CITY OF TORONTO

Department of the City Clerk

City Hall, Toronto, Ontario, Canada M5H 2N2

Roy V. Henderson / City Clerk

Barbara Caplan / Deputy City Clerk

J. O'Neill - 947-7025
November 20, 1984

TO: ALL INTERESTED PERSONS

I am enclosing, for your information, the appended Clause contained in a Report from the Board of Health, which was adopted by City Council at its meeting held on November 12, 1984.

Yours truly,

Roy V. Henderson.

City Clerk

JO/sp
JO
Encl.

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TORONTO'S DRINKING WATER: A CHEMICAL ASSESSMENT

The Board of Health reports having adopted the recommendations contained in the report "Toronto's Drinking Water: A Chemical Assessment" (April 5, 1984) from the Medical Officer of Health, and recommends that Council endorse same.

The following persons addressed the Board in support of the recommendations contained in the report "Toronto's Drinking Water: A Chemical Assessment":

- *David Sugarman, Member of the Eastern Health Area Community Advisory Board*
- *Sarah Miller of S.C.O.W.*
- *Colin Isaacs, Executive Director of Pollution Probe Foundation.*

The Board of Health submits the report (April 5, 1984) from the Medical Officer of Health:

Subject: Toronto's Drinking Water: A Chemical Assessment

Origin: Local Board of Health, November 24, 1981 (c34hlth84048:168)

Comments: At its meeting on November 24, 1981, the Local Board of Health had before it for consideration reports concerning Toronto's drinking water. The Board requested that the Department of Public Health prepare an in-depth report, in cooperation with members of Pollution Proble, City of Toronto Department of Public Works, and the Metrpopolitan Works Department, which would: (a) summarize current knowledge of the health effects of organic and hevy metal contaminants in drinking water; (b) review the need for and feasibility of upgrading the current purification system; and (c) report on the extent to which Toronto's sewage system is contributing to the contamination of Lake Ontario.

The concern at that time was "Is Toronto's drinking water safe?" I pointed out then and repeat now that Toronto does not have a high rate of gastro-intestinal or bladder cancer, and that our rate of congenital anomalies is remarkably low. In the study attached, we make rough comparisons of chemicals in Toronto's water with other jurisdictions in Canada and the United States and we find that Toronto water compares reasonably. Residents of Toronto can drink tap water with reasonable assurance it is not likely to cause harm or injury. There is no need to buy bottled water or to invest in purification devices.

Why, then, all the fuss?

In the first place, we have become increasingly aware of sources of chemical pollution in Lake Ontario. Secondly, advancing technology has given us new tools and new ways of looking at risk. Much of this is controversial and requires public debate. Finally, new treatment technologies hold promise for even purer water.

We know too little. Many of our recommendations call for testing or more research. For example, Metro Works Department carries our very extensive testing at the plant. Municipalities do little testing at the tap. Our knowledge of trihalomethane formation in the Toronto system is incomplete. Decisions about major capital investment cannot be made in the absence of good comparative data on the performance of other suystems. The Toronto Area Watershed Management Study (TAWMS) holds promise of identifying pollution sources affecting the Metro Toronto waterfront and hence, potentially, intake water quality.

Throughout this study we have used maximum ever concentrations reported by Metro Works Department. Some of these, such as the high mercury levels may be laboratory errors. Some may have occurred only once in thirty or forty testings, some at only one plant,. They represent a "worst case" situation. It is not appropriate to use these figures to generate human exposure estimates. We used these findings for consistency, to avoid having to use enormous numbers of tables, and to avoid the possibly misleading use of averages.

Setting standards for drinking water quality leads us into an area of scientific controversy and debate. Classical epidemiologic studies do not always detect slight risks, yet slight risks may be important when large numbers of people are exposed. The applicability of laboratory tests to humans is often challenged. Even the definition of what substances are carcinogens is not unchallenged.

We believe Canadian standards for drinking water quality should be reviewed using a risk assessment method similar to the procedures of the Environmental Protection Agency in the U.S.A., including the use of public hearings.

Finally, there is great interest in ozonation and activated carbon filtration as alternative strategies or additions in water treatment. While the most desirable strategy is to reduce the contamination of Lake Ontario at the source, it is prudent to consider these other treatment methods.

I recognize that Local Board of Health members have received this report too late to comment on April 24th. This delay was necessitated by a wish to avoid the highly emotional and confrontational atmosphere which surrounded previous reports on Toronto's water quality. There are important issues here which deserve reasoned debate. I support the recommendations of this report but suggest deferral of Board discussion to permit members adequate time to study them.

Recommendation: That the Local Board of Health adopt the recommendations contained in the attached report.

(Summary of the report "Toronto's Drinking Water: A Chemical Assessment" prepared by the City of Toronto Department of Public Health)

This report is intended to assess whether the consumption of Toronto's drinking water is likely to be a health hazard or not, and to evaluate alternative drinking water treatment systems from a public health perspective. This has been done by discussing possible sources of chemical contaminants to our drinking water, as well as the potential health effects of chemicals that have been identified in Toronto's water. In the light of our findings, the report goes on to assess several alternative filtration and disinfection systems that could be considered for use in Toronto.

Lake Ontario, the source of Toronto's drinking water, is the smallest in area of the Great Lakes and like all the Great Lakes, it has been seriously contaminated by human activity. Through the IJC (International Joint Commission), both the Canadian and U.S. governments are committed to improving the Great Lakes water quality, but progress has been slow partly because of a lack of coordination between the many jurisdictions involved.

Monitoring has shown the presence of more than 800 chemicals in the Great Lakes ecosystem. Concentrations of many organochlorines in fish and animals have been decreasing, but recent data suggest some chemical concentrations may be increasing again. Many species also contain heavy metals, but concentration trends over time are difficult to determine. Lake Ontario's sediments also contain organic and inorganic chemicals as a result of human activities. Data are not comprehensive enough to detect changes in concentrations.

There are many sources of chemical pollutants to Lake Ontario which could affect Toronto's drinking water. Probably the best known is the Niagara River. Sources of contaminants to the river include direct industrial and municipal discharges as well as leaking waste disposal sites and groundwater. Industrial discharges are poorly regulated, and municipal wastewater treatment plants still contribute large amounts of chemicals. This is especially true of the Niagara Falls, N.Y. wastewater treatment plant, which has not been fully operational since its construction in 1978. Leaking waste disposal sites also release chemicals to the river. There are four main sites of concern: Love Canal, Hyde Park, 102nd Street and S Area. Progress on the remedial work is agonizingly slow. This is because of a lack of agreement about what should be done and who should do it. Recent evidence suggests that groundwater contaminated by leaking waste disposal sites is migrating toward the Niagara River. If this is occurring on a large scale, the chemical loadings to the Niagara River from groundwater could be greater than those from point sources of contaminants.

Other sources that may affect drinking water quality include the Don and Humber Rivers and Mimico Creek. These watersheds are being studied by the Ministry of the Environment, and data show the presence of organic and inorganic chemicals, sometimes equalling or exceeding their respective Provincial Water Quality Objectives. It is hoped that this study will contribute to the development of abatement strategies for reducing chemical contamination in the Toronto watersheds.

Toronto's sewage system is probably also a major source of contaminants along the waterfront. Neither storm nor combined sewer overflows are routinely monitored for chemicals, so it is impossible to assess how much untreated chemical effluent is entering Lake Ontario. In addition, the treatment process itself was not designed to treat such effluents, and it is not known how the process affects them. Sewage effluent is routinely monitored for some metals, but not organic chemicals. At present we do not have sufficient data to assess the extent to which the sewage system is contaminating Lake Ontario.

Lakefilling and dredging is another local source of pollutants about which little is known. Dredgeate and fill materials have been shown to be contaminated with heavy metals and organics, such as PCBs. Dredging inevitably resuspends some of these and lakefilling deposits more contaminated material into the lake. Although there is no evidence that these activities are affecting the quality of Toronto's drinking water at present, the potential for contamination exists.

These, and other sources may influence the chemical quality of Toronto's drinking water. The filtration and disinfection processes also add chemicals to the water supply. One of these, chlorine, reacts with natural substances in water to form trihalomethanes, which are consistently detected in Toronto's drinking water. Trihalomethanes are mutagenic in the Ames test (except for chloroform, which is an animal carcinogen) and should therefore be regarded as potential human carcinogens.

It is now well established that chlorination increases the mutagenicity of drinking water, although only a fraction of this increase is due to trihalomethane formation. The majority is due to the formation of unidentified non-volatile mutagens. One study of Great Lakes water showed that chlorinated water was more mutagenic than raw lake water by factors of between 2-10 times. This suggests that chlorination is the largest single source of potentially hazardous chemicals to drinking water. However, in making this statement we would like to acknowledge the tremendous public health benefits that have resulted from the use of chlorine. We are therefore recommending that possible alternatives to chlorination (and existing filtration methods) be studied by federal (Health and Welfare Canada), provincial (Ontario Ministry of the Environment) and municipal (Metropolitan Toronto Works Department and Medical Officers of Health) authorities.

As well as trihalomethanes, many other organic and inorganic chemicals have been infrequently detected in Toronto's water. In total, 83 chemicals have been identified since 1971. Of these, 28 were inorganic and 55 were organic, although inorganics are detected more frequently. Seven are human carcinogens and 23 are potential human carcinogens.

The existing filtration and disinfection system was not designed to remove organic or inorganic chemicals from drinking water, but it does affect them. Concentrations are affected unpredictably, some increase, some decrease, and some stay the same. There is also variability in the behaviour of individual chemicals.

The quality of Toronto's drinking water is comparable with that in many U.S. cities. It is more difficult to do a comparison with Canadian drinking water, because there has not been a comprehensive national survey of inorganics and organics in Canadian drinking waters. Surveys of drinking water quality from around the Great Lakes and or trihalomethane concentrations, suggest that Toronto's water is of approximately the same quality as many other Canadian municipalities.

Water distribution systems can also contribute chemicals to drinking water. Toronto's system is approximately 100 years old, but it is still structurally sound. This is because corrosion is not a very serious problem. Recently, some plastic pipes have been installed, and there is evidence that chemicals can leach from them into drinking water.

Samples of drinking water used for chemical analyses are usually taken at the filtration plants, rather than at the tap. If samples from each are compared, it can be seen that concentrations of

some inorganics are higher in tap water. More significantly, in the few samples tested, concentrations of trihalomethanes were higher at the tap than at the filtration plants. This suggests trihalomethane formation is occurring in the distribution system.

The recent emphasis on the quality of drinking water has resulted in an increased use of alternatives to municipally supplied and treated water. Bottled waters are seen as one alternative to tap water, but they are not chemically analyzed on a regular basis, like municipally supplied water. Chemical analyses, conducted by the Department of Public Health and Metro Works Department, showed that bottled waters do not necessarily contain fewer chemicals, or at lower concentrations than tap water (excepting trihalomethanes). Water filters, another alternative, can be colonized by bacteria which may be pathogenic. There are doubts about the long term efficiency of such filters in removing chemicals. Water distillers can now also be purchased in Toronto, but distilling does not necessarily remove all organic chemicals and may in fact concentrate some. In addition, distilled water is felt by many to have a flat and unpleasant taste.

Health hazards that could be associated with drinking water are assessed by three main methods: epidemiology, animal studies, and carcinogenesis/mutagenesis assays. Each has advantages and disadvantages, but when used in combination the results are more likely to provide an accurate estimate of human health effects.

These methods mentioned above assess the hazards from exposure to individual chemicals, yet we are usually exposed to many chemicals through a variety of sources (e.g., food and water). Chemicals can interact synergistically, additively or antagonistically and it is unlikely that science will ever be able to quantify all the risks. Given this situation, we must look for new ways to improve our assessment of hazards. One possibility is the use of biological methods, such as the Ames test for mutagenicity. This type of test can assess the hazards associated with exposure to one or a mixture of chemicals.

Once the health hazards associated with chemical exposure have been investigated, this information can be used to derive standards for drinking water. There are two ways of evaluating data: establishing "no observed effects levels" and risk levels.

A "no observed effects level" is determined by identifying a concentration below which there are no observed adverse health effects in animals. This concentration is then extrapolated to human health, allowing for such factors as body weight, the average daily consumption of drinking water and how good the data are. A safety factor is usually incorporated, although not necessarily the same factor is used for all chemicals. The use of "no observed effects levels" implies that threshold levels of chemicals exist, below which there are no risks of health effects developing. While thresholds have been demonstrated for some non-cancer health effects, it is not generally accepted that they exist for cancers.

In contrast, risk levels are defined as the mortality or morbidity in a given population resulting from exposure to a particular chemical at a particular concentration. It is often necessary to extrapolate to low exposure levels and large populations, because most exposures resulting in observed health effects are relatively large, and the human population is often much larger than the experimental animal population. Extrapolation is made much more accurate by quantifying the health effects resulting from many exposure levels, although it is often difficult to estimate the risk of health effects at very low exposures. Estimates of risk levels are therefore subject to wide variations. After such an "exposure vs. health risks" table has been constructed, it is necessary to decide what level of health risk is acceptable, so that an exposure standard can be set. This decision is a matter of value judgement, rather than scientific fact. Even the term "acceptable risk" implies the purposeful acceptance of a risk (such as the presence of chemicals in drinking water) by those exposed to it. But most decisions about what risks are acceptable in Canada are not usually made in public. We are therefore recommending that public participation should be encouraged when drinking water, and other environmental standards, are being set.

At present, health effects are not the only criteria used to set drinking water standards. For example, in the Guidelines for Canadian Drinking Water Quality, 1978, most "objective concentration guidelines" are set at current detection levels, and in the U.S. the "maximum contaminant level" for trihalomethanes is set at "a feasible level achievable with water treatment technology". The Department of Public Health proposes that the primary determinants of drinking water standards should be the protection of the public's health and the supply of aesthetically acceptable water.

The Canadian drinking water guidelines are set using "no observed effects levels" for both carcinogens and non-carcinogens (except for trihalomethanes and nitrilotriacetic acid). This results in wide variations in the levels of risk when the guidelines are examined using the risk levels method. In addition, many regulatory agencies now use the risk levels method of setting standards for carcinogens because it is not generally accepted that there are threshold levels of chemicals below which there are no risks of health effects developing. We are recommending that this approach should also be used to set standards for carcinogenic chemicals in Canadian drinking water.

Other contentious issues around the Canadian drinking water guidelines are that they only cover a limited number of chemicals, and they are not legally enforceable. The Department of Public Health is recommending that additional chemicals be considered for inclusion, and that the desirability of enforceable standards be examined. Health and Welfare Canada is currently reviewing the existing guidelines.

In addition to the problems associated with the guidelines themselves, there are also vast uncertainties about the health effects of many chemicals that have been detected in drinking water. The report outlines those that are known, but our knowledge is very incomplete. Little is known about possible health hazards from the ingestion of chemicals detected infrequently and at low concentrations. Moreover, our knowledge of the combined effects of chemicals is almost non-existent. Many infrequently identified chemicals have been detected in parts per trillion, but we cannot dismiss these seemingly low concentrations as being insignificant. We simply do not know. Therefore, the Department of Public Health is advocating that a cautious approach be adopted to the ingestion of chemicals through drinking water. This lack of knowledge is a source of frustration for everyone, but probably most of all to the ordinary citizen who hears conflicting opinions from all sides.

These difficulties are aggravated by the widening gap between our ability to detect chemicals and our knowledge to interpret detected levels in terms of human health effects. Public officials report new data to the public, but if their significance cannot be explained, the possibility of generating alarm adds a new dimension to their responsibility. Different jurisdictions add to this problem by issuing different guidelines or standards. The public's interpretation is that one jurisdiction is saying that a given chemical concentration is safe, while another is saying it is unsafe. This severely threatens the credibility of government agencies in the public's eyes.

Another problem is the continuing imprecise use of the term 'safe'. Safe may mean free from danger, as in "A person once infected with small-pox is safe from having it a second time". Safe may also mean not likely to cause harm or injury, as Florence Nightingale used the term: "The safest atmosphere of all for the patient is a good fire and an open window".

We confront daily questions using the latter sense, e.g., is air travel safe? Will my child be safe playing minor hockey? What we are seeking is a statement of the degree of risk associated with the activity, or an assurance that all reasonable steps have been taken to minimize a known risk.

At the turn of the century, Toronto's water was unsafe because of bacterial contamination. Chlorination dramatically reduced that risk, but introduced a new, very much smaller risk, the production of mutagens and carcinogens from the interaction of chlorine with organic material in the water. As each new level of safety is reached, we seek further refinement. Helmets for children playing hockey were improved by the addition of protective eye shields. In the case of municipally supplied drinking water, there is a special obligation to ensure that all reasonable steps have been taken to minimize risk since the public has limited alternatives. This report is an attempt to explore the necessity and feasibility of improving the already good quality of Toronto's water, and to involve the public in the process.

From the discussion above, it can be seen that it is impossible to assess the extent of health effects that could be attributed to Toronto's drinking water accurately, however, data from the U.S. Environmental Protection Agency (EPA) can be used to derive a tentative estimate of the increased cancer incidence due to trihalomethanes in the City of Toronto's drinking water. This suggests that one cancer every three years may be due to trihalomethane ingestion. This is a minute fraction of the cancer incidence in Toronto. We would like to stress that this estimate cannot be scientifically supported. It is merely an estimate extrapolated from animal data and does not represent known cases of cancer. The use of this estimate does not imply that consumption of Toronto's water causes cancer, however it is intended to stress that there are risks associated with drinking water. Indeed, our epidemiological study failed to demonstrate any correlation between drinking water mutagenicity (as measured in the Ames test), three cancer sites

that have previously been associated with the presence of chemicals in drinking water, and adverse pregnancy outcomes.

Discussion of the Health effects associated with hazardous chemicals in drinking water has concentrated on cancer, mutagenesis, teratogenesis, birth defects and some short-term effects, such as disturbances of the central nervous system. This is because these are the types of health effects that have been studied. We should not preclude the possibility of the occurrence of other health effects which have not yet been studied in such detail. Although this report concentrates on known health effects this should not be seen as implying that these are the only possible effects.

In view of uncertainties regarding the effectiveness of conventional water treatment methods, and the lack of knowledge about the hazards associated with the presence of chemicals in drinking water, we are recommending that alternatives to conventional treatment methods be investigated at both field and research levels. There are several alternatives to both disinfection and filtration. Alternative disinfection methods include the use of ozone, and chlorine dioxide. The main alternative to conventional filtration is the use of granular activated carbon (GAC).

Ozone has been used throughout Europe for many years, and more recently in Montreal. It is popular due to its excellent biocidal abilities and effectiveness in controlling tastes and odours. Recent research has shown that ozone may be effective also at eliminating organic precursors to trihalomethane formation. Little is known about organic compounds that are formed in the process of ozonation. Those that have been identified (e.g., aldehydes, ketones, and carboxylic acids) are relatively biodegradable and are not regarded as being hazardous to human health.

The greatest disadvantage of ozone is that it does not provide residual disinfection. Unless ozone is used in conjunction with another disinfectant, microorganisms are likely to grow in the distribution system, particularly if finished water has a high dissolved organic carbon content and a long residence time in the system before it reaches the tap.

Chlorine dioxide is a powerful chemical oxidant widely used for primary and residual disinfection of water supplies in Europe. In the United States and Canada chlorine dioxide is used infrequently for taste and odour control. The U.S. Environmental Protection Agency recommends a maximum dosage of 1 mg/L of chlorine dioxide for drinking water treatment.

Unlike chlorine, chlorine dioxide does not form trihalomethanes when combined with organic matter. Little research has been undertaken concerning organic by-products of chlorine dioxide. Thus, work on health effects has been limited to studies of chlorine dioxide itself and its most common reaction products, chlorite and chlorate. Toxicological research demonstrates conclusively that these substances are blood oxidizing agents which impair the body's oxygen carrying ability and can lead to hemolytic anemia. Additionally, chlorine dioxide treated water has been shown to possess mutagenic properties. Preliminary epidemiological research has failed to demonstrate adverse effects of drinking chlorine dioxide treated water for up to three months among healthy adults. Both epidemiological and toxicological research suggests, however, that certain groups may be more sensitive to blood oxidizing effects of chlorine dioxide, namely individuals who are deficient in glucose-6-phosphate dehydrogenase, and infants. There is some evidence that newborns are adversely affected by chlorine dioxide treated water. Further work is required in this area and into chronic health effects of exposure to chlorine dioxide, chlorite and chlorate.

The practice of adding ammonia to chlorinated water supplies for taste and odour control, thereby producing chloramines, is common in North America. This practice is followed in Metro Toronto. Chloramines are weaker disinfectants than chlorine, but combined chlorine has the advantage of being more stable than free chlorine and thus persists longer as a residual disinfectant in distribution systems. Research shows that chloramines are less likely than free chlorine to react with organic compounds and form trihalomethanes. Unfortunately, little else is known about reaction products of chloramines with other compounds in water.

Information on health effects of chloramines also is limited. Some evidence indicates that monochloramine is a red blood cell oxidizer for humans, but this finding was not replicated in studies with animals. Monochloramine also is a weak bacterial mutagen, and research is currently underway on the long-term carcinogenesis bioassays of both mono- and dichloramine. At present, there are no recommended maximum concentrations of chloramine in finished water.

Activated carbon has become increasingly popular as a potential alternative to conventional treatment approaches.

Research over the past decade in the U.S. and in Europe has shown that activated carbon in its granular form is an effective chemical filter medium for many organic chemicsls, and possibly certain inorganics (iron, mercury, chromium). One disadvantage of granular activated carbon is that it becomes saturated and loses its effectiveness over time. When used in combination with ozone, however, it appears that the life of carbon beds can be extended significantly.

Activated carbon does not generate contaminants by forming by-products with chemical compounds. Because of its finite surface area and variable adsorption qualities of chemical compounds, not all compounds passing through a carbon bed are necessarily adsorbed on the carbon surface. Occassionally organic chemicals have been found in granular activated carbon effluents in concentrations exceeding influent levels. Whether these instances are due to competitive adsorption or variations in influent composition is unknown. Much of the research on activated carbon treatment effects has used grouped measures of organics rather than measuring individual organic compounds. Thus, future research efforts should seek to identify specific compounds that are of particular concern for health reasons.

It is possible, though unlikely, that pathogenic microorganisms colonized on carbon beds are sloughed off into finished water. Research on mutagenic activity of water treated with activated carbon indicates that rather than introducing contaminants into treated water, granular activated carbon removes them, at least those that are bacterial mutagens. In addition, pre-treatment with granular activated carbon reduces disinfection demand and increases disinfection efficiency. Research into microbial composition of granular activated carbon treated water has found that the most common bacterial strain in effluents is Pseudomonas. No fecal indicators or enteric bacteria have been found.

In the U.S., where pilot testing of granular activated carbon and other treatment alternatives has been in progress for many years, the first full-scale treatment facilities are now being planned. In Canada, the first granular activated carbon pilot plant study is being planned by the Ontario Ministry of the Environment for the Niagara Region.

There is an abundance of evidence to indicate the effectiveness of alternatives to conventional treatment. In the U.S. and in Europe there is a strong movement towards using granular activated carbon for chemical removal in conjunction with ozone for disinfection. From a public health perspective, this is a preferred treatment altrnative. We believe that Canada, and Toronto in particular, should also investigate the effectiveness of such alternatives. A city of Toronto's international stature should be taking a leadership role in issues as critical as drinking water quality and treatment.

In summary, this study has been unable to demonstrate that the consumption of municipally supplied water has resulted in any observed health effects. However, an extrapolative experimental technique suggests that a minute fraction of the cancer incidence in Toronto may be associated with the ingestion of trihalomethanes in drinking water. This estimate could not be supported scientifically because the predicted increased incidence is so small. Moreover, this estimate does not imply that Toronto's water causes cancer, but it is intended to stress that there are risks. There are also many uncertainties about the health effects of the trace amounts of inorganic and organic chemicals that are infrequently detected in Toronto's drinking water. Acknowledging this lack of information, we are recommending that experimental alternatives to the existing filtration and disinfection system be investigated to determine whether effective removal of these trace chemicals is possible in Toronto, and whether suitable alternative disinfectants exist.

Summary of Recommendations:

1. That the Commissioner of the New York State Department of Environmental Conservation be requested to review the basis for the SPDES (State Pollutant Discharge Elimination System) permits. Such a review should examine whether it is appropriate to include considerations of ambient contaminant concentrations in the Niagara River, chemical contaminants entering the river from non-point sources, and the water quality objectives of the Great Lakes Agreement, 1978, in discharge permits.

2. That the Commissioner of the New York State Department of Environmental Conservation be requested to encourage the regulation of more priority pollutants in all new and renewed SPDES permits.

3. That the Director of Utilities for the City of Niagara Falls, New York be requested to complete the necessary remedial work on its wastewater treatment plant as soon as possible.

4. That the Commissioner of the New York State Department of Environmental Conservation and the Administrator of the U.S. Environmental Protection Agency be requested to consider the excavation and removal of contaminated materials as an alternative to in situ management of the leaking waste disposal sites most likely to contribute to the contamination of the Niagara River.

5. That the Commissioner of the New York State Department of Environmental Conservation and the Administrator of the U.S. Environmental Protection Agency be requested to consider the development of environmentally sound disposal options as a matter of utmost importance. This should include the development of programs to minimize the quantities of hazardous wastes produced, and to improve their quality wherever possible.

6. That the Commissioner of the New York State Department of Environmental Conservation and the Administrator of the U.S. Environmental Protection Agency be requested to investigate the extent and levels of the chemical contamination of groundwater in the Niagara and Erie County region, and to estimate the likely effects on water quality in the Niagara River and Lake Ontario.

7. That the Minister of the Environment for Ontario be requested to continue to work toward abatement strategies for the Toronto watersheds.

8. That the Commissioner of the Works Department, Metropolitan Toronto, be requested to include computer modelling of the dispersion characteristics of the most significant chemicals (e.g., chlorine and heavy metals) identified in the Main treatment plant effluent, in the planning process for the new outfall pipe.

9. That the Commissioner of the Public Works Department, City of Toronto, be requested to undertake a comprehensive chemical analysis of all storm sewer outfalls and combined sewer overflows at least once a year, using the U.S. Environmental Protection Agency's list of priority pollutants as a basis.

10. That the Commissioner of the Works Department, Metropolitan Toronto, be requested to chemically analyze effluent samples from all four Metropolitan Toronto sewage treatment plants at least once a year using the U.S. Environmental Protection Agency's list of priority pollutants as a basis.

11. That the Commissioner of the Works Department, Metropolitan Toronto, and the Commissioner of the Public Works Department, City of Toronto, be requested to integrate the programs of chemical analysis mentioned in recommendations (9) and (10) above, by using the same list of chemicals, and standardized sample collection and analytical procedures.

12. That the Minister of the Environment for Ontario be requested to define, or have defined, and make public, "zones of non-compliance" with the Provincial Water Quality Objectives for point sources of contaminants to the Toronto waterfront.

13. That the Minister of the Environment for Ontario be requested to develop a consistent year-round monitoring programn for the Toronto waterfront, to be based on an assessment of the relative contributions of all point sources of chemical contaminants.

14. That the Chairmen of the Great Lakes Science Advisory Board and the Water Quality Board of the Intarnational Joint Commission be requested to investigate the atmospheric deposition of organic and inorganic chemicals into Lake Ontario to the fullest extent possible.

15. That the Minister of National Health and Welfare be requested to investigate the health effects of the non-volatile mutagenic fraction of chlorinated drinking water in animals to determine its carcinogenic potential.

16. That the Minister of National Health and Welfare be requested to initiate a research program to investigate possible alternatives to the use of chlorine as a drinking water disinfectant. This could also include an evaluation of alternatives to conventional filtration methods, such as granular activated carbon.

17. That the Commissioner of the Works Department, Metropolitan Toronto, be requested to identify any additional chemicals present in Toronto's drinking water at the most sensitive detection levels possible which are not included in regular analyses, by performing a complete gas chromatograph/mass spectrometer or electron capture scan on one set of drinking water samples in 1984.

18. That the Minister of National Health and Welfare and the Minister of the Environment (federal) be requested to undertake a national survey of organic and inorganic chemicals in Canadian drinking water.

19. That the Commissioner of Public Works, City of Toronto, be requested to investigate the extent of leaching of organic chemicals from plastic pipes and pipe sealants. Such a study should include the determination of actual concentrations in areas of the Toronto distribution system where plastic pipe is used.

20. That the Medical Officer of Health, in cooperation with the Commissioner of Public Works, City of Toronto, be requested to prepare a proposal for systematic testing for chemicals in tap water in the City of Toronto, and that other miunicipalities be encourgaged to do the same.

21. That the Commissioner of Works, Metropolitan Toronto, be requested to study possible methods of reducing trihalomethane concentrations in the distribution system.,

22. That the Minister of National Health and Welfare be requested to chemically analyze brands of bottled water sold in Canada, on a regular basis.

23. That the Minister of National Health and Welfare be requested to assess the chemical quality of brands of bottled water sold in Canada with the Guidelines for Canadian Drinking Water Quality, 1978, as well as with the bottled water regulations under the Food and Drug Act.

24. That the Minister of National Health and Welfare be requested to consider the policy of permitting the sale of tap filtration devices in Canada.

25. That the Minister of National Health and Welfare be urged to consider confining the use of the "no observed effects levels" method of standard setting to non-carcinogenic chemicals in drinking water.

26. That the Minister of National Health and Welfare be requested to recommend a zero level of exposure to carcinogenic chemicals, where possible. Where this is not possible, it is recommended that exposure levels to carcinogens should be set using risk levels, rather than "no observed effects levels".

27. That the Minister of National Health and Welfare be requested to develop a mechanism for encouraging public participation when setting drinking water and other environmental standards, by incorporating a time period for public review and public hearings before standards are finalized.

28. That the Minister of National Health and Welfare be requested to consider setting drinking water guidelines for a comprehensive range of organic chemicals. This could be based on the U.S. Environmental Protection Agency's list of priority pollutants.

29. That the Medical Officer of Health, City of Toronto, be requested to prepare a short report on the implications of mandatory drinking water standards for chemicals.

30. That the Minister of National Health and Welfare be requested to investigate the possible interactive multi-generational effects of long term exposure to chemicals in drinking water.

31. That the Minister of National Health and Welfare be requested to conduct animal studies on the possibility of such health effects as behavioural and psychological effects, suppression of the immune system and changes in fertility rates, and their relationship with the ingestion of hazardous chemicals, particularly through drinking water.

32. That the Minister of the Environment for Ontario be requested to consider initiating a comprehensive field study to evaluate alternative disinfection and filtration techniques, and report back to the Local Board of Health. Such a study could include evaluations of the

effectiveness of ozone (as a disinfectant and in eliminating organics) and granular activated carbon. It is further recommended that combinations of alternative technologies (for example, granular activated carbon and ozone) and combinations of alternative and conventional technologies (for example, granular activated carbon and chlorine) be evaluated. It is also recommended that this study be undertaken in collaboration with the Metro Toronto Works Department, using Toronto's drinking water supply, and the results be analyzed in consultation with the Medical Officers of Health for Metropolitan Toronto.

(Copies of the full report have been forwarded to members of City Council under separate cover.)

The Board of Health also submits the report (April 3, 1984) addressed to the Metropolitan Works Committee from the Metropolitan Commissioner of Works:

Re: Drinking Water Quality

For your information, we are forwarding copy of a paper presented at a Seminar on Development and Assessment of Environmental Standards, held by the American Academy of Environmental Engineers at George Washington University in December, 1981. The paper, by Dr. Cornelius W. Kruse (deceased), to whose memory the conference proceedings were dedicated, dealt with "Standard for Trihalomethane and Public Health."

Dr. Kruse noted that chlorinated water has been consumed for some seventy years. The United States employed chlorination, while Europe practiced ozonation for disinfection of public water supplies. Cancer statistics for the United States are quite similar to those in Western Europe. He notes that there is no evidence to suggest a rise in cancer rates, which would be expected in those body parts which ingest water, if waterborne carcinogens were prevalent. In fact, the rates have declined or remained constant.

In his concluding paragraph, Dr. Kruse, who was a professor in the School of Hygiene and Public Health at The John Hopkins University, comments: "The prevention of cancer through the removal of even traces of carcinogen, natural or man-made, has a low order of probable success compared to the cost."

In another commentary, extracted from the American Water Works Association's publication "Mainstream", copy appended, President William O. Lynch of American Water Works Association, observed that the drinking water industry cannot afford the attempted complete removal of all contaminants, which, because of sophisticated instrumentation, can be identified with incredible accuracy. "It is one thing to be told several parts per billion of something potentially dangerous is in one's drinking water, (but) it is quite another to learn that the risk posed probably is far less than that of being struck by lightning." (approximately 1 in a million).

Locally, it is worthy of note that 1983 water sampling results indicated the total Trihalomethane (THM) content of our drinking water approximated 0.020 parts per million (p.p.m.), only 6 per cent. of the Maximum Acceptable Concentration allowed under Federal and Provincial Guidelines, 0.35 p.p.m. As noted in Ontario's publication, the principal source of THM's in drinking water is the chemical interaction of chlorine added for disinfection. At 0.35 p.p.m. (or milligrams per litre), the health hazard is considered negligible, according to the Ministry of the Environment.

It is of further interest to note that, in recent discussions with two different firms exploring the possibility of the use of granular activated carbon in our water treatment system, they expressed reservation as to whether they could honestly promise very much better results than the excellent performance we are achieving now.

(A copy of the publication referred to is on file in the City Clerk's Department.)

The Board of Health also submits the further report (May 2, 1984) addressed to the Metropolitan Works Committee from the Metropolitan Commissioner of Works:

Re: Toronto's Drinking Water

At the April 24, 1984, meeting of the City of Toronto Board of Health, Dr. A.S. Macpherson, the City's Medical Officer of Health, presented a report on Toronto's Drinking Water, which the Board had requested in November, 1981. The report makes 32 recommendations, many of which supported further research by various bodies.

Having been afforded an opportunity, in confidence, to make a hasty review of the contents of the report shortly prior to its release, we were concerned, as were other agencies, that it might disturb or alarm some members of the public. The tenor of the report,

(a) referring, as it did in its opening section, on its goals and terms of reference, to papers published by Pollution Probe as having raised public awareness, ignoring responses made by this Department to those papers;

(b) using the "worst case scenario" approach, tabulating the maximum reading ever noted over a twelve-year period for any contaminant in Metropolitan Toronto's drinking water, and making comparisons with single-year readings elsewhere, (compounded by the fact that, in a number of instances, the maximum reading had been rechecked and found to be an aberration);

(c) seemingly ignoring reports which might support a more moderate approach, such as the 1978 report commissioned by the Board of Health which indicated, at that time, that the additional cost of refined treatment methods was not justified;

(d) advocating a public participation approach to the setting of drinking water standards

- before almost reluctantly acknowledging, in the paragraph leading into its recommendations: "This study has been unable to demonstrate that the consumption of municipally supplied water has resulted in any observed health effects," - seemed to emphasize the negative, rather than the positive aspects of its contents.

However, in actual fact, we are pleased that Dr. Macpherson's report was given a generally favourable reception. As we had expected a Pollution Probe representative has since seen fit to correspond with the media, annoyed that the negative aspect was not given greater attention.

A number of the 32 recommendations in Dr. Macpherson's report proposed action by the Metropolitan Commissioner of Works. The pertinent items, and our comments on each, are listed below.

Recommendation No. 8:

> "That the Commissioner of the Works Department, Metropolitan Toronto, be requested to include computer modelling of the dispersion characteristics of the most significant chemicals (e.g., chlorine and heavy metals) identified in the Main treatment plant effluent, in the planning process for the new outfall pipe."
>
> This is being done.

Recommendation No. 10:

> "That the Commissioner of the Works Department, Metropolitan Toronto, be requested to chemically analyze effluent samples from all four Metropolitan Toronto sewage treatment plants at least once a year using the United States Environmental Protection Agency's list of priority pollutants as a basis."

We recently reported on results of testing performed in 1983. We are prepared to continue annual sampling at each of our plants, currently costing approximately $24,000.00, although it must be noted that random sampling is vulnerable to whatever peculiarity might exist at the moment of sampling, since flow composition is variable. We submitted 24-hour composite samples for testing, to minimize the random sampling effect.

Recommendation No. 11:

> "That the Commissioner of the Works Department, Metropolitan Toronto, and the Commissioner of the Public Works Department, City of Toronto, be requested to integrate the programs of chemical analysis mentioned in recommendations (9) and (10) above, by using the same list of chemicals, and standardized sample collection and analytical procedures."

We are prepared to discuss this item with the Commissioner of Public Works, City of Toronto.

Recommendation No. 17:

> "That the Commissioner of the Works Department, Metropolitan Toronto, be requested to identify any additional chemicals present in Toronto's drinking water at the most sensitive detection levels possible which are not included in regular analyses, by performing a complete gas chromatograph/mass spectrometer or electron capture scan on one set of drinking water samples in 1984."

This recommendation appears to be prompted by a desire for information as to possible health effects of any previously unidentified substance in drinking water. We currently test for the United States Environmental Protection Agency priority list to their recommended detection limits, and are prepared to give consideration to testing for any items not on that list or on an expanded list. We have in the past (1983) required the analytical laboratory performing our organic analyses to identify any additional compounds that are indicated as present during testing. Without identifying specific chemicals to be checked, the assignment may prove difficult. The Medical Officer of Health is always free to sample the water and conduct tests at the City's expense.

Recommendation No. 21:

> "That the Commissioner of Works, Metropolitan Toronto, be requested to study possible methods of reducing trihalomethane concentrations in the distribution system."

The method of treatment employed by Metropolitan Toronto (i.e., post ammoniation) should not result in any significant increase in total trihalomethane formation in the distribution system. During 1983, there is in fact an indication that the average concentration of total trihalomethane dropped from 16.22 micrograms per litre (ug/L at the plant to 15.51 ug/L in the distribution system. We would be cautious in making this a final conclusion since 12 samples only were used in the survey.

Having regard for the extremely low levels of total trihalomethane in the Metropolitan System, in comparison with various existing standards, we feel that it does not appear to be a matter of great concern at this time.

In any event, we are continuing to review literature, and the Director of Water Supply, Mr. P.M. Emery, as a member of an American Water Works Association committee studying carbon filtration, recently was authorized to spend up to $5,000.00 annually in travel expenses related to that committee's work.

Recommendation No. 32:

> "That the Minister of the Environment for Ontario be requested to consider initiating a comprehensive field study to evaluate alternative disinfection and filtration techniques, and report back to the Local Board of Health. Such a study could include evaluations of the effectiveness of ozone (as a disinfectant and in eliminating organics) and granular activated carbon. It is further recommended that combinations of alternative technologies (for example, granular activated carbon and ozone) and combinations of alternative and conventional technologies (for example, granular activated carbon and chlorine) be evaluated. It is also recommended that this study be undertaken in collaboration with the Metropolitan Toronto Works Department, using Toronto's drinking water supply, and the results be analyzed in consultation with the Medical Officers of Health for Metropolitan Toronto."

This request appears to be a duplication of the pilot plant study of Niagara Falls' water supply, now being undertaken by the Minister of the Environment, using granular activated carbon. Whether any substantial benefit can be derived by establishing duplicate facilities in Toronto will have to be considered by the Minister, who presumably is being asked to fund the project.

General Observations

It may be worth noting that we have just received a volume from the American Water Works Association Research Foundation, "Activated Carbon in Drinking Water Tefchnology," which summarizes experience since 1971 in the Netherlands with granular activated carbon plants. The drinking water objective for trihalomethanes in the Netherlands is shown to be 70 ug/L. Toronto's drinking water, as previously mentioned, contains less than 20 ug/L.

The Netherlands study notes; "Trichlorethylene (TCE) can be removed very efficiently but trihalomethanes are reduced with only moderate efficiency," (by granular activated carbon adsorption.) The report emphasizes in several 9instances the need for further research into problems experienced with carbon filtration. It states: "Partially as a result of favourable reports from studies conducted in Germany, the combination of ozone plus carbon adsorption has attracted particular attention, but conclusions based upon further studies are not unanimous...it cannot be positively concluded that use of ozone preceding carbon adsorption enhances the removal of chronically toxic substances."

A copy of Dr. Macpherson's report has been provided to Committee members.

The Board of Health also submits the communication (September 11, 1984) addressed to the Commissioner of Works from the Metropolitan Toronto Clerk:

The Works Committee on September 11, 1984, had before it a report (July 31, 1984) from the Commissioner of Works advising that Recommendation No. 32 in the report on Toronto's Drinking Water, published in April, 1984, by Dr. A.S. Macpherson, Medical Officer of Health of the City of Toronto, was hat the Minister of the Environment for Ontario be requested to consider initiating a comprehensive field study to evaluate alternative disinfection and filtration techniques, in collaboration with the Metropolitan Toronto Works Department, using Toronto's drinking water supply; attaching a copy of the Minister's response to such a request; and recommending that no further action be taken at this time, but that receipt of results of research being performed at Niagara (and elsewhere) be awaited.

The Committee concurred in the foregoing recommendation.

(Report dated July 31, 1984, from the Metropolitan Commissioner of Works referred to in the foregoing communication)

Re: Water Treatment

One of the recommendations (No. 32) in a report on Toronto's Drinking Water, published in April, 1984, by Dr. A.S. Macpherson, Medical Officer of Health for the City of Toronto, was that the Minister of the Environment for Ontario be requested to consider initiating a comprehensive field study to evaluate alternative disinfection and filtration techniques, in collaboration with the Metropolitan Toronto Works Department, using Toronto's drinking water supply.

We communicated this request to the Honourable Andrew S. Brandt, Minister of the Environment, on May 17, 1984.

A copy of the Minister's reply, dated June 19, 1984, is appended. In it, he describes research similar to that proposed to be done locally which has been or is being performed under Ministry auspices at other locations in Ontario, and which he feels will be applicable to water works across the province. There is no suggestion that he would be willing to sponsor duplication of the research in Toronto.

We recommend that no further action be taken at this time, but that we await receipt of the results of research being performed at Niagara (and elsewhere).

The Board of Health also submits the communication (May 23, 1984) from the Secretary of the Local Board of Health, City of York:

At its meeting held on May 15, 1984, the Local Board of Health considered the attached report of the Medical Officer of Health (May 4, 1984), with respect to the subject matter.

I wish to advise that at the aforementioned meeting the Board unanimously adopted the following motion:

"That the recommendation of the Medical Officer of Health be approved."

(Report dated May 4, 1984, from the Medical Officer of Health of the City of York referred to in the foregoing communication)

This report from the Medical Officer of Health of the City of Toronto was forwarded by the Toronto Local Board of Health to Local Boards of Health of Metro with the request that they submit written comments to or make representations at a special meeting of the Toronto Local Board of Health on Tuesday May 22nd at 10:00 a.m. in Committee Room "4" of the City of Toronto New City Hall.

Although the details of this report are beyond the technical expertise of this Department to analyze, the recommendations contained in the summary appear both reasonable, comprehensive and worthy of support.

Recommendation: That the Local Board of Health endorse the recommendations in the report entitled "Toronto's Drinking Water: A Chemical Assessment" and that the Toronto Local Board of Health be advised.

The Board of Health also submits a communication (May 15, 1984) addressed to the Director of Water Supply of the Metropolitan Works Department from the Medical Officer of Health of the City of York:

In reply to your letter of May 10, 1984 I forward a copy of my report to our Local Board of Health which was adopted at its May 15th meeting.

I believe it is unfortunate that the Metropolitan Works Department which has been doing such an excellent job of water treatment and those who are specifically concerned with new and difficult-to-define threats to health are having such difficulty finding common ground since they are both interested in provision of the best possible quality of drinking water.

I wish you every success in addressing this difficult question of chemicals in water.

The Board of Health also submits a communication (June 19, 1984) addressed to the Metropolitan Commissioner of Works from the Minister of the Environment:

Thank you for your letter of May 17, 1984 regarding research on alternative water treatment technologies.

As you are aware, my Ministry is currently involved in comprehensive research of methods to optimize conventional water treatment processes for the removal of trace organics. Granular activated carbon filtration as an add-on system is being evaluated. The study will also define the conditions under which the application of these techniques may be required.

At the present time, field experimentation to support this research is being satisfactorily conducted at the Niagara Falls Water Treatment Plant. The results of the research are expected to be applicable to water works across the province, and take into account a variety of localized conditions. As the research program develops we shall consult with local governments and medical officers of health concerning the findings and future directions, including the Metropolitan Toronto operations.

A study has recently been completed for the Ministry, in conjunction with Health and Welfare Canada, on the use of ozone as an alternative disinfectant with specific attention to by-products produced, practicability of application and costs.

At the earliest possible date, we will advise you of the results of this work and of other research as well. My Ministry looks forward to continuing in active co-operation with you for the provision of the best possible water supply to Metropolitan Toronto.

The Board of Health also submits a communication (May 10, 1984) from the Ministry of the Environment Canada:

I understand that Environment Canada has been invited to present a submission on the Medical Officer of Health's recently released report entitled "Toronto's Drinking Water". I would like to respond to that invitation.

I want to compliment the Medical Officer of Health in Toronto and the Local Board of Health for their initiative in undertaking this review. I also wish to congratulate the Board's researchers for their thorough examination of all matters pertaining to the quality of Toronto's drinking water.

In particular, I appreciate the fact that this report recognizes the very real threat that pollution problems of the Niagara River pose to the quality of drinking water not only for Toronto but for all communities drawing their drinking water from Lake Ontario.

I support all the recommendations which the report makes concerning sources of pollution in New York State, including expedited action on all of the leaking chemical dumpsites.

I am concerned about all aspects of pollution in Lake Ontario which might threaten the quality of Toronto's drinking water. All findings and recommendations of the report concerning other discharges and areas of concern will be the subject of further detailed review by the department.

The Board of Health also submits a communication (May 22, 1984) from Toby Vigod, Counsel, Canadian Environmental Law Association:

The Canadian Environmental Law Association (CELA) has been involved with drinking water issues for a number of years. CELA has represented citizens' groups in relation to leaky landfills where there has been impact to both ground and surface water. Specifically, in regard to Lake Ontario, we have represented Pollution Probe in relation to the Hooker Chemical Hyde Park Landfill case and Stop Contaminating our Waterfront (SCOW) in relation to dredge and fill activities in the Toronto Harbour.

In 1982, we co-authored a Brief with Pollution Probe on the Need for a Safe Drinking Water Act in Canada. This brief outlined the rationale and principles for drinking water legislation.

We would commend the Department of Health for undertaking the Drinking Water Report and believe that the authors have done an excellent job in providing a comprehensive examination of the situation regarding Toronto drinking water. We certainly agree with the approach that while clean-up of the sources of contamination should be a matter of priority, in reality this is not going to happen overnight, and that alternative treatment methods must be investigated. The fact that 83 chemicals have been found in Toronto drinking water; the mutagenicity of our water and the possible link to infant mortality; and the creation of trihalomethanes raise serious issues about chemicals in our drinking water that must be addressed. We would also point out that the inventory of Major Industrial Point Source Dischargers in the Great Lakes Basin, prepared by the Canada-Ontario Review Board for the International Joint Commission, published in January 1984 showed that in 1982 18/40 (i.e. 45%) of the industrial dischargers to Lake Ontario were in violation of either provincial or federal effluent requirements.

The main area I would like to deal with today is the issue of drinking water legislation. It is our opinion that the City should take a position with regard for the need for safe drinking water legislation at both the federal and provincial levels. We would specifically recommend that the City clearly indicate to Health and Welfare Canada their support for this long overdue legislation. We know that the public has identified drinking water quality as the No. 1 environmental issue and we do not believe it is acceptable to the public for the City to be ambiguous on the issue of drinking water legislation.

We would stress that presently we have no enforceable standards for either drinking water or water quality generally. While we support the drinking water reports' recommendation for more public input into standard-setting, the process becomes somewhat meaningless if in fact the so-called standards are only unenforceable guidelines. This is the present situation.

While the drinking water report (at p. 86) raises the issue that standards may be set at the lowest common denominator, we contend that with full public involvement, at least everyone would be aware of the trade-offs and would know that the standard is a reflection of a risk assessment and not a magic "safe" level. We believe that government cost sharing proposals can be arrived at to help upgrade facilities and provide for adequate monitoring. We would note that the U.S. has had drinking water legislation since 1974. Further, we maintain that the drinking water report itself provides a strong foundation on an environmental health basis for a specific recommendation by the Department of Health for legally enforceable drinking water standards under federal or provincial law.

Finally, we also note that many of the States have legislative schemes which provide for public input into the granting of industrial discharge permits (.i.e. SPDES permits in New York). Presently there are no statutory provisions for public input into control orders which apply to industrial dischargers in Ontario. It is our recommendation that the City also advocate increased public input into this process.

The Board of Health also submits a communication (May 3, 1984) addressed to the Medical Officer of Health from the President of Gore & Storrie Limited, Consulting Engineers:

We would like to take this opportunity of complimenting you and your staff on a recent paper entitled "Toronto's Drinking Water A Chemical Assessment".

It has concerned us for some considerable time as engineers that we are somewhat isolated in making decisions on water treatment related to public health issues which really require the more intense guidance and direction of the medical profession.

We sincerely believe that your paper will go a long way in creating a much better understanding with the general public on the real issues relating to the "safety" of its drinking water supply.

We would like to pose this position to you for contemplation particularly with respect to the generation of trihalomethanes in drinking waters as a result of chlorine used as a disinfecting agent.

The City of Belleville has a water treatment plant which goes back to the early 1920's, since which time at least, the City has been practising chlorination for water disinfection. The precursors in the water are mostly natural from vegetation sources and have been there for a very long time. It is therefore reasonable to assume that the production of trihalomethanes in the Belleville water supply has been going on for at least the past sixty years.

In 1979, a chloroform reduction investigation programme was carried out on the Belleville water supply.

In this programme experiments were made to determine the highest T.H.M. production which could occur from the Belleville raw water.

The predominant trihalomethane form is chloroform. Increasing chlorine dosages were applied on a laboratory scale basis up to a chlorine dosage of 300 mg/L where chloroform levels of over 2,000 mg/L were experienced. It is appreciated that conventional water supply systems would not be operating with such astronomically high chlorine applications but it does point out the T.H.M. limit certainly in this case is based on the amount of precursors available.

In your report you suggest that trihalomethane formation is occuring in the distribution system. Our investigation in Belleville indicated the most important parameter was time and that the formation of the chloroform was continuing for as long as a 48-hour period after chlorine was applied.

We therefore recommended to Belleville and to the Ministry of the Environment that all water samples should be taken at the faucet of the consumer and not at the plant producing the water, or alternatively the plant water sample should stand for 48 hours before it is tested for the T.H.M. content.

Another area of concern to us in setting up water treatment systems which are capable of removing the organic chemicals is the monitoring of the treatment effectiveness and with respect to granular activated carbon, a satisfactory method of determining when the effectiveness of the GAC is used up.

Reliable monitoring techniques are therefore critical in the industry to provide some assurance of the effectiveness of any proposed water treatment techniques.

Once again, we compliment you on your very important contribution in bringing some stability into the drinking water quality furor.

We hope that we may have the opportunity of maintaining a dialogue with you or your department as we have a great interest in this specific field of environmental engineering.

The Board of Health also submits a communication (October 17, 1984) from Diane Roulston:

I would like to take this opportunity to urge you to adopt the recommendations contained on pp.11-15 of the "Report on Toronto's Drinking Water" by the City of Toronto, Department of Public Health.

I was gratified to see our public health unit prepare a report of this calibre and importance. I commend the authors for the recommendation for thorough testing of our water using the most sensitive methods. I would be particularly interested in having our tap water tested by special testing equipment in Ottawa which is reported by Pollution Probe as being capable of detecting dioxin levels above 0.005 ppt. As far as I am concerned there is no safe dose of dioxin. We cannot wait for it to be detected in our drinking water before we act to remove it, but a detection level of 0.2 ppt is unacceptable to base a conclusion that we are "safe" in drinking the water. We know that dioxin is leaking into the Niagara River (Drinking Water, make it safe, Pollution Probe - 1983).

I commend the authors for recommending the setting of standards for our protection and concur with their position that the public should become involved in setting acceptable risk levels. I feel the Local Board of Health and public health employees could take a much greater role in educating citizens through the media, libraries and community meetings so that this discussion can take place in a meaningful way.

I would, most importantly, like to see a pilot project in Toronto to establish an alternate filtration system that will remove chemicals and their compounds now passing through our present system.

I am not alone in my concerns. As a member of the executive of Williamson Road Home and School Community Organization, I suggested, at our final meeting, that we hold a general meeting to obtain information about this report and about the safety of our drinking water. The executive were enthusiastic about holding such a meeting and it was held in our school library on May 29, 1984.

The invited speakers were Katherine Davies, from the City of Toronto Public Health Department, Senior author of the report "Toronto's Drinking Water", and Kai Millyard, researcher from Pollution Probe. Our alderman, Tom Jakobek and Dorothy Thomas, were present. Mr. Jakobek brought Mr. F.J. Horgan, Commissioner of Works, and Mr. J.A. Carnduff, Assistant Director of Water from Metro Works Department, to answer questions. Dorothy Thomas brought copies of the summary of recommendations of the report, "Toronto's Drinking Water" for the community.

It was an informative meeting and I was personally distressed by the attitude of the two gentlemen from Metro Works. Mr. Horgan and Mr. Carnduff spoke, as well as responding to questions, and both seemed concerned that we would have any doubts that our drinking water was safe.

Most in the audience were surprised to learn that no one has any legal obligation to report to the public if the water is not safe.

One person suggested that there was a moral obligation to the public, and Mr. Horgan responded that if unsafe levels of any element were detected he would "Shut it down".

I personally did not find this very comforting. Since we cannot survive without water and we obviously don't have an alternate supply for over two million people, this does not seem to be a very viable solution. What it clearly suggests is the need for a filtration system capable of removing the harmful elements already present and those which we know are eventually likely to seep into our lake water.

I am worried about my two young boys and the long term effects of the chemicals presently in our water. How many are stored in the body?

Bottled water is expensive and the only testing done on a regular basis is for bacterial counts. It is supplied in plastic jugs which could be contaminated because they are reused.

There are no guidelines to help us in choosing a home filter. I would like to see standards set for these devices.

Both bottled water and home filters only affect our drinking water. I understand that there is recent evidence to support that chemicals are absorbed by the body every time we take a bath. It is imperative that we improve the filtration of our water at the source.

I am aware that this would increase the cost of my water but according to my calculations it would cost roughly the same as two cases of beer per year per family, which I can well afford and so can most others.

Thank you for taking the time to read my views, Please adopt these recommendations and continue in your strong leadership as evidenced in your request of this report. Those with knowledge must press for action. Many people still believe that the water is "okay if you boil it". An educated public would be strongly supportive.

(Council Action)

Council endorsed the Recommendations contained in the report "Toronto's Drinking Water: A Chemical Assessment", and requested the Board of Health to give consideration to amending Recommendation 31 by deleting therefrom the word "animal".