75.
F - Initial density (parts water to parts solids), 2.04:1.0
D - Final density (parts water to parts solids), 0.52:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(2.04 - 0.52)}{0.75} = 2.70$$

Note: Pulp was diluted with cyanide filtrate from filtering tests. With a 25% safety factor A = 3.38.

EXHIBIT 4

Settling Test No. 9

Purpose: Same as Settling Test No. 8.

Sample: Diluted Cyanidation Test No. 17, 48 hr leach pulp.

Sample % Solids: 41.8.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
6	0.50
12	1.03
18	1.53
24	2.03
30	2.53
36	3.00
42	3.47
48	3.94
54	4.41
60	4.88
66	5.34
72	5.88
78	6.41
84	6.88
90	7.00
19 hr	7.16

Compaction in 19 hours, 67.3% solids.
R - Settling rate in feet per hour, 0.41.
F - Initial density (parts water to parts solids), 1.39:1.0.
D - Final density (parts water to parts solids), 0.48:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\,(F - D)}{R} = \frac{1.333\,(1.39 - 0.48)}{0.41} = 2.96$$

Note: Pulp was diluted with cyanide filtrate from filtering tests. With a 25% safety factor A = 3.70.

EXHIBIT 4

Settling Test No. 10

Purpose: Same as Settling Test No. 8.

Sample: Diluted Cyanidation Test No. 17, 48 hr leach pulp.

Sample % Solids: 48.6.
Sample Temperature, °F: Ambient.
Flocculant Added: None.

Settling Time min	Inches of Clear Effluent
0	0
12	0.56
24	1.22
36	1.84
48	2.53
60	3.19
72	3.94
84	4.75
90	5.59
19 hr	5.94

Compaction in 19 hours, 68.1% solids.
R - Settling rate in feet per hour, 0.27.
F - Initial density (parts water to parts solids), 1.06:1.0.
D - Final density (parts water to parts solids), 0.47:1.0.
A - Thickener area in square feet per ton of dry solids per 24 hours.

$$A = \frac{1.333\ (F - D)}{R} = \frac{1.333\ (1.06 - 0.47)}{0.27} = 2.91$$

Note: Pulp was diluted with filtrate from filtering tests. With a 25% safety factor A = 3.64.

EXHIBIT 5

FILTRATION TESTS

Filtration Tests No. 1 through 13

Purpose:	To determine the filter rate of cyanide leach pulp and washing efficiency.
Sample:	Pulp from Cyanidation Test No. 17.
Procedure:	The leach pulp was filtered using a 0.1 sq ft, round, Dorr-Oliver test leaf. A drum filter cycle was used. The first stage of filtering was on leach pulp undiluted and unthickened. Four tests were made for data. Twenty tests were made using the 120-second cycle. This cake was repulped with distilled water to provide feed for the 2nd stage of filtering. All of the 2nd stage tests were saved for test data. The final test was made on thickened pulp in an effort to determine filtering rate if first stage filtration cake was diluted a minimum amount.
Results:	See following page.

EXHIBIT 5

Filtration Tests No. 1 through 13 (continued)

Results:

Sample Temperature: Ambient.
Filter Media: N. F. M. No. 33 Cotton Duck.
Area of Media: 0.1 sq ft.
Pulp: Cyanidation Test No. 17.

Test No.	1	2	3	4	5	6	7	8	9	10	11	12	13
Filter Stage	First	First	First	First	Second	Second	Second	Second	Second	Second	Second	Second	Second
Sample, % solids	50	50	50	50	46.8	46.8	46.8	46.8	46.8	46.8	46.8	46.8	68.3
Form Time, sec	30	30	60	30	30	30	30	30	30	60	60	60	30
Air Emergence Time, sec	--	--	--	--	--	10	10	5	5	15	15	15	10
Wash Time, sec	--	--	--	--	--	30	30	45	50	60	60	90	30
Dry Time, sec	60	60	120	60	60	20	20	10	5	45	45	15	20
Total Cycle Time, sec	120	120	240	120	120	120	120	120	120	240	240	240	120
Form Vacuum, in. Hg	20	20	20	20	20	20	20	20	20	20	20	20	20
Dry Vacuum, in. Hg	20	20	20	20	20	20	20	20	20	20	20	20	20
Cake Thickness, in.	3/8	1/2	11/16	7/16	1/4	1/4	1/4	1/4	1/4	1/2	1/2	1/2	3/4
Cake Cracking	None	None	Yes	None	None	None	None	None	None	None	None	None	None
Filtrate	Cloudy	Cloudy[3]	Cloudy[3]	Cloudy[3]	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Filtrate, ml	124	116	176	108	100	130[2]	136[2]	144[2]	166[2]	226[2]	226[2]	236[2]	110[2]
Wash H_2O, ml	--	--	--	--	--	40	40	75	75	75	65	95	35
Filtrate Rate, gal./min/sq ft	0.16	0.15	0.12	0.14	0.13	0.12	0.13	0.09	0.12	0.10	0.11	0.09	0.08
Wash Rate, gal./min/sq ft	--	--	--	--	--	0.05	0.05	0.10	0.10	0.05	0.04	0.06	0.04
Cake Weight Wet, gm	198.3	211.1	277.9	197.0	118.6	115.7	125.2	121.9	144.8	193.4	206.4	218.1	420.6
Cake Weight Dry, gm	167.5	166.6	220.9	157.7	93.0	89.5	97.8	90.1	108.0	152.1	163.9	164.6	325.1
Trim Weight Dry, gm	3.7	3.2	11.4	2.9	None	None	None	None	None	None	None	None	59.9
Moisture, %	18.4	21.1	20.5	19.9	21.6	22.6	21.9	26.1	25.4	21.4	20.6	24.5	22.7
Filter Rate, lb/sq ft/24 hr	2659	2644	1735	2503	1476	1421	1552	1430	1714	1207	1301	1306	5160
Cake, Au, oz/ton	0.03	0.03	0.03	0.03	0.02	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.02
Cake, Ag, oz/ton	6.73	6.89	6.85	6.59	3.74	2.69	2.89	2.81	2.71	2.75	2.75	2.75	3.64
Per Cent Distribution[1]													
Cake, Au	42.9	42.9	42.9	42.9	28.6	14.3	14.3	14.3	14.3	14.3	14.3	14.3	28.6
Cake, Ag	32.5	33.3	33.1	31.8	18.1	13.0	14.0	13.6	13.1	13.3	13.3	13.3	17.6
Solution, Au	57.1	57.1	57.1	57.1	71.4	85.7	85.7	85.7	85.7	85.7	85.7	85.7	71.4
Solution, Ag	67.5	66.7	66.9	68.2	81.9	87.0	86.0	86.4	86.9	86.7	86.7	86.7	82.4

1/ Based on cake of 100% of feed weight and computed solution by difference.
2/ Total filtrate, filtrate plus wash water.
3/ Filtrate contained 0.1 gm/liter of suspended solids.

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EXHIBIT 5

Filtration Tests No. 14 through 21

Purpose: To determine the filter rate of cyanide leach pulp and washing efficiency using simulated "barren" mill solution.

Sample: Pulp from Cyanidation Test No. 19.

Procedure: The leach pulp was filtered using a 0.1 sq ft round Dorr-Oliver test leaf. A drum filter cycle was used. The 1st stage of filtering was on leach pulp undiluted and unthickened. The 1st test, the cake was not washed. The next 3 tests, the cake was washed with pH 12.1 lime water. Then, 20 tests were made, similar to Tests No. 15, 16, and 17 with washing. These cakes were collected and repulped with pH 12.1 lime water. Then, Test No. 18 was conducted on this pulp without washing. Tests No. 19, 20, and 21 were conducted using a water wash.

EXHIBIT 5

Filtration Tests No. 14 through 21 (continued)

Results:

Sample Temperature: Ambient.
Filter Media: N. F. M. No. 33 Cotton Duck.
Area of Media: 0. 1 sq ft.
Pulp: Cyanidation Test No. 19.

Test No.	14	15	16	17	18	19	20	21
Filter Stage	First	First	First	First	Second	Second	Second	Second
Sample, % solids	50	50	50	50	48. 7	48. 7	48. 7	48. 7
pH	12. 1	12. 1	12. 1	12. 1	12. 1	12. 1	12. 1	12. 1
Form Time, sec	30	30	30	30	30	30	30	30
Air Emergence Time, sec	--	10	10	10	--	10	10	10
Wash Time, sec	--	30	30	30	--	30	30	30
Dry Time, sec	60	20	20	20	60	20	20	20
Total Cycle Time, sec	120	120	120	120	120	120	120	120
Form Vacuum, in. Hg	21	21	21	21	20. 5	20. 5	20. 5	20. 5
Dry Vacuum, in. Hg	21	21	21	21	20. 5	20. 5	20. 5	20. 5
Cake Thickness, in.	7/16	3/8	3/8	3/8	3/8	3/8	3/8	3/8
Cake Cracking	None	None	None	None	None	None	None	None
Filtrate	Clear	Clear	Clear	Clear	Clear	Clear	Clear	Clear
Filtrate, ml	140	162[2]	168[2]	165[2]	116	144[2]	150[2]	150[2]
Wash Solution pH 12. 1, ml	--	50	50	50	--	--	--	--
Wash H_2O, ml	--	--	--	--	--	40	40	40
Filtrate Rate, gal. /min/sq ft	0. 18	0. 15	0. 16	0. 15	0. 15	0. 14	0. 15	0. 15
Wash Rate, gal. /min/sq ft	--	0. 07	0. 07	0. 07	--	0. 05	0. 05	0. 05
Cake Weight Wet, gm	196. 6	191. 9	193. 9	194. 2	160. 3	167. 7	177. 3	177. 3
Cake Weight Dry, gm	157. 1	146. 8	149. 9	149. 0	126. 4	128. 7	135. 0	135. 2
Trim Weight Dry, gm	--	--	--	--	--	--	--	--
Moisture, %	20. 1	23. 5	22. 7	23. 3	21. 1	23. 3	23. 9	23. 7
Filter Rate, lb/sq ft/24 hr	2, 494	2, 330	2, 379	2, 365	2,006	2,043	2, 143	2, 146
Cake, Au,oz/ton	0. 04	0. 03	0. 02	0. 02	0. 02	0. 01	0. 01	0. 01
Cake, Ag,oz/ton	6. 36	2. 87	2. 52	2. 76	2. 44	2. 33	2. 33	2. 37
Per Cent Distribution[1]								
Cake, Au	53. 3	40. 0	26. 7	26. 7	26. 7	13. 3	13. 3	13. 3
Cake, Ag	32. 8	14. 8	13. 0	14. 2	12. 6	12. 0	12. 0	12. 2
Solution, Au	46. 7	60. 0	73. 3	73. 3	73. 3	86. 7	86. 7	86. 7
Solution, Ag	67. 2	85. 2	87. 0	85. 8	87. 4	88. 0	88. 0	87. 8

1/ Based on cake of 100% of feed weight and computed solution by difference.

2/ Total filtrate, filtrate plus wash water.

EXHIBIT 6

BALL MILL GRINDABILITY TEST

Ball Mill Grindability Test No. 1

Purpose: To determine the ball mill grindability of the test sample in terms of a Bond work index number.

Sample: Composite Sample No. 5, -6M.

Procedure: The equipment and procedure duplicate the Bond method for determining ball mill work indices.

Test Conditions: Mesh of grind: 100
Weight of undersize product for 250% circulating load: 360.0 gm
Weight % of undersize material in ball mill feed: 12.8

Results:

		Undersize				Undersize Produced	
Stage No.	New Feed gm	In Feed gm	To Be Ground gm	Revolutions Revolutions	Undersize in Product gm	Total gm	Per Mill Revolution gm
1	1,260.0	161.3	198.7	100	286.7	125.4	1.254
2	286.7	36.7	323.3	191	253.8	217.1	1.137
3	253.8	32.5	327.5	339	429.1	396.6	1.170
4	429.1	54.9	305.1	261	392.2	337.3	1.292
5	392.2	50.2	309.8	240	387.1	336.9	1.404
6	387.1	49.5	310.5	221	356.7	307.2	1.390
7	356.7	45.7	314.3	226	365.1	319.4	1.413

Average last three = 1.402

EXHIBIT 6

Ball Mill Grindability Test No. 1 (continued)

Ball Mill Work Index Computations

$$Wi = \frac{44.5}{P_1^{0.23} \times Gbp^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}}\right)}$$

Wherein: P_1 = 100% Passing Size of Product = 149 microns
Gbp = Grams per Revolution = 1.402
P = 80% Passing Size of Product = 112 microns
F = 80% Passing Size of Feed = 2,300 microns

Wi = 14.49

Note: See Screen Tests No. 6 and 7.

EXHIBIT 7

SCREEN TESTS

Screen Test No. 1

Sample: Composite Sample No. 4, -20M, from Cyanidation Tests No. 1, 2, 9, 13, and 14.

Procedure: The sample was dry screened for 20 minutes using a Ro-Tap.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
Feed	100.0	100.0
- 20 + 28	18.2	100.0
- 28 + 35	17.1	81.8
- 35 + 48	15.0	64.7
- 48 +100	20.3	49.7
-100 +200	11.5	29.4
-200 +325	4.9	17.9
-325	13.0	13.0

EXHIBIT 7

Screen Test No. 2

Sample: **Feed to Cyanidation Tests No. 3, 4, 10, 15, and 16, 10-minute dry grind.**

Procedure: The sample was dry screened for 20 minutes using a Ro-Tap.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
Feed	100.0	100.0
+ 35	0.2	100.0
- 35 + 48	3.5	99.8
- 48 +100	22.2	96.3
-100 +150	11.9	74.1
-150 +200	8.8	62.2
-200 +325	10.4	53.4
-325	43.0	43.0

EXHIBIT 7

Screen Test No. 3

Sample: Feed to Cyanidation Tests No. 5, 6, and 11, 30-minute dry grind.

Procedure: The sample was dry screened for 20 minutes using a Ro-Tap.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
Feed	100.0	100.0
- 48 + 65	0.1	100.0
- 65 +100	0.4	99.9
-100 +150	3.6	99.5
-150 +200	7.4	95.9
-200 +325	13.7	88.5
-325	74.8	74.8

EXHIBIT 7

Screen Test No. 4

Sample: Feed to Cyanidation Tests No. 7, 8, and 12, 5-minute dry grind.

Procedure: The sample was dry screened for 20 minutes using a Ro-Tap.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
Feed	100.0	100.0
+ 28	0.8	100.0
- 28 + 35	4.9	99.2
- 35 + 48	11.5	94.3
- 48 +100	24.9	82.8
-100 +200	17.7	57.9
-200 +325	9.3	40.2
-325	30.9	30.9

EXHIBIT 7

Screen Test No. 5

Sample: Cyanidation Test No. 17 tail, wet ground 30 minutes.

Procedure: The sample was wet screened on a 325M screen. The plus 325M was dried and dry screened for 20 minutes.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
Feed	100.0	100.0
+ 48 - 48 + 65	0.1	100.0
- 65 +100	0.2	99.9
-100 +150	1.5	99.7
-150 +200	5.2	98.2
-200 +270	8.8	93.0
-270 +325	6.6	84.2
-325	77.6	77.6

EXHIBIT 7

Screen Test No. 6

Sample: **Composite Sample No. 5, -6M, feed to Bond grindability Test No. 1.**

Procedure: **The sample was dry screened for 20 minutes on a Ro-Tap.**

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
- 6 + 8	19.9	100.0
- 8 + 14	31.6	80.1
- 14 + 28	18.7	48.5
- 28 + 48	10.1	29.8
- 48 +100	6.9	19.7
-100 +150	2.5	12.8
-150	10.3	10.3

EXHIBIT 7

Screen Test No. 7

Sample: Bond Grindability Test No. 1 product, -100M.

Procedure: The sample was dry screened for 30 minutes using a Ro-Tap.

Results:

Screen Product (Tyler) Mesh	Weight % Direct	Weight % Cumulative Passing
-100 +150	24.4	100.0
-150 +200	16.1	75.6
-200 +270	11.1	59.5
-270 +325	8.5	48.4
-325	39.9	39.9