Dr. E.A. Watkinson C455-10-13

J.P. Windish June 6, 1956.

Supplemental Report on Yellowknife.

Enclosed are ten copies of Supplemental Report No. 1 on the Arsenic Problem at Yellowknife. The initial report published last September was distributed from your office as follows:

Department of Northern Affairs and National Resources	3 copies
Department of Mines and Technical Surveys	3
Dr. Charron	1
Mr. Menzies	1
Mr. Menzies (for Edmonton office)	1

If you wish to send copies of this supplemental report to any other interested persons we have additional copies on hand.

As you requested in our telephone conversation of Monday, I have drafted, for Dr. Cameron's signature, letters of transmittal to accompany the sending of three copies of the report to Mr. Robertson, Deputy Minister of Northern Affairs and National Resources and to Dr. Hume, Acting Deputy Minister of Mines and Technical Surveys.

J.P.W.

RESTRICTED

THE ARSENIC PROBLEM AT YELLOWKNIFE

Supplemental Report No. 1: August 1955 - March 1956

by

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Laboratory Services
Occupational Health Division
Department of National Health and Welfare
OTTAWA.

May 1956

THE ARSENIC PROBLEM AT YELLOWKNIFE

Supplementary Report No. 1: August 1955-March 1956.

1. In September 1955, Laboratory Services, Occupational Health Division, Department of National Health and Welfare, issued a report on the arsenic problem at Yellowknife, covering the period 1949-July 1955. The present report deals with data obtained between August 1955 and March 1956.

Results

(a) Arsenic in drinking water

2. The concentrations of arsenic in the three drinking water supplies of the area are given in Table 1. These results were obtained from samples collected and analysed by the Laboratory Services, Occupational Health Division.

TABLE 1

Arsenic in tap water

Area	No. of Sampling Points	Parts per million arsenic (As) by weight					
		Dec. 1952	Dec. 1953	Dec. 1954	Jan. 1956.	Jul 56	Dec 56
Giant	1	0.008	0.005	<0.0025	<0.0025	0.03	0.0025
Townsite	1	0.008	0.005	<0.0025	<0.0025	0.03	0.0025
Con	1	0.008	0.005	<0.0025	<0.0025	0.02	0.0025
Average		0.008	0.005	<0.0025	<0.0025	0.027	0.0025

(b) Arsenic in water bodies

3. In each of the three areas - Giant, Townsite and Con - the Occupational Health Division collected and analysed seven samples of water from various water bodies. Arsenic concentrations in some of the individual lakes are given in Table 2, while the overall average for each area is given in Table 3.

(c) Arsenic Deposit on grass

4. The amounts of arsenic deposits on grass, as found on samples collected by the Laboratory services, Occupational Health Division in the winter of each year since 1951 are given in Table 4. It should be noted that the latest set of samples was collected approximately six weeks later in the year than the previous years' samples had been collected. The levels of arsenic found could therefore be expected to be somewhat higher than they would have been if the samples had been taken at the usual time.

TABLE 2.

Arsenic content of some lakes in the Yellowknife area.

Lake	Parts per million arsenic (As) by weight					
	Dec. 1952	Dec. 1953	Dec. 1954	Jan. 1956	Jul 1956	Dec 1956
Veronica	2.2	1.85	2.6	4.37	4.00	4.5
Jackfish	0.24	0.22	0.33	0.48	0.65	0.65
Frame[1]	0.25	0.58	0.57	2.07	0.39	1.31
Long	0.096	0.10	0.19	0.37	0.24	0.43
Rat	2.40	2.93	2.71	5.05	2.48	3.37
Pud	1.4	3.10	3.15	6.00	10.00	21.4
Kam[2]	2.9	1.95	1.01	2.77	2.11	2.7

[1]Two samples are taken from Frame Lake at points about 3/4 of a mile apart, and the results averaged.

[2]Two samples are taken from Kam Lake at points about 1 1/4 miles apart and the results averaged.

TABLE 3

Arsenic in Water Bodies

Area	No. of Sampling Points	Parts per million arsenic (As) by weight					
		Dec. 1952	Dec. 1953	Dec. 1954	Jan. 1956	Jul 1956	Dec 1956
Giant	7	0.46	0.86	0.55	1.16	1.87	2.03
Townsite	7	0.11	0.11	0.12	0.24	0.06	0.23
Con	7	1.16	1.50	1.20	2.56	2.14	4.57
Average		0.58	0.82	0.62	1.40	1.36	2.27

TABLE 4

Arsenic Deposit on Grass

Area	No. of Sampling Points	Parts per million arsenic (As) by weight						
		Dec. 1951	Dec. 1952	Dec. 1953	Dec. 1954	Jan. 1956	Jul 1956	Dec 1956
Giant	11	2600	2000	1600	1700	1270	255	1241
Townsite	7	250	750	1150	1230	751	90	579
Con	8	250	300	400	395	583	24	296
Average		1250	1140	1110	1180	919	139	772

Giant pts: 55-64 incl @ 96
Town pts: 65, 66, 67, 68, 70, 82, 94.
Con pts: 71-75 incl, 77, 80, 81

1133
5.56

(d) Fallpan data

5. Con collects fallpan samples at six different locations around the Con and townsite areas. The stations are from 1/4 to 2 miles distant from the stack. Samples are collected every 90 days, analysed for arsenic and the results of the six stations averaged. Results expressed as pounds of elemental arsenic deposited per acre per year are shown in Figure 1.

6. Giant Yellowknife has set out fallpans at 15 different locations around the Giant area, in concentric circles approximately one, two and three miles from the stack. Samples are collected every 30 days (weather permitting), analysed for arsenic, and the results of the 15 stations averaged. The results, expressed as pounds of elemental arsenic deposited per acre per year, are shown in Figure 2.

Discussion of results

7. As only a trace of arsenic was detectable in the drinking water, there appears to be no cause for concern in this regard at this time. However, arsenic concentrations during spring runoff should be watched carefully, to see whether there is a repetition of the experience of last year, when arsenic levels exceeded the safe limit of 0.05 ppm early in May and stayed above this figure until late in June.

8. For several years Rat Lake and Pud Lake have been posted with signs warning that their waters are polluted with arsenic and must not be drunk. Data in Table 2 indicates that all the lakes listed therein have reached the point where they should be similarly posted.

9. If the amount of arsenic deposited from the air onto the surface of a lake, plus the amount of arsenic carried into the lake at the time of spring runoff is greater than the amount of arsenic removed from the lake by water draining out of it, then we have an explanation for the continuing increase in the arsenic content of water bodies in the area, as shown in Table 3. In support of this hypothesis it is pointed out that most of the lakes are contained in rocky basins and that during the summer months there is only a small outflow from several of them.

10. On the other hand, as arsenic collection efficiency at Giant increased from an average of 41.8% in July 1954 to 67.4% in July 1955, and the amount of arsenic discharged to the atmosphere per day correspondingly decreased from 5.99 tons to 3.65 tons it could reasonably be expected that the amount of arsenic found on the grass samples would decrease. Table 4 shows that this actually did happen, the overall average falling from 1180 ppm in December 1954 to 920 ppm in January 1956. The decrease probably would have been more noticeable if the samples had been collected six weeks earlier, as mentioned previously in this report.

11. Inspection of figures 1 and 2 indicates the following:

(a) In general, since Giant's second Cottrell began operating in mid-February 1955, there has been a large overall reduction in the amount of arsenic caught in Giant's fallpans but little or no overall change in the amounts caught in Con's.

(b) Since February 1955, there is a gross similarity in the shapes of the two curves i.e. in both cases there is a considerable decrease in fallpan values until the fall of the year, then a rise, then another decrease.

12. Because of the striking decrease in the Giant fallpan figures (since February 1955) the situation looks somewhat better than it did a year ago. Study is now being given to the August 1955-February 1956 rise in the Giant figures, and the 3rd-4th quarter 1955 rise at Con which at first sight appear more likely to have been caused by meteorological influences than by changes in plant operation.

SUMMARY

1. Concentrations of arsenic in the various drinking water supplies were very low at the time of the winter sampling, and did not constitute a hazard to health.

2. Concentrations of arsenic in Veronica, Jackfish, Frame, Long and Kam Lakes are sufficient to warrant the posting of notices at each lake warning that the water should not be drunk.

3. Concentrations of arsenic in all the water bodies in the Yellowknife area have risen sharply and probably will continue to rise until the amount of arsenic discharged from the Giant stack is drastically reduced from its present level.

4. Amounts of arsenic found on grass are lower than they have ever been at this time of year since 1952. This probably reflects the increased arsenic collection efficiency at Giant, which was effected in 1955.

5. Contamination of the Giant area, as measured by their fallpans, is considerably less this year than last year. Contamination of the Con area as measured by Con's fallpans is very little changed from what it was last year.

CONCLUSION

The lower figures obtained by the Giant fallpans, coupled with the decreased amounts of arsenic found on grass, indicate that the general hazard to public health in the area as a result of arsenic deposition is no greater than it was last year. Consequently, the precautions which have been taken and the warnings which have been issued, in previous years, should, if followed, be sufficient this year.

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16 May, 1956.

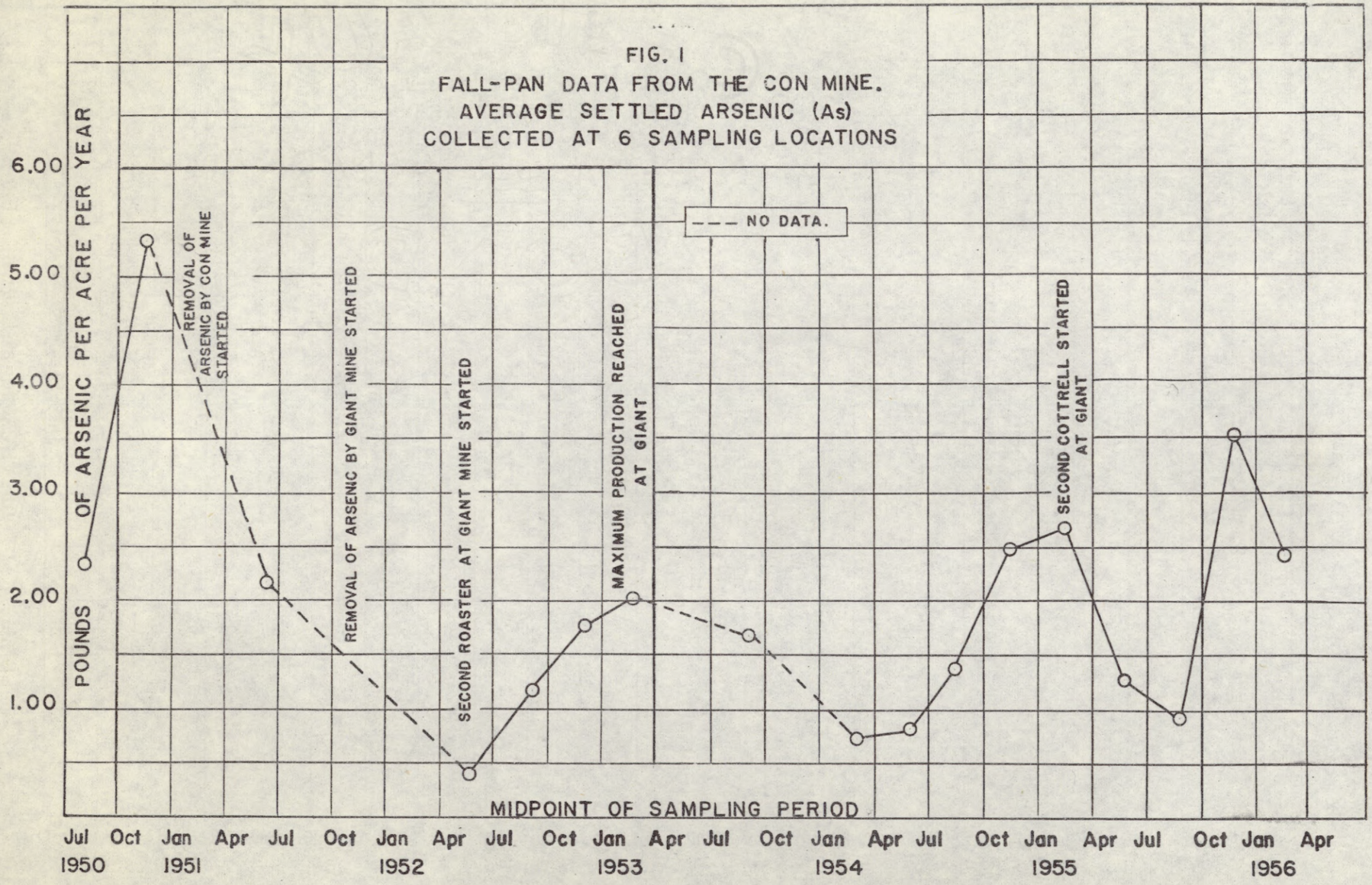
FIG. 1
FALL-PAN DATA FROM THE CON MINE.
AVERAGE SETTLED ARSENIC (As)
COLLECTED AT 6 SAMPLING LOCATIONS
POUNDS OF ARSENIC PER ACRE PER YEAR
6.00
5.00
4.00
3.00
2.00
1.00
--- NO DATA.
REMOVAL OF ARSENIC BY CON MINE STARTED
REMOVAL OF ARSENIC BY GIANT MINE STARTED
SECOND ROASTER AT GIANT MINE STARTED
MAXIMUM PRODUCTION REACHED AT GIANT
SECOND COTTRELL STARTED AT GIANT
MIDPOINT OF SAMPLING PERIOD
Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr Jul Oct Jan Apr
1950 1951 1952 1953 1954 1955 1956

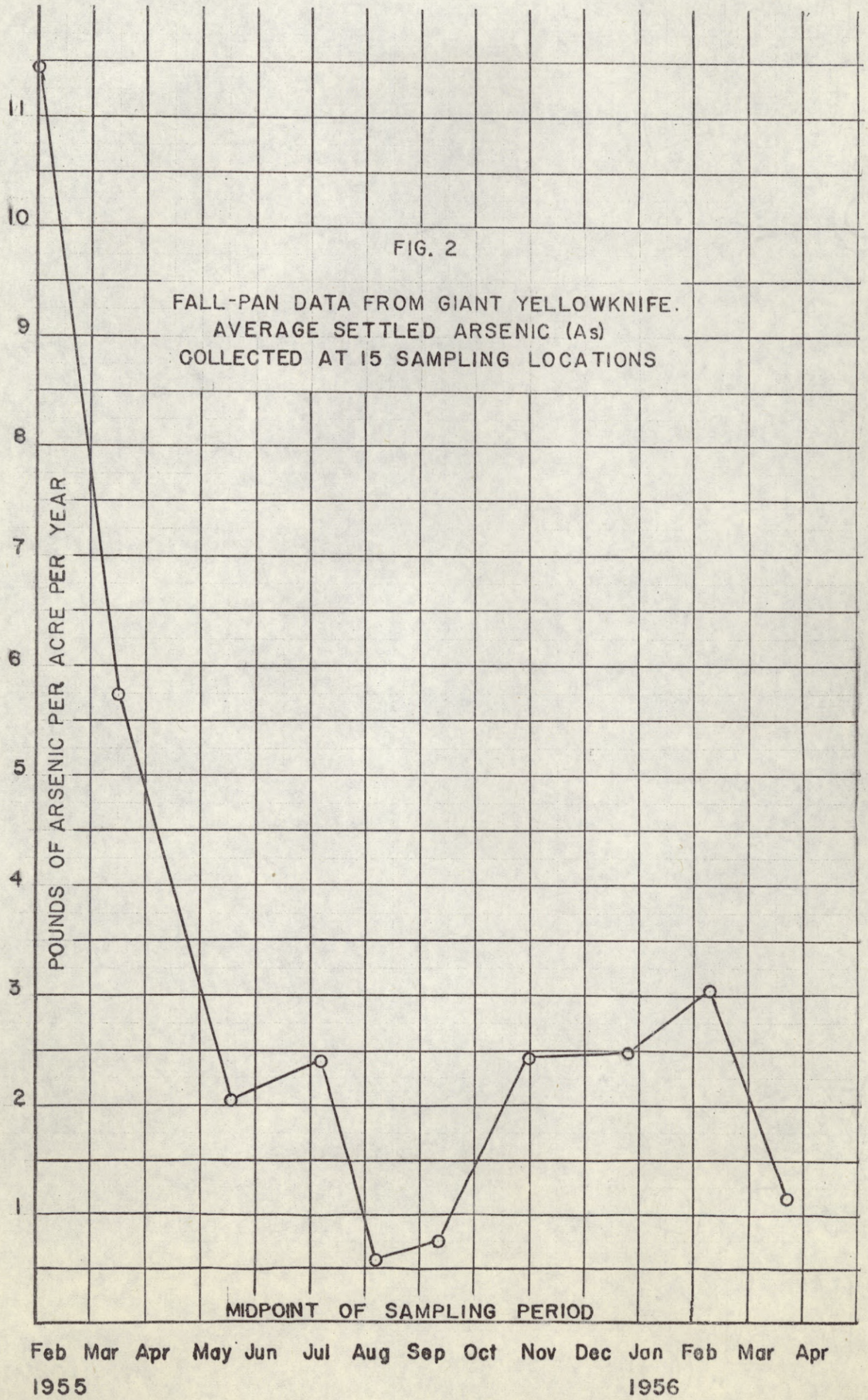
FIG. 2
FALL-PAN DATA FROM GIANT YELLOWKNIFE.
AVERAGE SETTLED ARSENIC (As)
COLLECTED AT 15 SAMPLING LOCATIONS
POUNDS OF ARSENIC PER ACRE PER YEAR
11
10
9
8
7
6
5
4
3
2
1
MIDPOINT OF SAMPLING PERIOD
Feb Mar Apr May Jun Jul Aug Sep Oct Nov Dec Jan Feb Mar Apr
1955
1956