

# MEMORANDUM

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Date Dec 4/75

From C.Q. Olesen

Ref.

Subject The use of Ferric Chloride as a means of suppressing arsenic.

Procedure: 500 ml samples of thickeners 6, 11 and a combination of 6 + 11 + 13 and one liter samples of thickener 13 were treated with varying quantities of ferric chloride and then later treated with 7 drops of  $\text{NH}_4\text{OH}$ .

## Data:

Part I - #6 thickener pH 6.9 PPMAs 20.3 ppmCu 0.17 ppmFe 8.0

<u>FeCl<sub>3</sub>(g)</u>	<u>pH</u>	<u>pHOH</u>	<u>ppmAs</u>	<u>ppmAsOH</u>	<u>ppmCu</u>	<u>ppmCuOH</u>	<u>ppmFe</u>	<u>ppmFeOH</u>
.090	3.1	9.6	17.0	3.2	.90	ND	48	5.0
.180	3.2	9.4	17.0	2.1	.30	ND	100	ND
.270	3.1	9.1	17.0	2.1	.14	ND	204	0.6

Part II - #11 thickener pH 5.3 ppmAs 62.0 ppmCu 0.17 ppmFe 320

<u>FeCl<sub>3</sub>(g)</u>	<u>pH</u>	<u>pHOH</u>	<u>ppmAs</u>	<u>ppmAsOH</u>	<u>ppmCu</u>	<u>ppmCuOH</u>	<u>ppmFe</u>	<u>ppmFeOH</u>
.400	2.8	7.8	102	4.6	.6	ND	600	.6
.550	2.8	9.6	90	1.8	.5	ND	650	.2
.700	2.7	9.1	100	3.0	1.6	.05	830	.1

Part III - #13 thickener pH 6.5 ppmAs 430 ppmCu 0.25 ppmFe 74

<u>FeCl<sub>3</sub>(g)</u>	<u>pH</u>	<u>pHOH</u>	<u>ppmAs</u>	<u>ppmAsOH</u>	<u>ppmCu</u>	<u>ppmCuOH</u>	<u>ppmFe</u>	<u>ppmFeOH</u>
3.00	5.6	6.95	200	280	.44	ND	127	.3
3.50	5.5	6.9	203	280	.70	ND	154	.6
4.00	5.3	6.55	170	240	1.07	.05	200	12.4

Part IV - Combination (13+6+11) pH 6.0 ppmAs 92 ppmCu 4.80 ppmFe 100

<u>FeCl<sub>3</sub>(g)</u>	<u>pH</u>	<u>pHOH</u>	<u>ppmAs</u>	<u>ppmAsOH</u>	<u>ppmCu</u>	<u>ppmCuOH</u>	<u>ppmFe</u>	<u>ppmFeOH</u>
.50	5.3	8.25	81	43.8	.93	ND	139	1.5
.55	5.1	8.2	81	34.0	2.47	ND	150	2.8
.60	4.6	6.7	81	38.2	4.10	.20	172	17.4

## Calculations:

### Part I

<u>Available Fe from FeCl<sub>3</sub> mg Fe</u>	<u>Consumed As mg As</u>	<u>Fe/As</u>	<u>Total Avail Fe mg Fe</u>	<u>Fe/As</u>
18.9	8.6	2.20	22.9	2.66
37.8	9.1	4.15	41.8	4.59
56.7	9.1	6.23	60.7	6.67

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## Part II

<u>mg Fe</u>	<u>mg As</u>	<u>Fe/As</u>	<u>T.A. Fe</u>	<u>Fe/As</u>
84.0	28.7	2.93	244	8.50
115.5	30.1	3.84	275.5	9.15
147.0	29.5	4.98	307	10.41

## Part III

<u>mg Fe</u>	<u>mg As</u>	<u>Fe/As</u>	<u>T.A. Fe</u>	<u>Fe/As</u>
630	150	4.20	704	4.69
735	150	4.90	809	5.39
840	190	4.40	914	4.81

## Part IV

<u>mg Fe</u>	<u>mg As</u>	<u>Fe/As</u>	<u>T.A. Fe</u>	<u>Fe/As</u>
105	24.1	4.36	155	6.43
115.5	39.0	2.96	165.5	4.24
126	26.9	4.68	176	6.54

## Conclusions:

- as mentioned before, pH is a critical factor in the suppression of arsenic, as noted in parts I and II to parts III and IV
- upon the addition of the ferric chloride, copper has the tendency to appear in the solution, but this probably comes from the solids themselves. Then with the addition of  $\text{NH}_4\text{OH}$  the copper drops out
- Using Mr. La Clare's assumption that 5 moles of iron is used for 1 mole of arsenic, the weight ratio would be 3.72. Now, compare the above figure to the calculated ratio of the iron available from the ferric chloride to the consumed amount of arsenic, it comes close to this theoretical ratio. Then in the final comparison of the ratio's for the total amount of iron available exceeds way beyond Mr. La Clare's statement of 5 to 1.
- therefore in the next series of tests a larger amount of  $\text{FeCl}_3$  should be used and a higher pH obtained. As this may rectify the problems.