



THE
ONTARIO WATER RESOURCES COMMISSION

**A
SUMMARY REPORT
OF
ARSENIC LEVELS
FOUND IN THE
MOIRA RIVER WATERSHED**

April 1970

DIVISION OF INDUSTRIAL WASTES

Copyright Provisions and Restrictions on Copying:

This Ontario Ministry of the Environment work is protected by Crown copyright (unless otherwise indicated), which is held by the Queen's Printer for Ontario. It may be reproduced for non-commercial purposes if credit is given and Crown copyright is acknowledged.

It may not be reproduced, in all or in part, for any commercial purpose except under a licence from the Queen's Printer for Ontario.

For information on reproducing Government of Ontario works, please contact ServiceOntario Publications at copyright@ontario.ca

Provincial Guidelines for Arsenic Levels in Water Supplies

Arsenic Content mg/L	Comments
Less than 0.05	<p>Suitable for drinking water. Water containing up to this level may be permitted for continuous use for all purposes e.g., domestic supplies.</p> <p>In my opinion short-term fluctuations may be permitted above this level. As a guide the fluctuations should not exceed three times this limit and should not persist any longer than 30 days in any 6 months period.</p>
0.05 - 0.2	<p>For summer camp use and for summer cottagers the desirable level would still be 0.05 mg/L. In my opinion short-term consumption of levels up to 0.2 may be permitted for periods of 2 to 8 weeks by summer cottagers and campers.</p>
1.0	<p>Water containing this level should be rejected for human consumption.</p>

**A SUMMARY REPORT
OF
ARSENIC LEVELS
FOUND IN THE MOIRA RIVER WATERSHED**

APRIL 1970

INTRODUCTION

The Ontario Department of Health, the Deloro Smelting and Refining Company Limited, and the Ontario Water Resources Commission have all Analysed samples from the Moira River for arsenic. The results are compiled in this report and an effort is made to interpret the data collected.

SAMPLING AND ANALYSIS

During the period 1951 - 1957, the only samples taken of the Moira River were those collected and analysed for arsenic by the Ontario Department of Health (ODH). In 1958, when a cattle kill was reported, the Ontario Water Resources Commission commenced its present sampling programme. In 1960, the Company started to report its analysis on samples collected and analysed in its laboratories. It had been the practice of the Company to take duplicate samples for comparative purposes whenever the two Government organizations made a survey.

The samples which are submitted to the OWRC laboratories in Toronto are analysed by a modified Guitzeit method in accordance with the procedures described in "Standard Methods for the Examination of Water and Wastewater", 12th edition. Results are reported as milligrams per litre As and are accurate to 0.01 mg/L. Those samples which are sent to the ODH laboratories in Toronto are analysed by the Silver Salt method. These are reported as milligrams per litre As_2O_3 and have an accuracy of ± 0.05 mg/L.

During the past 8 years the Moira River at the plant site has been sampled on an average of 26 days per year by the three organizations concerned. Over the same period, the OWRC has obtained samples on an average of 17 days per year.

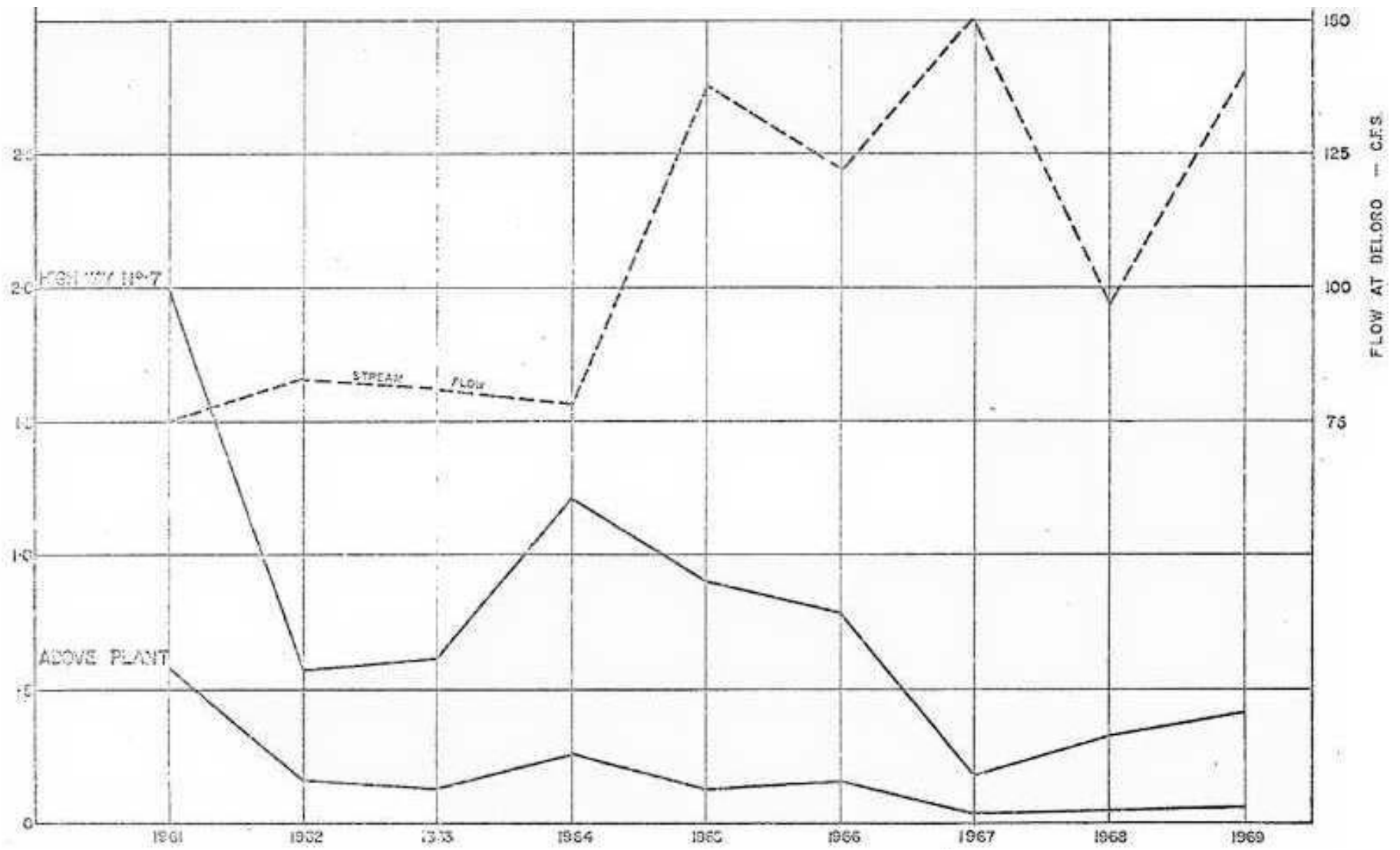
Routine monitoring of the water quality in the Moira River system is carried out by the Water Quality Surveys Branch of the Commission. The sampling points in this programme are shown in the appended map.

RESULTS

The results for the samples collected from the Moira River above the abandoned plant site and downstream at Highway #7 are tabulated in Appendix 1. Also included in Appendix I is a summary of the annual average concentrations at these points.

The results for all sampling points on the Moira River system are summarized on a monthly basis in Appendix II.

The frequency at which samples are collected from the Moira River is greatest during the summer and fall when the arsenic concentrations are highest. Thus calculating a straight average of the results would give an unrepresentative average. In order to determine a more representative yearly average, the results were first averaged monthly and these monthly averages were used in determining an annual average. The annual average concentrations calculated in this manner are shown in Table I. Also, the annual average concentrations in the Moira River above the abandoned plant site and at Highway #7 are plotted in Graph #1 along with the annual average stream flow at Deloro.



GRAPH 1. Annual average arsenic concentration and stream flow on Moira River.

TABLE I

Miles from Bay of Quinte	1964	1965	1966	1967	1968	1969
0.7	-	-	-	-	0.01	0.03
3.9	-	-	-	-	0.01	0.03
27.2	-	-	-	0.01	0.01	0.04
29.7	-	-	-	0.01	0.02	0.04
31.0	-	-	-	-	-	0.04
31.2	-	-	-	-	0.01	0.03
44.4	-	0.08	-	-	0.10	0.13
57.6	1.21	0.91	0.79	0.18	0.34	0.42
58.7	0.27	0.13	0.17	0.03	0.05	0.07

RIVER FLOWS AND ARSENIC LOADINGS

The yearly mean river flow in the Moira. River at Deloro has remained within 75 - 151 cfs. Flows as low as 0.3 cfs. and as high as 1150 cfs. have been recorded at Deloro since the stream gauging station was installed in October 1965. River flows at Deloro between 1959 and 1965 were estimated by extrapolation using the recorded flows at Foxboro and the ratio of the flows at Deloro and Foxboro from October 1965 until the present.

The arsenic loadings were calculated by using the concentration and flow on the day of sampling and averaging the loadings thus determined on a monthly and then yearly basis.. These loadings are shown in Table II.

TABLE II. Arsenic loadings (lbs/day).

MONTH	1965		1966		1967		1968		1969	
	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7	Above Plant	Hwy. #7
January	-	-	0	84	10	10	-	28	0	-
February	-	-	22	74	23	35	3	27	0	1
March	-	-	21	184	11	70	0	264	0	19
April	-	-	0	84	8	175	5	305	0	146
May	-	-	18	73	5	206	8	37	63	292
June	-	-	4	27	0	83	6	115	10	74
July	-	-	3	6	3	33	2	43	4	20
August	-	-	1	8	3	13	3	25	7	51
September	-	-	3	7	2	11	9	111	2	14
October	172	343	1	4	-	8	4	15	4	17
November	0	50	10	71	0	208	8	67	0	192
December	13	264	0	215	0	0	-	-	10	194
AVERAGE			7	70	5	70	5	94	8	96
AVERAGE INCREASE			63		65		89		88	

DISCUSSION OF RESULTS

The general trend of the arsenic concentration in the river both above the abandoned plant site and at Highway #7 has been towards lower levels. This may in part be due to the higher stream flows which occurred during the same period.

Arsenic occurs naturally in the Moira River as is indicated by its presence as far upstream from the plant site as Malone in concentrations as high as 0.03 ppm. Over the past 9 years at a point just above the abandoned plant site an average yearly concentration of 0.21 ppm has been observed. However, the values obtained over the past 3 years have been considerably lower averaging 0.06 ppm.

The arsenic concentration in the river rises considerably in passing through the abandoned plant site as is evidenced by the samples collected at Highway #7. The 9 year average concentration at Highway #7 (M-57.6) is 0.85 ppm, but the concentrations at this point during the past 3 years have also dropped considerably, the average being 0.31 ppm.

In the 13.2 river miles downstream of Highway #7 (M-57.6) to the bridge on Moira Lake (M-44.4) the arsenic concentration drops to an average value of 0.12 ppm.

The Skootamatta and Black Rivers join the Moira River about 1 and 1.3 miles downstream of Moira Lake. The concentration of arsenic in the Moira River downstream of these influents remains within the OWRC drinking water quality objective.

A part of the reduction noted at Highway #7 between 1966 and 1967 is believed to have resulted from the installation of the waste treatment works by Deloro Smelting and Refining

Company Limited and placed in operation in late 1966. These works treat the water flowing in the New Westerly Creek which picks up contaminated ground water from the abandoned plant site. Arsenic is precipitated by the addition of ferrous sulphate and then settled out in ponds.

Trenches were dug by the Company in 1969 to try to locate other sources of arsenic contaminated ground water gaining access to the river. Two flows believed to contain in the order of 20 to 40 lbs/day of arsenic were intercepted. These were directed to the treatment works in the latter part of the year. Insufficient data has been collected to date to determine if the treatment of these contaminated ground water streams will have a significant effect on the concentration in the river.

The programme of intercepting contaminated ground water streams for diversion to the waste treatment works is to continue in 1970.

CONCLUSIONS

The annual average concentration of arsenic in Moira Lake has been found to be in the order of 0.12 ppm or two to three times the maximum, recommended in the OWRC drinking water quality objectives. It is hoped that the concentration can be reduced to less than 0.05 ppm with the present programme being carried out by Deloro Smelting and Refining Company Limited of intercepting contaminated ground water streams and directing these to the waste treatment works. It is expected that this programme will be completed this summer.

APPENDIX I

**A Tabulation of All Arsenic Results for Samples
Collected From the Moira River Above the Plant Site
and at Highway #7**

ARSENIC AS As (PPM)

DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
1951			.02			.28
1952			.02			.27
1953			.13			.04
1954			0			.03
1955			.01			.02
1956			.01			.05
1957			.01			.01
1958	.17*		.32	1.79*		2.01
1959	.02*		.29	.26*		.98
1960	1.2*		.78	2.67*		.54
1961	.58	.54	.37	2.01	1.43	.87
1962	.16	.27	.40	.57	.74	.17
1963	.13	.17	.04	.62	.62	.19
1964	.27	5	.35	1.21	1.53	.57
1965	.13	.10	.03	.91	.79	.12
1966	.17	.18	.22	.79	.58	.88
1967	.03		.04	.18		.18
1968	.05		.09	.34		.29
1969	.07	.11		.42		.58

* - Less than 5 samples taken

ARSENIC AS As (PPM)

1969 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 26		0				
Feb. 17				.08		
Mar. 14				.06		
Apr. 13	0	0		.02	.06	
Apr. 22				.08		
May 25	.03	0		.14	.16	
June 9	.02			.22		
June 18				.14		
June 22	.02	0		.08	.10	
July 6	.02	.02		.11	.16	
July 15				.18		
July 15				.18		
Aug. 10	.09	.06		.53	.64	
Aug. 19	.10			1.00		
Aug. 19				1.00		
Sept. 2	.11			.47		
Sept. 7	.26	.36		1.44	1.50	
Sept. 23				1.52		
Sept. 29	.04			1.36		
Oct. 5	.52	.64		1.60	1.80	
Oct. 7				1.60		
Oct. 21				.47		
Nov. 29		0			.52	
Dec. 14		0			.32	
Dec. 21	.02			.18		

ARSENIC AS As (PPM)

1968 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 21				.08		
Feb. 13	0					
Feb. 25	0			.07		
Feb. 26	.02					
Mar. 18	0		.04	.54		.17
Mar. 31	0		.08	.04		.08
Apr. 2				.04		
Apr. 14	0		.08	.04		.08
Apr. 28	.02			.21		
May 3				.09		
May 12	.02		.03	.06		.20
June 4				.49		
June 9	.02		.08	.02		.20
July 3				.06		
July 11	.01			.40		
July 21	.01			.20		
Aug. 7				.54		
Aug. 17	.15			1.40		
Sep. 7				.88		
Sep. 15	.09			1.00		
Oct. 13	.16		.20	.56		1.06
Nov. 10	.03		.12	.14		.23
Nov. 25				.29		

ARSENIC AS As (PPM)

1967 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Jan. 15			.03			.03
Feb. 14			.04	.06		.20
Mar. 12	.02			.13		
Apr. 9	0		.03	.05		.16
Apr. 20	.01			.10		
Apr. 23	0			0		
May 7	.01		.08	.15		.20
May 21	0			.23		
June 4	0			.10		
June 12			.03			.32
June 13	0			.20		
June 18	0			.58		
July 16	.01			.11		
Aug. 13	.09			.30		
Aug. 27	.10			.67		
Sept. 10	.08			.42		
Oct. 2				.01		
Oct. 26	2.5			1.0		
Nov. 1				.22		
Nov. 12	0			.12		
Nov. 26	0			.05		
Dec. 5				0		
Dec. 10	0			0		

ARSENIC AS As (PPM)

1966 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 9		0	.04		.75	.05
Feb. 13	.03	0		.10	.21	
Mar. 13	.02	0	.02	.18	.15	.24
Apr. 3		0			.12	
Apr. 17	0	0	.03	.07	.05	.04
May 5	0	0	.04	.03	.03	.08
May 22	.02	0		.07	.06	
June 1	0	0	.03	.03	.05	.03
June 19	.04	0		.20	.21	
July 3	.08	.15		.20	.38	
July 17	.20	.18		.28	.45	
Aug. 2				2.5		
Aug. 7	.32	.53		1.50	.95	
Aug. 21	1.0	.90	.67	2.0	1.36	1.58
Sept. 4	.8	.60	.67	2.3	1.50	1.67
Sept. 18	.53	.60		1.8	1.80	
Oct. 9	.40	.75	.51	2.0	1.67	1.65
Oct. 13	.32	.75		2.0	1.80	
Nov. 6	.10	.11	.20	2.1	1.80	3.35
Nov. 19	.04	0		.25	.18	
Dec. 4	0	0	.03	.10	.15	.12
Dec. 18	0	0		.13	.15	

ARSENIC AS As (PPM)

1965 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Feb. 21	0	0	.03	.10	.09	.03
Mar. 8				.13		
Mar. 14	0	0	.03	.25	.24	.03
Mar. 23				.20		
Apr. 5				.05		
Apr. 11	.01	0	.03	.04	.15	.12
Apr. 12				.20		
Apr. 25	.01	0	.03	.05	.12	.04
May 9		0			.03	
May 31	0	0		.12	.14	
May 31				.08		
June 13	.07	.09	.03	.50	.24	
June 17				.30		
June 21				.30		
June 27	.15	.15		.40	.45	
July 8				1.00		
July 11	.38	.33	.03	1.14	1.17	.20
July 20				1.50		
July 25	.38	.18		1.14	.83	
July 28				0		
Aug. 3				1.0		
Aug. 8	.20	.30	.05	1.0	1.36	
Aug. 17				5.0		.47
Aug. 18				5.0		
Aug. 22		.65			6.82	
Sept. 5	.40	.22		4.0	2.27	.10
Sept. 8				2.5		

1965 (cont'd)	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Sept. 16				4.0		
Sept. 19	0	.06		.5	.68	
Sept. 21				6.0		
Oct. 3	.20	.09	.03	4.0	.39	.09
Oct. 17	.75	.02		.95	.24	
Oct. 21				.25		
Nov. 7	0	0	.03	0	.06	.03
Nov. 15				0		
Nov. 22	0	0		.10	.20	
Dec. 13	.01		.03			.20

1964 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 25	.10	.09	1.06	.69	.51	.20
Feb. 15	.04	0	.03	.24	.15	.04
Mar. 14	.03	0	.03	.04	.08	.04
Apr. 11	0	0	.03	.05	.12	.03
Apr. 25	0			.03		
Apr. 26		0			.12	
May 9	0	0	.03	.03	.15	.04
May 23	.02	0		.01	.09	
June 6	0	0	.03	.20	.15	.06
June 20		.03			.24	
June 24	.03		.17	.20		.20
July 4		.82			.51	
July 18	.03	.11		.59	.90	
Aug. 1	.25	.48	.39	.74	1.50	.79
Aug. 15		.70			1.59	
Aug. 29		1.06			4.23	
Sept. 12	.79	.98	.98	4.9	7.95	2.35
Sept. 26	7.1	1.06		4.2	6.00	
Oct. 9	1.36	1.14	.98	4.9	4.92	1.58
Oct. 24		1.36			4.16	
Nov. 7	1.36	.98		6.4	3.41	
Nov. 17				.32		
Nov. 22	0	.08	.45	.98	1.14	1.36
Nov. 24				0		
Dec. 6	0	.03	.03	.55	.24	.05

1963 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 12	0	0	.03	0	.09	.03
Feb. 16	0	0	.03	.10	.09	.04
Mar. 16	0	0	.03	.12	.09	.03
Apr. 6	0	0	.04	0	.03	.04
Apr. 13		0			.05	
Apr. 20	0	0		.11	.06	
Apr. 27		0			.06	
May 4		0			.08	
May 11	.01	0	.03	.15	.11	.14
May 18		0			.15	
may 25	.02	0			.08	
June 1		0			.08	
June 8		0			.18	
June 15		.03	.03	.18	.18	.08
June 22		.06			.21	
June 29	.33	.30		.36	.30	
July 6		.48			.83	
July 13	.69	.60	.07	1.6	1.50	.47
July 21		.38			.75	
July 27		.53			1.20	
Aug. 3	.45	.53	.08	1.8	2.10	.59
Aug. 10		1.20			3.00	
Aug. 17		.53			2.40	
Aug. 24		.60			2	
Aug. 31		.60			2	
Sept. 7		.90			2.70	
Sept. 14	.04	.06	.03	1.5	2.60	.59

continued

1963 (cont'd)	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Sept. 21		.30			1.20	
Sept. 28		.53			1.40	
Oct. 5	.20	.53		1.3	.90	
Oct. 12		.60			1.00	
Oct. 19	.07	.08		.75	.38	
Oct. 26		.06			.45	
Nov. 2		.18			.83	
Nov. 9	.07	.09	.04	.59	.60	.04
Nov. 16		.03			.18	
Dec. 7		0			.24	
Dec. 14	.02	0	.03	.20	.18	.04

ARSENIC AS As (PPM)

1962 DATE	ABOVE PLANT			HIGHWAY #7		
	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Jan. 13	0	.75	.03	.2	.24	.10
Feb. 10	0	.06	.03	0	.12	.03
Mar. 10	0	.06	.03	0	.24	.05
Apr. 7	0	0	.03	100	.08	.03
May 12	0	0	.03	.04	.15	.03
June 2	0	.03	.03	.3	.42	.04
June 16	0	.05		.3	.55	
July 7	0	.27	.10	.4	.73	.29
July 21	.5	.73		.4	1.4	
Aug. 4	0	.30	.03	1.0	1.2	.20
Aug. 18	.36	.23		1.3	2.4	
Sept. 8	1.5	1.50	.05	3.0	2.6	.38
Oct. 13	0	.07	.05	1.00	1.70	.79
Nov. 11	0	.02	.03	30	.27	.10
Dec. 9	0	0	.03	.4	.09	.04

ARSENIC AS As (PPM)

1961 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 11		.15			.49	
Feb. 8		.27			.53	
Feb. 23			.98			2.05
Mar. 15		.09			.24	
Mar. 27			.75			3.80
Apr. 6			.03			
Apr. 11	0	0		.4		
Apr. 19	0	0	.36	.1	.18	.08
May 11	0	0	.06	.4	.15	.05
June 2	0	0	.03	.2	.18	.03
June 21	.04	.03		.2	.24	
July 5	.08	.06		.7	.49	
July 10			.03			.14
July 11	.14	.06		.4	.38	
Aug. 9	.19	.30	.05	.72	.74	.10
Aug. 23	.36	.90		4.2	2.5	
Sept. 6	2.6	1.8	.38	2.8	2.6	.60
Sept. 20	1.6	1.8		2.5	3.3	
Oct. 4	3.0	2.4	.30	9.0	5.3	.69
Oct. 18	1.8	2.1		7.5	5.3	
Nov. 1	1.8	1.5	.90	9.0	4.2	1.97
Nov. 15	1.0			6.0		
Dec. 4	.10		.10	.5		.10
Dec. 16	.05			.6		

ARSENIC AS As (PPM)

1960 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 21			.01			.30
Feb. 12			.01			.21
Apr. 21			.10			.25
May 5			.01			.20
May 10	0			.23		
May 31			.10			.60
June 23			.08			.20
July 18			.30			.30
July 28	1.2			3.0		
Aug. 23			.51			.70
Sept. 12			.90			1.36
Oct. 19			2.20			.98
Oct. 19			3.0			4.0
Nov. 4	2.4		2.4	4.8		
Nov. 7			1.59			9.0
Dec. 29			.10			.98

ARSENIC AS As (PPM)

1959 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 14						
Jan. 21						.51
Feb. 18			.12			.20
Mar. 18			.01			.10
Apr. 16			.01			.01
May 6	.03		.02	.13		.10
May 22			.05			.10
May 23				.39		
June 18			.20			.40
July 21			.48			2.53
Aug. 20			.90			3.60
Sept. 16			.70			2.20
Oct. 27			.90			2.05
Nov. 19			.10			.01
Dec. 28			.01			.10

ARSENIC AS As (PPM)

1958 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Jan. 29			.01			1.67
Feb. 17			.01			.02
Mar. 27			.01			.01
Apr. 28			.01			.01
June 2			.04			.04
June 20			.15			2.27
July 21			.53			8.86
Aug.13	.20			17.4		
Aug. 18				58.0		
Aug. 22			1.09	12.1		28.4
Sept.5				12.9		
Sept. 19			.60			4.05
Oct. 21			.80			.91
Dec. 9	.15			.91		
Dec. 18			.04			.60

ARSENIC AS As (PPM)

1957 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 8			.01			.01
Jan. 25			.02			.02
Mar. 22			.02			.02
Apr. 18			.02			.03
May 3			.02			.02
May 31			.01			.01
July 5			.01			.01
July 19			.01			.01
Sept. 25			.01			.01
Nov. 8			.01			.01
Dec. 11			.02			.01
Dec. 24			.03			.01

ARSENIC AS As (PPM)

1956	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan. 6			.02			.01
Jan. 30			.02			.03
Feb. 29			.02			.01
Mar. 29			.01			.01
Apr. 20			.02			.02
June 22			.02			.02
June 25			.01			.02
July 20			.02			.03
Aug. 31			.01			.01
Nov. 16			.01			.07
Nov. 30			.01			.01

ARSENIC AS As (PPM)

1955	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Jan. 14			.02			.02
Feb.15			.01			.03
Mar. 23			.01			.02
May 6			.01			.01
May 27			.01			.01
June 28			.02			.02
July 29			.01			.05
Aug.23			.02			.03
Oct. 13			.02			.03
Nov. 3			.02			.01
Nov. 23			.02			.01

ARSENIC AS As (PPM)

1954	ABOVE PLANT			HIGHWAY # 7		
DATE	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Jan. 21			0			0
Feb. 26			.01			0
Mar. 19			0			0
Apr. 15			0			0
May 17			0			.11
June 8			.02			.02
July 14			0			.10
Sept. 9			0			0
Sept. 13			0			.02
Oct. 28			0			0
Nov. 17			0			.08
Dec. 17			.01			

ARSENIC AS As (PPM)

1953 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Jan . 5			0			.07
Feb. 4			0			0
Feb. 27			.01			0
Mar. 19			0			.02
Apr. 1			0			.02
May 6			1.10			.04
June 3			0			0
July 2			0			0
Aug. 5			0			.06
Sept. 2			.19			.20
Oct. 7			.01			.03
Nov. 4			0			0

ARSENIC AS As (PPM)

1952 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELORO	HEALTH	OWRC	DELORO	HEALTH
Feb. 15			.05			.08
Mar. 22			.03			0
Apr. 29			.03			0
May 21			0			0
June 25			0			0
July 15			.02			.4
Aug. 25			.06			1.50
Sept. 25			0			.17

ARSENIC AS A (PPM)

1951 DATE	ABOVE PLANT			HIGHWAY # 7		
	OWRC	DELOORO	HEALTH	OWRC	DELOORO	HEALTH
Feb. 7			.05			.08
Mar. 6			.03			0
Apr. 25			.03			0
May 19			0			0
June 23			0			0
July 11			.02			.38
Aug. 22			.06			1.50
Sept.22			0			.17
Oct. 29			0			.07

APPENDIX II

A Summary of the Monthly Average Arsenic Concentrations for Samples Collected at All Sampling Stations on the Moira River System

MOIRA RIVER
YEAR 1969

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													Victoria Park
.7		.02	.03	.01		.03	.02	.04	.07	.04			Hwy #2 Bridge
1.5		.02	.03	.02		.02	.03	.04	.07	.04			Sewer Effluent
3.9		.03	.03	.02		.03	.04	.06	.04	.05			Canifton Bridge
26.3													Chapman's Bridge
27.2		.03		.03		.02	.04	.08	.11	.07			Stoco Lake Outlet
29.7		.02	.04	.03		.02	.02	.07	.10	.06			Stoco Bridge
31.0		.04		.04		.04	.04	.07		.06			Stoco Lake
31.2		.04	.04	.03		.04	.04	.05	.02	.05			Tweed
32.0				.02			.01			.02			Clare River
32.7				.02			.01			.02			Sulphide Creek
37.7			.02	.01		.02		.04	.01				Skootamatta River
38.0				.01									Black River
44.4		.08	.08	.01		.11	.12	.36	.21	.22	.29		Moira Lake
45.4										.02			Deer Creek
46.5			.02	0		.01		.01	.01				Deer Creek
57.8		.08	.06	.05	.14	.15	.16	.84	1.20	1.22	.52	.18	Hwy No. 27
58.7	0			0	.03	.02	.02	.10	.14	.52	0	.02	Above Plant
62.6													Downstream of Malone

MOIRA RIVER
YEAR - 1968

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													Victoria Park
.7			.01	0	.01	.01	.01	.30	0		.02		Hwy #2 Bridge
1.5			.03	0	.01	.02	.01	.20	0		.02		Sewer Effluent
3.9			0	0	.01	.01	.01	.02	0				Canifton Bridge
26.3													Chapman's Bridge
27.2				0	.01	.01	0	.03	0		.03		Stoco Lake Outlet
29.7	0.	.11		0	.01	.02	0	.01	0		.05		Stoco Bridge
31.0											.02		Stoco Lake
31.2	0.	0		0	.01	.03	0	.02	0		.03		Tweed
32.0			.03	0			0						Clare River
32.7				0			.10						Sulphide Creek
37.7			.01			.01	0	0			0		Skootamatta River
38.0				0									Black River
44.4	.05	.05	.06	.05	.06	.09	.10	.13	.12		.26		Moira Lake
45.4													Deer Creek
46.5				0	0	.01	0	.01	.01		.02		Deer Creek
57.8	.08	.07	.29	.10	.08	.26	.22	.97	.94	.56	.22		Hwy No. 27
58.7		.01	0	.01	.02	.02	.01	.15	.09	.16	.03		Above Plant
62.6													Downstream of Malone

MOIRA RIVER
YEAR: 1967

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													Victoria Park
.7										0	0	0	Hwy #2 Bridge
1.5										0	0	0	Sewer Effluent
3.9										0	0	0	Canifton Bridge
26.3													Chapman's Bridge
27.2			0	0	0	0				.06		.01	Stoco Lake Outlet
29.7	.02		.02	0	0	0			.04	0	0	0	Stoco Bridge
31.0													Stoco Lake
31.2										.05	0	0	Tweed
32.0										0			Clare River
32.7										.05			Sulphide Creek
37.7										0	0	0	Skootamatta River
38.0										0			Black River
44.4								.21		.19	.17	.04	Moira Lake
45.4													Deer Creek
46.5										0	0	0	Deer Creek
57.8	.03	.06	.13	.05	.19	.29	.11	.48	.42	.50	.13	0	Hwy No. 27
58.7	.03	.04	.02	0	.01	0	.01	.10	.08		0	0	Above Plant
62.6													Downstream of Malone

MOIRA RIVER
YEAR: 1966

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2													Victoria Park
.7				0				.10					Hwy #2 Bridge
1.5													Sewer Effluent
3.9								.04					Canifton Bridge
26.3													Chapman's Bridge
27.2							0	.10			.02	0	Stoco Lake Outlet
29.7							0	.06			.01		Stoco Bridge
31.0													Stoco Lake
31.2			0					.04					Tweed
32.0								.01					Clare River
32.7								.02					Sulphide Creek
37.7								.02					Skootamatta River
38.0								.02					Black River
44.4								.18					Moira Lake
45.4													Deer Creek
46.5								0					Deer Creek
57.8	.75	.10	.18	.07	.05	.12	.24	2.00	1.55	2.00	2.30	.12	Hwy No. 27
58.7	0	.03	.02	0	.01	.02	.14	.66	.67	.36	.07	0	Above Plant
62.6													Downstream of Malone

MOIRA RIVER
YEAR: 1965

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2				.02		.04	.01		0				Victoria Park
.7						.01	.01						Hwy #2 Bridge
1.5			.01				.01	.05	0				Sewer Effluent
3.9							.01	.03	0				Canifton Bridge
26.3			.06	.03	0	.02	0		0				Chapman's Bridge
27.2													Stoco Lake Outlet
29.7			.06	.02		.04	.01	.13	0				Stoco Bridge
31.0													Stoco Lake
31.2							.03	.10	.01				Tweed
32.0													Clare River
32.7													Sulphide Creek
37.7													Skootamatta River
38.0													Black River
44.4			.03	.13	.08	.07	.10	.03	.03		.20		Moira Lake
45.4													Deer Creek
46.5													Deer Creek
57.8		.10	.20	.08	.10	.38	.96	3.00	3.40	1.73	.03		Hwy No. 27
58.7		0	0	.01	0	.11	.38	.20	.20	.48	0	.01	Above Plant
62.6			0	0	0	0							Downstream of Malone

MOIRA RIVER
YEAR: 1964

Miles from Lake Ontario	JAN.	FEB.	MAR.	APR.	MAY	JUNE	JULY	AUG.	SEPT.	OCT.	NOV.	DEC.	LOCATION
.2				.02		.04	.01	.02	0				Victoria Park
.7													Hwy #2 Bridge
1.5							.02	.01	0				Sewer Effluent
3.9							.02	.04	.04				Canifton Bridge
26.3							.02	.03	.02				Chapman's Bridge
27.2													Stoco Lake Outlet
29.7													Stoco Bridge
31.0							.02	.03	.04				Stoco Lake
31.2							.01	.02	.01				Tweed
32.0													Clare River
32.7													Sulphide Creek
37.7													Skootamatta River
38.0													Black River
44.4							.03	.06	.11		.12		Moira Lake
45.4													Deer Creek
46.5						.01	0						Deer Creek
57.8	.69	.24	.04	.04	.07	.20	.59	.74	4.70	4.90	1.90	.55	Hwy No. 27
58.7	.10	.04	.03	0	.01	.02	.03	.25	.79	1.36	.68	0	Above Plant
62.6											.15		Downstream of Malone