MINUTES OF THE 15th MEETING OF GOLD MINING WORKING GROUP,
PLACE VINCENT MASSEY
HULL, QUEBEC

EXCERPTS

October 22nd and 23rd, 1986

Mt Skukum Hearing

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8. Update on the SO_2/Air Process - E. Devuyst

Two other operating mines are licensed to use the SO_2/air process at present. Equity Silver, in B.C. and Mount Skukum, in Yukon. E. Devuyst presented operating parameters and available performance data for these two plants.

At Equity, the original plant design was modified, at Inco's recommendation, to incorporate a large reactor with increased mixing capacity (250 HP), at the feed end of the plant, ahead of the two existing reactors. Most of the cyanide destruction is accomplished in this first stage. The plant operates on slurry and the reagent is added as liquid SO_2. Although not intended for complete cyanide removal (the mill's cyanide circuit is on a 100% recycle and 5 ppm CN is acceptable), the treatment plant performs very well, as can be seen in Table 6.

The plant at Mount Skukum is also treating slurry in a three-stage process using three modified flotation cells. Performance data from the plant are provided in Table 7. The operating parameters for the plants at Mount Skukum and Equity are presented in Table 8.

In an answer to a question from A. Hussain, E. Devuyst stated that the treatment of a higher density pulp would require a longer retention time and possibly increase the reagent consumption and the aeration requirements. Answering another question from J. Scott, he said that Inco is confident that the SO_2/air process can consistently achieve total cyanide concentrations below 1 mg/L and copper concentrations around 1 mg/L in the reactor's effluent.

B. Conard described Inco's new royalty fee which is to be based on the amount of SO_2 used, i.e., a measure of the amount of cyanide removed. The proposed rate is \$0.15/pound of SO_2 or equivalent SO_2 used.

The present royalty system is based on a percentage of the value of gold produced by the mine. Inco estimates that the fees will go down substantially with the new rate (40% in the case of the McBean mine).

TABLE 6 LABORATORY AND ACTUAL PLANT PERFORMANCE AT EQUITY SILVER

Location	Stream	% Solids	Total Retention (min)	pH	Assays (mg/L)					Reagents Added (g/g CN_T)		
					CN_T	SCN	Cu	Fe	Ni	SO_2	Cu^{2+}	Lime
Lab	Feed	35		10	195	120	42	25	1.2			
	Effluent		30	8.0	0.4	100	1.1	<0.2	0.2	3.8	0.25	3.5
Plant	Feed	35		-	125	-	35	2	-			
	Effluent		60*	8.5	< 1	-	1.0	<0.1	-	3.5	0.11	-

* Useful retention is 30 minutes

TABLE 7 LABORATORY AND ACTUAL PLANT PERFORMANCE AT MOUNT SKUKUM

Location	Stream	% Solids	Total Retention (min)	pH	Assays (mg/L)			Reagents Added (g/g CN_T)		
					CN_T	Cu	Fe	SO_2	Cu^{2+}	Lime
Lab	Feed	45		9.8	215	3	40			
	Effluent		40	8.0	0.3	0.2	0.1	2.1	0.50	1.0
Plant	Feed	35		11	100	-	15			
	Effluent		40	8.2-8.5	0.9	<1	<0.2	3.8	0.25	0

TABLE 8 OPERATING PARAMETERS OF THE SO_2/AIR PLANTS AT MOUNT SKUKUM AND EQUITY

		Mount Skukum	Equity
Tonnage	: tonnes/day	300	8000
% Solids in Tails	: %	35	35
NaCN Dosage	: lbs/tonnes	1.0	1.1
Cyanide Destruction	: Stages	3	3
Total Retention	: Minutes	40	60
CN_T in Tails	: kg/day	60	1700
SO_2	: kg/day	225	6000
$CuSO_4.5H_2O$	: kg/day	75	1000

9. Effluent Treatment at Noranda's Golden Giant Mine, Hemlo - M. Wiber

The Golden Giant mine has been in operation since mid-1985. It currently processes 1250 tonnes/d using the carbon-in-pulp process. The tailings slurry is discharged to the tailings pond and supernatant water is recycled back to the mill.

Excess reclaim water is treated before discharge to the environment for cyanide destruction, as well as antimony and arsenic precipitation. Noranda has been experimenting with two cyanide destruction processes. One is a method patented by Noranda and using SO_2. The reagent, as liquid SO_2 is mixed with the water in the first of three tanks in series (Figure 9). No mechanical aeration is provided. Copper, as $CuSO_4$, is added as a catalyst. The precipitate solids are removed in a clarifier with partial sludge recycle. The remainder of the sludge is discharged to the tailings pond. Ferric sulphate and lime are then added to another series of 3 tanks for antimony and arsenic precipitation. The effluent from the third reactor is discharged to a clarifier from which the overflow is pumped to Lim Lake. A portion of the clarifier underflow is recycled to the third reactor and the remainder discharged to the tailings pond.

Noranda initially used hydrogen peroxide for cyanide removal, but started to experiment with SO_2 when faced with difficulties. Testing with H_2O_2 is still

performed, but Noranda has not been able to produce an effluent of acceptable quality with cyanide concentrations in feed water above 10 mg/L. A summary of treatment plant performance for 1986 is presented in Table 9. Typical operating parameters for both SO_2 and H_2O_2 processes are illustrated in Tables 10 and 11.

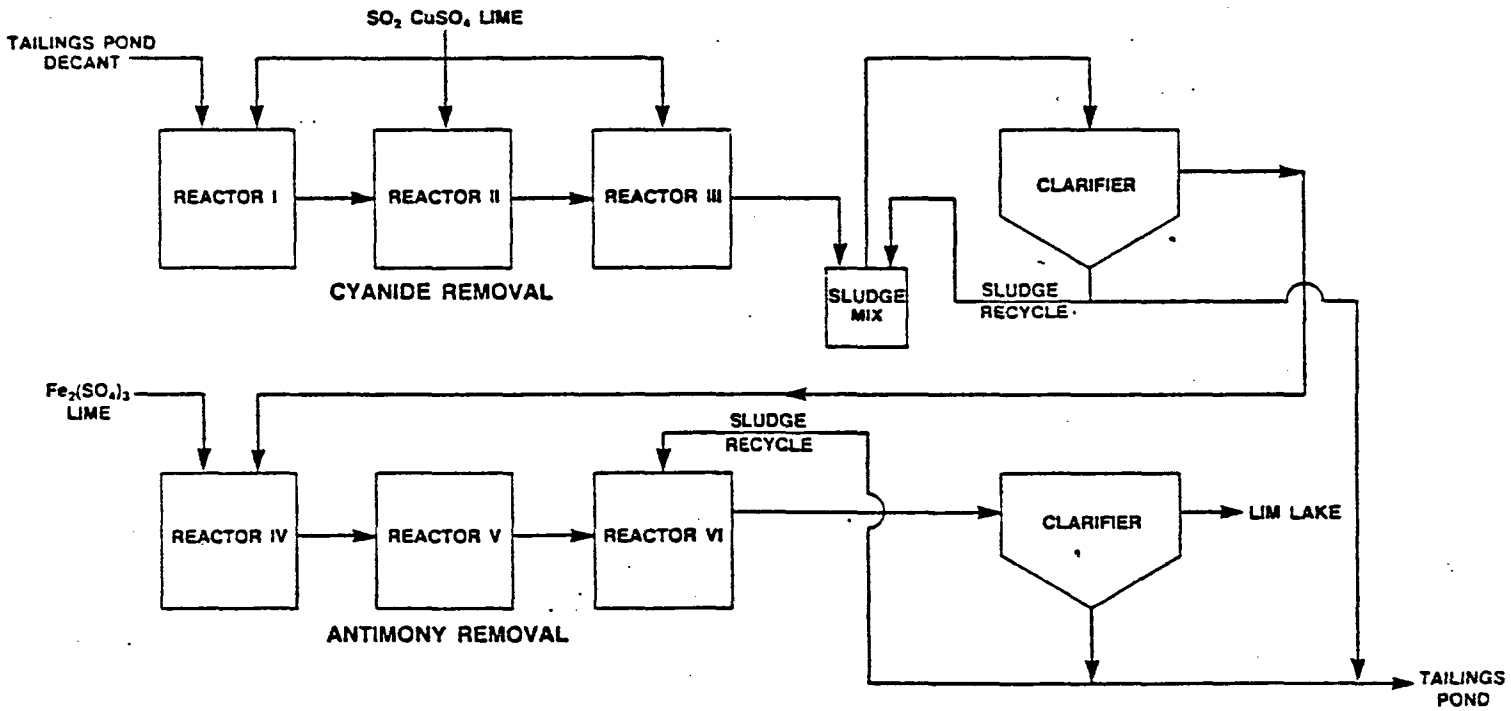

FIGURE 9 EFFLUENT TREATMENT PLANT, GOLDEN GIANT MINE

TABLE 9 SUMMARY OF 1986 EFFLUENT TREATMENT AT NORANDA'S GOLDEN GIANT MINE

	Average Concentration in mg/L							
	CN_T	Cu	Fe	Ni	Sb	CNS	CNO	pH
Influent	26.8	4.3	3.1	4.9	12.8	51	10.9	8.9
Effluent	0.46	0.14	0.41	0.3	3.6	43	31.2	8.6
% Removal	98.3	96.7	87	94	72	16	-	-

TABLE 10 TYPICAL RESULTS AND OPERATING PARAMETERS FOR THE SO_2 PROCESS - APRIL 1986

	Concentrations in mg/L			
	CN_T	Cu	Fe	Sb
Influent	50	5.5	5.1	11.2
Effluent	0.10	0.04	0.04	2.7
% Removal	99.8	99.3	92.1	75.9

Operating Parameters						
Flow m^3/hr	Ret. Time hrs	$SO_2:CN_T$	$Cu:CN_T$	Fe:Sb	pH, 1st Stage	pH, 2nd Stage
190	3.45	6-7:1	0.5:1	10:1	8.9	7.8

Reagents: - 100% liquid SO_2
Fe source: 100 g Fe/L pickling waste