

(CONFIDENTIAL)

STUDY OF BAKER CREEK DRAINAGE
WITH RESPECT TO SOLUBLE ARSENIC

OBJECTS:

1. To pinpoint the source(s) of water containing excessive amounts of soluble arsenic.
2. To determine if there are any hitherto unsuspected reasons for fluctuations in the soluble arsenic content of the Giant tap water.

METHODS:

1. Water samples were taken at selected points in and adjacent to Baker Creek. These samples covered all known waters flowing into Baker Creek in the plant area. These samples were analysed for soluble arsenic.
2. Water flows of Baker Creek and tributary waters were measured and/or calculated.
3. A soluble arsenic balance was calculated for the drainage area being studied.
4. Daily Giant tap water samples were taken and analysed for soluble arsenic.
5. Rainfall measurements for the Yellowknife area were obtained from the Meteorological Office at the airport.

RESULTS:

1. Tabulation of Giant tap water assays and rainfall:

<u>Date</u>	<u>ppm As.</u>	<u>Rainfall (in.)</u>	<u>Remarks</u>
July 5/66	0.065	-	
July 6/66	0.079	0.14	
July 7/66	0.160	0.03	Note increase As content
July 8/66	0.253	-	" " " "
July 11/66	0.068	-	
July 12/66	0.029	-	

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<u>Date</u>	<u>ppm As.</u>	<u>Rainfall (in.)</u>	<u>Remarks</u>
July 13/66	0.109	-	
July 14/66	0.0226	-	
July 15/66	0.023	-	
July 16/66	-	0.05	
July 18/66	0.104	-	Note increase As content.
July 19/66	0.072	-	
July 20/66	0.032	-	
July 21/66	0.096	-	
July 22/66	0.078	-	
July 25/66	0.009	-	
July 26/66	0.025	0.21	(Rainfall from 10 A.M. (July 25 to 10 A.M. July 27)
July 27/66	0.088	-	Note increase As content.

2. Tabulation of Sample Results - Baker Creek drainage.

July 18/66

#1 Baker Cr. above falls; 1505 hrs. 0.177 ppm As.
 #2 Baker Cr. at 'A' Boiler house; 1515 l. 3.00 ppm As.

July 20/66

#1 Tailings pond solution; 1055 hrs. 47.00 ppm As.
 #2 Tailings pond effluent close
 to junction with Baker Cr.; 1040 hrs. 38.70 ppm As.
 #3 Baker Cr. above falls; 1030 hrs. 0.218 ppm As
 #4 Baker Cr. below conc. wash
 thickener C/F discharge; 1020 hrs. 5.20 ppm As.
 #5 Baker Cr. below mine drainage
 discharge (pumps operating); 1005 hrs. 4.50 ppm As.
 #6 Baker Cr. at 'A' Boiler House; 1010 hrs. 3.80 ppm As.
 #7 Lake water at main pump intakes
 (strong NE wind blowing) 1015 hrs. 0.0625 ppm As.

July 25/66

#1 Concentrate wash thickener
overflow (at Baker Cr.): 1120 hrs. 7.10 ppm As
#2 Mine drainage water (at Baker Cr.): 1150 hrs. 8.05 ppm As

July 27/66

#1 Baker Cr. sieve tails. 0800 hrs. 0.128 ppm As

3. Calculations of average water flows

a) Baker Cr.

The Engineering Dept. under the direction of E. Widman took flow measurements at 5 points below the bridge to the H.C.P.C. substation on July 22 and 25th. Two of these measurements were discarded as erroneous. The other seven measurements were averaged as follows:

Xn B	8.12 ft ³ /sec
Xn C	7.38
Xn D	8.72
Xn E	5.48
Xn F	11.62
Xn G	9.05
Xn H	<u>5.52</u>
Total	57.09 ÷ 7 = 8.16 ft ³ /sec (average)

Recalculation cutting high flows to 8.15 ft³/sec

Xn B	8.12 ft ³ /sec
Xn C	7.38
Xn D	8.15
Xn E	5.48
Xn F	8.15
Xn G	8.15
Xn H	<u>5.52</u>
Total	59.95 ÷ 7 = 7.23 ft ³ /sec (average)

b) Concentrate wash thickener overflow

At 1315 hrs on July 21/66 flow was 88.6 imp. gals/min or 0.2296 ft³/sec.

c) Mine discharge water

During June 1966, 1330L pumps operated a total of 454.9 hrs. Pumps are rated at 416 imp. gal/min. at 1328 ft. total head. Adjusting for time

when both pumps were operating at the same time average flow was 11.35×10^6 Imp. gals. $\pm 30\%$ = 9.09×10^6 Imp. gals. or 216 Imp. gals/min or $0.582 \text{ ft}^3/\text{sec}$.

d) Tailings pond effluent loading into Baker Cr.
 $0.64 \text{ ft}^3/\text{sec}$ (measured by Eng. Dept.)

e) By subtraction, flow at Baker Cr. above falls = $7.29 - (0.58 + 0.23 + 0.64)$
 $= 5.83 \text{ ft}^3/\text{sec}$.

4. Calculation of soluble arsenic balance.

Adjusted flow measurements and sample results of July 30th and 31st are used.

a) Baker Creek at 'A' Roller house

$$7.29 \text{ ft}^3/\text{sec} \times 3.80 \text{ ppm As} = 27.7$$

b) Baker Cr. above falls

$5.83 \text{ ft}^3/\text{sec} \times 0.23 \text{ ppm As}$	$= 1.33$
plus Tailings pond effluent	
$0.64 \text{ ft}^3/\text{sec} \times 29.70 \text{ ppm As}$	$= 24.75$
plus Conc. weigh. th. C/P	
$0.23 \text{ ft}^3/\text{sec} \times 7.10 \text{ ppm As}$	$= 1.63$
plus Mine disch. water	
$0.56 \text{ ft}^3/\text{sec} \times 3.05 \text{ ppm As}$	$= 1.71$
Total	29.33

∴ Average calculated soluble As in Baker Cr. is

$$29.33 \div 7.29 \text{ ft}^3/\text{sec} = 4.04 \text{ ppm As}$$

This is 6.1% more than measured content (3.80 ppm As)

5. Calculation of effect on Baker Cr. of eliminating tailings pond effluent.

$5.83 \times 0.22 =$	1.29
$0.23 \times 7.10 =$	1.63
<u>$0.56 \times 3.05 =$</u>	<u>1.71</u>
Total	4.63

∴ Average calculated soluble As in Baker Cr. would be

$$\frac{4.63}{0.65} = 0.696 \text{ ppm As. This would be 17.2\% of present calculated content (4.04 ppm As)}$$

CONCLUSIONS

1. The calculated soluble arsenic in Baker Cr. checks quite well with the measured content taking into consideration the approximate nature of the flow data and the fact that only one sample at each location was used. The information derived from the calculations must be considered only as indicative of the conditions in Baker Cr.
2. The greatest source of contamination in Baker Cr. is the tailings pond effluent.
3. For some reason, right after a rainfall the soluble arsenic in the Giant Top water increases. On the basis of the water sample taken above the falls on July 27th (after a fairly good rain) it does not appear that arsenic bearing dust is washed into the stream, at least no dust that is soluble. To the contrary, it appears that the wind in places the fairly high soluble arsenic content in the creek.

It is quite possible that the rain falling in the immediate plant area and on the old tailings pond area near the main pumps picks up considerable soluble arsenic and brings it down into Baker Cr.

1. Although it is not indicated by this study, the direction of the wind in Wolfenbutte Bay, has a very large influence on the soluble arsenic content of the Giant Top water. Any appreciable southerly wind (SE to SW) holds the Baker Creek discharge along or close to the shoreline where the pumps are located. This can be confirmed visually. Not only when this condition exists a rise in the soluble arsenic in the Giant Top water is noticed.

RECOMMENDATIONS

1. That work on the tailings dam be continued necessary to reduce the leakage of effluent into Baker Creek to minimum. It will be difficult to eliminate this entirely.
2. That the suggestions of Mr. Foster (see para. 8 & 9 of memo dated July 7/69) regarding the Garber Plant be acted upon. This should reduce the tonnage of very "hot" solution going to the tailings pond and would be a step toward reducing the content of soluble arsenic in the Tailings Pond effluent.

WAG/ah
July 28/69

Submitted by W. A. Case