Ontario

Ministry of the Environment

135 St. Clair Avenue West
Suite 100
Toronto Ontario
M4V 1P5

965-1491

April 5, 1974

Hooker Chemical Corporation
Buffalo Avenue
Niagara Falls, New York 14302

Attention: Fred T. Olotka

Dear Mr. Olotka:

RE: ASBESTOS IN DRINKING WATER

Herewith a copy of the report prepared by myself that appeared in the September 1973 issue of the Canadian publication Water and Pollution Control.

Since that time we have continued our sampling and analyses. To date the surface and grand waters of Ontario do not exhibit asbestiform fibres concentrations in excess of 3 million fibres per litre except in the Detroit River, which we are investigating.

We find that concentional regulation, flocullation and filtration remove these fibres to a level below 1 million per litre, a level adjuged to be safe by our Ministry of Health.

It is interesting to note that clarifier blow-down levels appear to be about 600 times the concentration of the raw water. It confirms the propriety of our program of requiring treatment of all water treatment plant wastes.

Thank you for your interest.

Yours very truly,

G. H. Kay
Supervisor
Water Works

ASBESTOS IN DRINKING WATER

The July 20, 1971 edition of the publication NATURE, included a paper by Doctors H.M. Cunningham and R. Pontefract of the Department of Health and Welfare, Food and Drug Directorate, Ottawa. It was titled "Asbestos Fibres in Beverages and Drinking Water". It revealed that some beers, sherries, ports, vermouths, soft drinks and drinking waters, contained millions of fibres per litre (quart) of asbestos when examined via the electron microscope.

The Ontario Ministry of the Environment felt that it was desirable to assess the water supplies of municipalities in the Province in this regard. In August, 1972, the collection of samples, initially at twenty two Ontario cities using surface waters for their supplies was initiated. This number was selected since funds for this exploratory work were limited and because most of the people of the Province are served by surface water supply systems. After collection, the samples were sent to the Ontario Research Foundation. Dr.Eric Chatfield, Head, Electron Optical Laboratory, Department of Applied Physics, developed the methodology and supervised the examinations. Basic instructions were that the results must be able to be compared with the work of Cunningham and Pontefract and that an electron micrograph should be made of a representative asbestiform fibre from each sample.

The methodology, particularly sample preparation, is very exacting and time-consuming. Ultimately, the samples were examined at a direct screen magnification of 25,000 times, at an accelerating voltage of 80 KV. At this magnification, the area of sample examined represents some 40 square metres on which fibres as small as 3 mm are being sought among other material. This illustrates the difficulty of the technique, that of manual counting of very widely spaced

fibres. Identification of chrysotile asbestos fibres was relatively simple due to their characteristic tubular appearance and an equally characteristic electron diffraction pattern.

It should be borne in mind that asbestos is a generic term that applies to a number of naturally-occurring hydrated mineral silicates, incombustible in air and separable into filaments. The most widely-used in industry is chrysotile, a fibrous form of serpentine. Amphibole types include amosite, crocidolite, tremolite, anthophyllite and actinolite. Generally, however, the term asbestos is commonly used.

Knowing the density of chrysotile asbestos (about 2.4 g/cc), the mass concentrations were estimated. In some instances, magnifications of 50,000 were used to ensure proper identification.

On November 27, 1972 the results were delivered to the Ministry. They were as shown in Table 1. Distribution of fibres as to size was also calculated for each sample (Fig. 21A, 21B). Mr.Paul Emery, Director of Water Supply, The Municipality of Metropolitan Toronto, assisted by arranging sampling at that municipality (Table II).

At this time, it could be seen that all the samples tested and thereby, the drinking waters at all these locations, contained asbestos. It should be noted that although Sarnia had the highest fibre count, the filtration plant that is being built there is

reduce these values to one million fibres per litre.

The next question was: "Is there a health hazard?" There has been a great deal of work performed on the effects of inhaled asbestos and standards for maximum inhalation allowable, have been established. However, there is a paucity of information on the effects of ingested asbestos.

Staff of the Ontario Ministry of Health were contacted and after careful assessments of known information, advised that at the levels of concentration and size distribution reported, and based on information available at this time, there was no evidence of an effect on health. Subsequently, sampling was performed at the City of Windsor, and the Town of Lindsay. See Table III for results.

All the above is based on surface supplies. At present, sampling is being performed on municipal well supplies, particularly in the Timmins-Matheson area where chrysotile asbestos has been mined.

Since that time, the City of Duluth, Minnesota has been discovering asbestiform fibres in its drinking water. Reportedly, there are about one million to one hundred million fibres per litre and mass values of 1 - 100 micrograms (ug) per litre.

This is approximately 40 times as many fibres, and approximately one hundred thousand times greater mass, per litre, than at Thunder Bay. Note that both cities use Lake Superior water unfiltered, for their supplies.

It was very fortunate that values were already known for the asbestos concentrations at Thunder Bay, for without these, it would have had to be assumed that the levels were the same at Thunder Bay as at Duluth.

It would appear from these differences that in general, the sub-surface currents in Lake Superior flow in a counter-clockwise direction, from Thunder Bay towards Duluth approximately 200 miles southwest.

The United States organizations are diligently trying to assess any health hazard, at Duluth. This is a slow, painstaking procedure that requires monumental investigations. Those persons engaged in this work will warrant sympathetic understanding by the public.

There is some real evidence that complete treatment filtration can reduce the concentrations of asbestiform fibres in water. Duluth will probably, at least, have to provide treatment, such as filtration, of its drinking water, if no other source is available.

There is some evidence that in the Ontario cities using surface waters, the numbers and/or mass of asbestos fibres are related, in part, to the size of the municipality. Analysis for asbestos in treated sewage and storm water flows would be desirable. Evaluations will continue, to assess the contributions, if any, of asbestos-cement watermain pipe, particularly in aggressive water areas.

In areas of asbestos-bearing rock, it would appear that care should be taken when using this material for the building of roads and the control of ice on roads.

The Research Branch of the Ministry of the Environment has been asked to assess various pretreatment procedures together with depth and other configurations of filter materials to provide optimum asbestos removal from municipal

What then is the situation? Apparently, there is asbestos in all surface waters of all habited areas of Ontario, and perhaps there has always been some asbestos there. We have only just discovered its presence, as we will continue to discover new constituents therein. Our Ministry of Health has indicated that ingestion of asbestos at these levels does not appear to present a health hazard at this time. As with any other constituent, research will have to continue, particularly to ascertain if there is a level of ingested asbestos that must not be exceeded. In this, the toxicologist, the epidemiologist and all those other professions of the medical and public health fields will be in the forefront. It reiterates that the vigilant efforts to protect the environment in general, and the public's drinking water in particular, are being performed via personnel from many disciplines.

TABLE 1

ASBESTOS FIBRE COUNT
DISTRIBUTION SYSTEM WATER

Sample Location	Source	Fibre Count, in Millions per litre	Estimated Mass Concentration, ug/
Toronto (SEE ALSO TABLE II)	L. Ontario	1.90	0.000941
Belleville	Bay of Quinte	0.533	0.000937
Brantford	Grand River	0.570	0.00113
Brockville	St. Lawrence R.	0.446	0.000602
Chatham	Thames River	0.595	0.00157
Cornwall	St. Lawrence R.	2.11	0.000729
Hamilton	L. Ontario	0.694	0.000154
London	L. Huron	0.456	0.000429
Niagara Falls	Niagara River	2.58	0.00225
North Bay	Trout Lake	0.384	0.000104
Oshawa	L. Ontario	0.557	0.000159
Ottawa	Ottawa River	0.136	0.000093
Pembroke	Ottawa River	2.85	0.000538
Peterborough	Otonabee R.	1.86	0.00354
Port Colborne	Welland Ship Canal	0.608	0.000847
Sarnia	L. Huron	3.87	0.00213
Sault Ste. Marie	St. Marys River	0.248	0.000141
St. Catharines	Welland Ship Canal	1.03	0.00156
Sudbury	Ramsay Lake	0.297	0.000542
St. Thomas	L. Erie	1.60	0.000500
Thunder Bay	L. Superior	0.830	0.000235
Welland	Welland Ship Canal	0.820	0.000479

TABLE II

ASBESTOS FIBRE COUNT

WATER SUPPLY

MUNICIPALITY OF METROPOLITAN TORONTO

Sample Location	Fibre Count, in Millions per litre	Estimated Mass Concentration, ug
9 Pandora ~~CRESCENT~~ GRETTE CRESCENT.	1.90	0.00094
Scarborough F.P. - Output	1.35	0.00149
R. C. Harris F.P. - Raw	0.83	0.00085
R. C. Harris F. P. - Output	0.72	0.00099
Island F.P. - Raw	4.06	0.00508
Island F.P. - Combined Filtered	2.16	0.00247
Westerly F. P. - Raw	2.76	0.00473
Westerly F. P. - Output	0.77	0.00033
Distribution-St. Clair Reservoir	0.73	0.00036
Distribution-Bayview-York Mills	0.90	0.00074

NOTE: — ug/l = MICROGRAM PER LITRE

TABLE III

ASBESTOS IN DRINKING WATER

DISTRIBUTION SYSTEM WATER

SAMPLE LOCATION	SOURCE	FIBRE COUNT IN MILLIONS PER LITRE	ESTIMATED MASS CONCENTRATION µg/l
WINDSOR	DETROIT RIVER	1.80	0.00192
(AFTER FILTRATION)		1.73	0.00279
WINDSOR	DETROIT RIVER	25.3	0.052
(RAW)		18.2	0.00781
LINDSAY	SCUGOG RIVER	1.19	0.00101

ASBESTOS FIBRE COUNT ANALYSIS

SAMPLE: WATER SAMPLE, THUNDER BAY

SIZE CATEGORY	PARTICLE SIZE, UM	NUMBER COUNTED	CUM NUMBER	CUM NO PERCENT	CUM MASS PERCENT
1	0.040	0	0.0	0.00	0.00
2	0.057	6	3.0	4.48	0.38
3	0.080	8	10.0	14.93	1.48
4	0.113	20	24.0	35.82	4.73
5	0.160	10	39.0	58.21	10.45
6	0.226	11	49.5	73.88	18.59
7	0.320	3	56.5	84.33	27.84
8	0.453	8	62.0	92.54	60.98
9	0.640	1	66.5	99.25	94.90
10	0.905	0	67.0	100.00	100.00
11	1.280	0	67.0	100.00	100.00
12	1.810	0	67.0	100.00	100.00

TOTAL NUMBER OF PARTICLES COUNTED = 67

CONCENTRATION OF ASBESTOS IN SAMPLE = 8.30×10^{5} FIBRES/LITRE

ESTIMATED MASS CONCENTRATION = 2.35×10^{-4} MICROGRAMS/LITRE

THIS MASS CONCENTRATION CORRESPONDS TO ONE PART OF

ASBESTOS IN 4.26×10^{12} PARTS OF WATER

Figure 21B. Fibre Length Distribution: Thunder Bay