

G I A N T
Yellowknife Mines Limited

MEMO TO: Sadek El-Alfy
CC: Don Cooper
FROM: Dan Kivari - Kilborn Engineering
DATE: October 3, 1988
SUBJECT: T.R.P. REVIEW AND RECOMMENDATIONS

The following is a summary for the review of the TRP and a list of recommendations.

1.0 SUMMARY

- 1.1.1 The gold dissolution is the most serious problem at the TRP. The present levels of cyanide addition at 2 pounds per ton have not improved the gold recovery. This plant test coupled with the attached cyanidation testwork demonstrates that extensive testwork will be required to determine the reagents and the leach time that are required for optimum gold recovery.
- 1.1.2 The wood chips that are trapped in the CIL circuit are being recovered with the carbon may have been activated in the kiln. Thus samples of the wood chips were taken at the trash screens and safety screens to determine if there is any difference in the gold content.
- 1.1.3 The wood chips that are being transferred with the carbon are causing carbon transfer problems at the loaded carbon screen. The wood chips can be separated from the carbon by elutriation at the acid wash tank. This would require a piping change at the acid wash vessel so that the wood chips can be pumped to the tailings. If the gold content of the wood chips are high, then a system for

recovering the wood chips for future processing should be installed after the elutriation of the carbon.

- 1.1.4 The gold losses in the CIL tailings have improved dramatically in the recent weeks. The present gold content in the tailing solution ranges from 0.0005 ounces per ton to 0.0015 ounces per ton whereas previous tailing solution assays were 0.006 ounces per ton.
- 1.1.5 Further effort in improving the time required for the loaded carbon transfer and strip cycle is required. The operations staff are actively pursuing methods of improving the cycle time.
- 1.1.6 The uneven distribution of the slurry feed to the safety and trash screens is causing flooding on the screens. The volume flow to the screens could be increased if a more even split of the feed to the screens could be obtained.
- 1.1.7 Presently the trash screens are operating well without the high pressure spray water. However the screens should be checked and cleaned on a regular basis, probably once per day.
- 1.1.8 The dissolved oxygen in the CIL slurry is very high at 11 to 12 ppm. This high level of dissolved oxygen can cause the formation of bicarbonates which will foul the carbon. Thus careful monitoring of the carbon and tailing solution will be required.
- 1.1.9 The mechanical availability of the CIL plant is good; thus it is not adversely affecting the gold recovery.

100 mesh
*
20 mesh
Screen blend
Gypsum / carbonates.

1.2 RECOMMENDATIONS

- 1.2.1 Daily bottle roll tests are required on the CIL feed and tailing samples. This will provide gold recovery information on a parallel test basis.
- 1.2.2 Additional testwork on the use of calcium peroxide and hydrogen peroxide as oxidizing agents in the CIL circuit should be done in the laboratory.

Lakefield did this.

1.2.3

Bottle roll tests using reclaim water and fresh water should be done to determine if the gold dissolution is affected by the reclaim water.

1.2.4

Five millilitres of 10% lead nitrate solution should be added to the CIL tailing solution prior to the free cyanide determination. The samples must be filtered to remove any precipitate prior to titrating with silver nitrate.

*Assumes
No chemical
consumption.*

1.2.5

Free cyanide determination should be done on samples of the CIL feed solution containing one to five pounds per ton of cyanide. These tests will determine the amount of cyanide that is required to be added to the CIL circuit to achieve the 300 ppm of free cyanide in the CIL solution. The tests can be done in the laboratory.

1.2.6

Recovery by size fraction must be determined. This can be done by sampling the CIL feed and CIL tailing on a daily basis and making a weekly composite for the testwork.

1.2.7

The determination of the fine carbon concentration in the CIL circuit should be done by carbon analysis or sink float tests.

1.2.8

As a temporary fix for the uneven split of the slurry feed to the safety and trash screens, valves could be instilled on the lines feeding the flooded screens.

1.2.9

To achieve higher rates of carbon transfer in the strip circuit, the size of the eductors can be increased. However the drainage of the extra water will require the piping to be modified.

1.2.10

A metallurgist dedicated to solving the cyanidation problems is required immediately.

2.0 CYANIDATION TESTS

2.1 Purpose

To investigate the recovery of gold from samples of the CIL feed and tailing.

TABLE 1
TEST RESULTS SUMMARY

TEST	FEED AU OZ/T	FEED AU OZ/T	RECOVERY %	LEACH TIME (HRS)	NACN LB/T	PB(NO3) LB/T 2	CAO2 LB/T	SAMPLE WEIGHT(GM)	PH
1	0.087	0.065	25.3	16	2.0	NIL	NIL	164.0	10.7
			AVE 24.7						
2	0.087	0.066	24.1	16	2.0	NIL	NIL	161.6	10.7
3	0.087	0.059	32.2	16	1.9	NIL	1.5	168.2	10.7
			31.6						
4	0.087	0.060	31.0	16	2.0	NIL	1.5 NIL	162.2	10.8
5	0.087	0.067	24.1	16	2.0	0.5	NIL	161.5	* 10.7
			24.4						
6	0.087	0.067	24.7	16	2.1	0.5	NIL	155.4	* 10.4
7	0.046	0.045	2.2	16	1.8	NIL	NIL	175.8	10.5
8	0.046	0.043	6.5	16	1.7	NIL	1.5	183.0	10.8

LEACH TIME = 16 HOURS

$$\text{Cost of } H_2O_2 = \$2 / \text{kg}$$

$$7\% \text{ Gold Recovery} = 1 \text{ ton} \times \frac{.067 \text{ g}}{\text{ton}} \times 0.07 \times \frac{\$540 \text{ / oz}}{.3} = \$2.53 / \text{ton.}$$

$$1.5 \text{ lb / ton } H_2O_2 = 1 \text{ ton} \times \frac{1.5 \text{ lb} \times \$2 / \text{kg}}{2.2 \text{ kg}} = \$1.36 / \text{ton.}$$

* Cyanidation Handbook.

High pH cancels effect of $Pb(NO_3)_2$
 Plumbate type lead dissolution PbO_2^- ?
 Guffy Lake found that pre aeration must be at pH 11.0

2.2 Procedure

- 2.2.1 Samples of the CIL feed were taken on two hour intervals over a 16 hour period and filtered to remove the excess moisture. The feed samples were blended together with a pit sample of equal size to make a test feed composite.

Six portions of approximately equal sizes were taken from the composite as feed for the cyanidation tests. The remaining portion of the composite were used for moisture and gold assays.

The six test portions were placed in thoroughly cleaned acid bottles. Tap water was added to the bottles to make a slurry of 35 percent solids by weight. The reagents as outlined on the Test Results Summary sheet were added to the test bottles. Lime was added for pH control.

- 2.2.2 The CIL tailing was sampled every two hours over a 16 hour period and the samples were filtered to remove the excess moisture. The filtered samples were blended together to make a tailing composite for the cyanidation tests. Two portions of approximately equal size were removed from the tailing composite for the cyanidation tests. The remainder of the tailing composite was used for the gold and moisture assays. After the test portions were added to the clean acid bottles, water was added to the bottles to make a slurry of 35 percent solids by weight. The reagents were added to the test bottles as outlined on the Test Result Summary sheet. Lime was added for pH control.

3.0 FREE CYANIDE TITRATION

3.1 Purpose

To investigate the effect of the addition of a lead nitrate solution to samples of the CIL tailing solution in the determination of free cyanide.

TABLE 2
TEST RESULTS SUMMARY

TEST	LEAD NITRATE (ML)	SILVER NITRATE (ML)		FREE CYANIDE (LB/T)	
		UNFILTERED	FILTERED	UNFILTERED	FILTERED
1	2	7.1	---	0.71	---
2	4	6.7	5.6	0.67	0.56
3	6	5.8	---	0.58	---
4	8	5.3	5.2	0.53	0.52
5	10	4.8	---	0.48	---
6	20	2.3	2.5	0.23	0.25
7	0	8.0	8.0	0.80	0.80

SILVER NITRATE STOCK SOLUTION = 8.67 GM/L

LEAD NITRATE STOCK SOLUTION = 10%

3.2 Procedure

Approximately 1.5 litres of tailing was filtered with the filtrate being saved for the determination of free cyanide. Eleven 120 millilitre samples were removed from the tailing solution sample for the free cyanide titration tests. A 10 percent solution of lead nitrate was added to nine of the test solution samples. After the addition of the lead nitrate solution, three of the samples were filtered through sharkskin filter paper to remove any precipitate prior to the titration with silver nitrate.

4.0 DISCUSSION

4.1 Cyanidation Tests

- (1) The bottle roll tests gave substantially lower gold recoveries than previous tests that were performed by Lakefield Research and by in-house personnel i.e. 25% versus 40% after 16 hours.
- (2) The addition of 0.5 lb/t of lead nitrate had no effect on the gold recovery.
- (3) The addition of calcium peroxide to the bottle tests increased the gold recovery by approximately seven percent on the CIL feed sample and by approximately four percent on the CIL tailing sample.
- (4) An extra 16 hours of leaching on the CIL tailing had a minimal effect on the gold recovery.
- (5) The lower overall gold recoveries when compared to previous tests may be the result of different testing procedures. The previous cyanidation tests were performed on oven dried samples where the oxidation of gold bearing sulphides could occur thereby giving better results than the present tests.

*Lakefield
Checked This.*

Also, the CIL feed composite sample was collected over a short period of time thus the ore type that was entering the CIL circuit at the time of the sampling may have had an affect on the cyanidation test results.

4.2 Free Cyanidation Determination

- (1) The addition of lead nitrate to the tailing test solutions caused a lower free cyanide determination.
- (2) A large excess of lead nitrate in the tailing solution caused erroneous free cyanide determinations.
- (3) The precipitate that is created by the addition of lead nitrate to the tailing solution interferes with the free cyanidation determination.

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