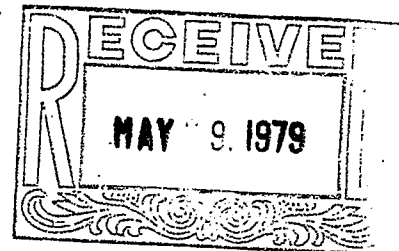


# FALCONBRIDGE NICKEL MINES LIMITED

## INTER OFFICE MEMORANDUM



MEMO TO: M. Collins

FROM: W.R. Hatch/L. Beky

DATE: May 22, 1979

SUBJECT: Purification of Arsenious Oxide by the Hot Water Leach Method

KEYWORDS: Giant Yellowknife

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PROJECT No. 201-0-790522  
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### SUMMARY

A number of laboratory tests were carried out at Giant YK in support of the Arsenious Oxide pilot plant. The response of current production bag-house dust was evaluated. It was found that this material contained 90.0% soluble  $\text{As}_2\text{O}_3$  which dissolved readily to produce a saturated solution containing 70 g/L  $\text{As}_2\text{O}_3$ . The effect of incomplete dissolution on the arsenic content of the residue is discussed.

Saturated solutions from laboratory leach tests and from the pilot plant were evaluated and it was found that with stirring, heavy seeding and forced cooling about 50 g of  $\text{As}_2\text{O}_3$  could be crystallized per litre of solution.

The effect of flocculent addition during leaching is discussed. The information gained in these tests was transferred to the pilot plant where an attempt was made to simulate operating conditions.

### INTRODUCTION

During our recent visit to Giant YK Mines<sup>(1)</sup>, a number of laboratory experiments were carried out in support of the pilot plant operation. The mill lab was made available for this work and the results were directly transferred to the pilot operation. Mr. Brian Cross assisted with some of the experimental work. The experiments carried out are summarized as follows:

1. Amount of soluble  $\text{As}_2\text{O}_3$  in current bag-house dust and arsenic concentration in residue.
2. Large scale leach - crystallization tests using various conditions.
3. Large scale leach - crystallization test using water jacket for cooling, heavy seeding and mechanical stirring.
4. Crystallization test on Pilot Plant leach solution.
5. Flocculent addition settling test.

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(1) Visit to Giant Yellowknife Gold Mines, Yellowknife, N.W.T., April 26 to May 11, 1979, W.R. Hatch/L. Beky, FTR-503.

## TEST #1

Soluble As<sub>2</sub>O<sub>3</sub> in Bag-house Dust

Fifty grams of current bag-house dust used in the pilot plant was leached in 1. L of water at 100°C for 1.0 hr. The solution was filtered, residue weighed and solution analyzed. This leach, with a large excess of water would dissolve all the soluble As<sub>2</sub>O<sub>3</sub>.

Residue Wt. 4.5 g  
% As 6.9 (9.1% as As<sub>2</sub>O<sub>3</sub>)

Solution Analysis - Chemical 43 g/L As<sub>2</sub>O<sub>3</sub>  
- Density Method 45 g/L As<sub>2</sub>O<sub>3</sub>

Solubility  $\frac{45.5}{50.0} \times 100 = 91.0\%$

% Arsenic soluble in BHD =  $\frac{43.0}{43.41} = 99.0\%$

Thus a "clean" - leach residue will contain insoluble arsenic compounds (arsenopyrite etc.) equivalent to 9.1% As<sub>2</sub>O<sub>3</sub>. A leaching operation which dissolves 90% of the soluble arsenic will result in a residue containing 54% As<sub>2</sub>O<sub>3</sub> (Figure 1).

In order to produce a clean residue for subsequent gold recovery it would seem most appropriate to carry out a primary leach on this high arsenic bag-house dust to produce a residue containing 20 → 40% As<sub>2</sub>O<sub>3</sub> and then releach the residue (thickener underflow) in water or recycle solution in a final treatment stage. It may also be advantageous to combine this 2nd stage with the leaching of low As<sub>2</sub>O<sub>3</sub> content material (Cyclone Dust).

## TEST #2

A large scale leach was carried out on the bag-house dust contacting 320 g with 4.0 L of water at 100°C. The residue was filtered off, dried and weighed and the leach solution was divided into four portions for crystallization tests as follows:

- 1) 1000 mL in 2 L beaker - slow stirring - natural cooling.
- 2) 1000 mL in 2 L beaker - slow stirring - natural cooling.
- 3) 1000 mL cooled under vacuum.
- 4) 600 mL transferred to 3-250 mL beakers in ultrasonic bath(2).

All tests were carried out overnight.

(TEST #2, Cont'd.)

The leach residue weighed 94 g and the solution (3.8 L) analyzed 57 g/L  $\text{As}_2\text{O}_3$ .

The solutions in #1 and #2 evaporated to 950 mLs and deposited 23 and 19 g of  $\text{As}_2\text{O}_3$  crystals, deposition occurring on the stirrer and walls of the container.

Crystallizer #3 had a final volume of 800 mLs and deposited 30 g crystals and #4 (ultrasonic) deposited 19 g of crystals with a high evaporative loss (final volume approx. 420 mLs). All final crystallizer solutions were in the 30 to 35 g/L  $\text{As}_2\text{O}_3$  range with the exception of #2 which contained 41 g/L  $\text{As}_2\text{O}_3$ . The ultrasonic bath provided fine crystals with no crystallization on the walls of the beaker.

The filtrates were combined and 2.0 L of solution were used in a recycle leach of 80 g dust. The final 1600 mL volume contained 70 g/L  $\text{As}_2\text{O}_3$  and after overnight cooling, slow stirring, dropped to 40 g/L  $\text{As}_2\text{O}_3$ . The pH+ measured 3.7.

None of these crystallizer tests were seeded and all were cooled to ambient temperature without forced cooling.

## TEST #3

This test was carried out to evaluate the effect of seeding and water bath cooling on the rate of crystallization.

An initial leach was carried out at 100°C with 800 g of dust in 4.0 L of water, leaching 2.0 hours. The pH+ of the slurry was adjusted to 4.9 using 14 mL of 20% W/V  $\text{H}_2\text{SO}_4$ . The slurry was filtered on a glass fibre paper using mild suction. Total filtration time was 15 minutes with a final cake thickness of 3.8 cm. The final solution contained 72.9 g/L  $\text{As}_2\text{O}_3$  and 300 mLs of this were seeded with 500 g  $\text{As}_2\text{O}_3$  and stirred in a beaker immersed in a water bath. Samples were taken periodically as the temperature of the solution was dropped via the water bath. The results are given in Table I and shown in Figure 2. The improvements associated with seeding or maintaining a high crystal weight in solution and rapid cooling are evident.

## TEST #4

The above test was repeated using actual pilot plant solution obtained by leaching at pH+=4.0 with the addition of flocculent. These results are given in Table I and shown in Figure 2. It is noted that about 50 g of  $\text{As}_2\text{O}_3$  were crystallized out in six hours with fairly rapid cooling and a high solids/liquid ratio in the crystallizer.

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- (2) Suggested by B. Cross as a means of preventing crystal buildup on wall of container.

(TEST #4, Cont'd.)TABLE I: Crystallization Tests

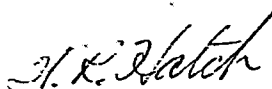
Test #3			Test #4		
Time (m)	Temp. (°C)	As <sub>2</sub> O <sub>3</sub> (g/L)	Time (Hr)	Temp. (°C)	As <sub>2</sub> O <sub>3</sub> (g/L)
0	80	72.9	0	80	74.0
0.5	60	63.7	0.5	53	48.6
1.3	50	45.9	1.0	45	39.5
1.8	40	38.3	2.0	20	28.6
2.3	30	31.9	9.5	20	18.4
6.3	25	21.1	18.0	20	18.4

FLOCCULENT ADDITION TEST

A test was carried out to determine the optimum amount of flocculent required in recycle leaching of bag-house dust. Recycle solution from the pilot plant (4.0 L) was used to leach 160 g bag-house dust at 98°C. The slurry was divided into four parts and additions of 0, 0.5, 1.0 and 2.0 mL of flocculent solution from the plant were added. The slurry was stirred and allowed to settle.

The addition of 0.5 mL of flocculent appeared to be optimum for providing good settling and a clear supernatant liquid.

WRH/lm  
Attach.



W.R. Hatch

FIGURE 1: Percentage of Soluble Arsenic Dissolved

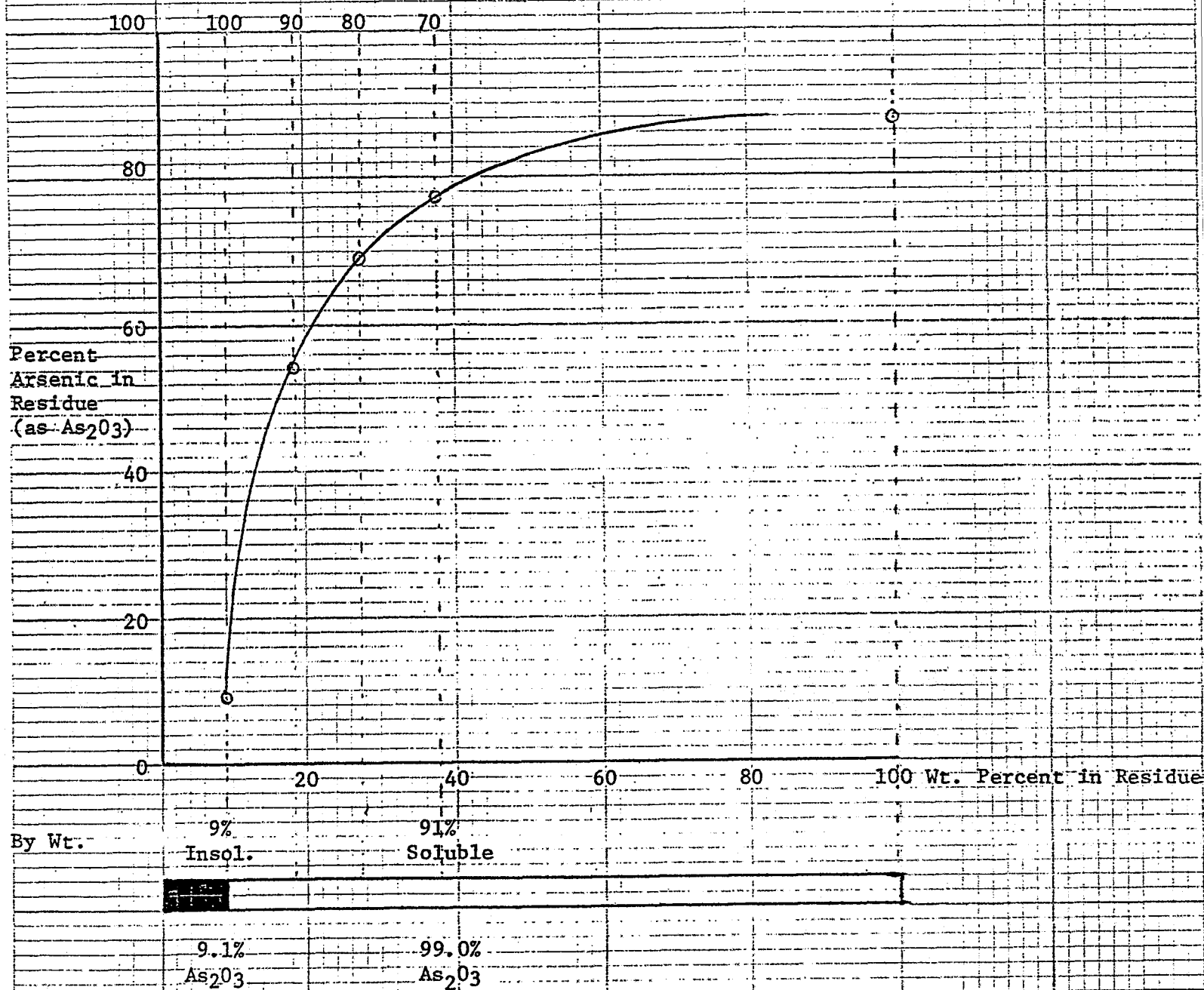


FIGURE 2:  $\text{As}_2\text{O}_3$  Crystallization vs Time

