

# MEMORANDUM

To H.E. Pawson

Date March 19, 1975

From R.J. Tucker

Ref.

Subject Waste Treatment - Arsenic Suppression in Total Carbon Plant Waste Stream (CaO and FeSO<sub>4</sub>)

Having achieved good arsenic precipitation from filtered D.T.B. solutions using lime, it was decided to investigate treatment of the total Carbon Plant Effluent stream.

## Series I Dust Treatment Residue for Feb 16/75 (1500 p.p.m. As.)

	CaO (lb/ton sol)	FeSO <sub>4</sub> (lb/ton sol.)	Reagent Addition	pH	p.p.m. As.
1.	10	1	CaO - 30 min agitat. then FeSO <sub>4</sub>	9.5	1364
2.	10	1	CaO and FeSO <sub>4</sub> together	9.4	1342
3.	10	1	FeSO <sub>4</sub> - 30 min. agitat then CaO	9.4	1386

All three samples were agitated on the rolls for 3.5 hours. The low levels of CaO did not produce a high enough pH for significant arsenic suppression and there was no significant difference in arsenic suppression as a result of the method of reagent addition.

## Series II Dust Treatment Residue for Feb 16/75 (1309 p.p.m. As.)

Three samples were taken and rolled for 30 minutes with 15 lb CaO/ton of solution in each and 1.5 lb FeSO<sub>4</sub>/ton of solution in #1 and 3. The pH of all three after  $\frac{1}{2}$  hour was 10.2. An additional 15 lb CaO per ton of solution was added and the samples were rolled for another 15 minutes.

After settling the clear solution was analyzed for arsenic. The solutions were then allowed to sit in contact with the solids and were monitored for arsenic over a period of a week; the total pulps were then diluted in various proportions and the arsenic levels monitored.

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1-3 = 30% CaO + 15% FeSO<sub>4</sub>  
2 = 30% CaO

Date			Dilution CPR vol/total Vol.	pH	As. p.p.m. 1309 ppm Smet
Feb. 17/75		1	---	11.1	14.0
	Clear	2	---	11.1	15.0
		3	---	11.1	12.3
Feb. 19/75		1	---	11.2	9.2
	Clear	2	---	11.2	7.2
		3	---	11.2	9.2
Feb. 19/75		1	---	11.2	9.2
	Rolled				
	1/2 hr. & filt'd	2	---	11.2	9.2
		3	---	11.2	9.2
Feb. 24/75		1	---	11.2	7.7
	Clear	2	---	11.2	7.7
		3	---	11.2	7.7
Feb. 24/75		1	1/2	11.2	13.3
	Clear	2	1/3	11.0	15.0
		3	1/4	10.9	13.8
Feb. 24/75		1	1/2	11.1	11.0
	Shaken				
	& filtered	2	1/3	10.9	13.8
		3	1/4	10.9	13.8
Feb. 25/75		1	1/2	11.2	4.4
	Clear	2	1/3	11.2	8.4
		3	1/4	11.2	12.1
Feb. 25/75		1	1/2	11.4	7.2
	Shaken	2	1/3	11.2	7.2
	& filtered				
		3	1/4	11.2	10.2
Feb. 26/75		1	1/6	10.9	10.2
	Clear	2	1/15	10.5	12.2
		3	1/20	10.1	15.0
Feb. 26/75		1	1/6	10.9	11.0
	Shaken				
	& filtered				
		2	1/15	10.5	12.7
		3	1/20	10.3	15.0

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March 3/75	Clear	1	1/6	10.8	13.4
		2	1/15	10.3	18.5
		3	1/20	10.0	38.2
March 10/75	Clear	1	1/6	10.6	22.0
		2	1/15	10.1	25.3
		3	1/20	9.6	39.8

- The precipitated As goes into solution with dilution*
- Above a pH of 10.9 solution assays for arsenic decreased with time.
  - Arsenic assays after agitation and filtration did not significantly differ from those of clear solutions.
  - Above a pH of 10.9 the soluble arsenic levels in equilibrium with the solids remained between 7 and 15 p.p.m. As., indicating in the case of the  $\frac{1}{2}$  dilution, a four fold increase in the total dissolved arsenic.
  - For dilutions of 1/6, 1/15, and 1/20 resulting in pH's below 10.9 arsenic levels increased above the original 7-15 p.p.m. range and continued to increase with time. The 1/20 dilution produced a final arsenic assay of 40 p.p.m. indicated a dissolution of approximately 60% of the originally precipitated arsenic.
  - As expected greater dilution produced lower pH's and higher arsenic levels.

Conclusion: As originally indicated in the report "Waste Treatment - Stability of Arsenic Precipitate" significant amounts of precipitated arsenic ~~was~~ returned to solution from treated Carbon Plant Waste. A 50% increase in lime addition (from 20 to 30 #CaO/ton of solution) maintained low arsenic assays, as long as the pulp remained undiluted. However, dilution resulted in immediate reversal of precipitated arsenic to the solution and dilution to the pH range of mill waste (pH 9.5 - 9.8) produced over 50% dissolution of precipitated arsenic.

It is apparent that low arsenic levels and permanent suppression of arsenic cannot be achieved by treatment of the total carbon plant waste stream with lime and low levels of  $\text{FeSO}_4$ . High levels of  $\text{FeSO}_4$  (10 lb  $\text{FeSO}_4$  to 1 lb As. in solution) might be effective but would entail the addition of at least  $\frac{1}{2}$  ton of  $\text{FeSO}_4$  to #5 agitator per day.

## Options:

- High iron salt addition to #5 agitator - probably 500-600 lbs/day<sup>Fe</sup> assuming D.T.B. of 1500 p.p.m. As. ---  $\text{FeCl}_3$  may improve arsenic precipitation but will precipitate remain stable<sup>3</sup> after continued contact between solution and solids and tailings area dilution?

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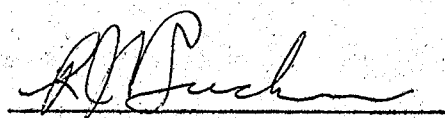
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2. High iron salt addition to mill waste --- probably 700-800 <sup>lb</sup>lb/day assuming a mill waste arsenic content of 20 p.p.m.
3. Iron Salt and/or CaO treatment of Tailings Pond solution after separation from solids
4. Separation of D.T.B. from D.T.R. before dilution and lowering of pH.

*or filtering out  
the precipitate as  
soon as formed.*

  
R. J. Tucker  
Mill Metallurgist

- A- Dilution reverses the reaction by lowering pH so arsenic comes out returning to a soluble state
- B.- The obvious solution would be to filter out the precipitate (and solids) before releasing water.
- C- RGT indicates as did Cheng that iron may hold arsenic ~~in~~ in precipitate without reversal.