WALKERTON INQUIRY PART II

Review of Issue #5 - Drinking Water Standards - in the Krewski et al Report "Managing Health Risks from Drinking Water: A Background Paper for the Walkerton Inquiry"

Prepared on behalf of the Ontario Water Works Association and the Ontario Municipal Water Association.

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Dr. L. Gammie

EPCOR Water Services

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1.0 Introduction

The Ontario Water Works Association and the Ontario Municipal Water Association (OWWA/OMWA) requested assistance in the evaluation of some of the reports presented as information for Part II of the Walkerton Inquiry. This review looks at the Krewski Report on "Managing Health Risks from Drinking Water" (Daniel Krewski, John Balbus, David Butler-Jones, Charles Haas, Judith Isaac-Renton, Ken Roberts and Martha Sinclair), with particular reference to the section on drinking water standards.

1.1 Overall Report

This report from the University of Ottawa Centre for Population Health Risk Assessment, does a reasonably good job of setting out of the models for defining risk, and provides a useful short history of waterborne disease outbreaks (although limited to Ontario and British Columbia). It reviews typical microbiological pathogens and monitoring procedures, and compares drinking water standards from Ontario, Canada, WHO, USEPA and Australia. It concludes by offering suggestions for improving drinking water management practices.

Overall I agree with this report's definition of risks, comparison of drinking water standards, and suggestions for improvement (e.g. improving health surveillance

programs, and creating total quality management systems). However there are some concerns with the report's consideration of water treatment as a means of public health protection.

1.2 "Source Protection"

Although the report does list the Hazard Analysis Critical Control Point (HACCP) identification of water treatment as a critical control point, it identifies "source protection" as the most effective approach to managing microbiological risks (Executive Summary page 14, and Conclusions page 185). This may be true from a theoretical point of view, or where municipalities have full control over their watersheds, but for most municipalities, source protection is a very difficult, multi-stakeholder, long-term process. Moreover, often there is limited support from regulatory requirements on source water pollution control on a watershed basis.

Source protection is however increasingly seen as a very important step in the multi-barrier concept of water treatment, and should be included along with optimized water treatment (filtration or clarification/filtration), effective disinfection, system maintenance, adequate water quality monitoring, and operator training. For communities on surface water that do not have filtration, source protection is a much more critical part of the overall treatment process, and would have to be prioritized accordingly. A proactive strategy for drinking water should thus follow a comprehensive management plan and not rely on one control measure (see Australian Management Framework). This is known as the multiple barrier approach.

These topics (source water protection, quality of source water, drinking water quality, and water treatment) are referenced in such water industry standards as the American Water Works Association (AWWA) policy documents.

The policy on Quality of Water Supply Sources (2000) states:

The American Water Works Association is dedicated to securing drinking water from the highest quality sources available and protecting those sources to the maximum degree possible.

The policy on "Treatment of Public Water Supplies and Quality Control in the Distribution System (1988) " states:

The American Water Works Association (AWWA) strongly supports the practices of filtration of surface water used as sources of public water supply, disinfection of public water supplies, including the maintenance of residual disinfectant in the distribution system, and the covering of reservoirs that store water for direct delivery to consumers, and adequate monitoring to assure conformance with water quality standards.

The policy on Drinking Water Quality (2000) states:

All water utilities should deliver to the consumer an adequate supply of drinking water that meets or exceeds all drinking water standards established by regulatory agencies. This objective is achieved most economically and effectively when the source water is taken from the highest quality source available; the water is appropriately

treated to meet regulatory and community water criteria; and the water quality is maintained during transmission to the consumer.

In addition the AWWA White Paper on "Source Water Protection (1997)" also states:

AWWA promotes a multiple-barrier approach to providing safe drinking water that includes source water protection (SWP), treatment as appropriate, distribution system maintenance, and monitoring. SWP may reduce health risks and treatment costs and improve finished water quality. SWP may also provide ancillary benefits of enhancing water quality for other users and improving the natural and aesthetic environments of communities. Accordingly SWP should be pursued diligently for every water supply source.

To highlight the need for proper evaluation of risk to supposedly-protected groundwater sources, the USEPA provided a definition of "groundwater under the influence of surface water" (GWI) in their proposed rule on filtration and disinfection (US Federal Register Nov 1987):

"The proposed definition of "surface water" includes springs, infiltration galleries, wells and other collectors which are directly influenced by surface water. Direct influence of surface water may be indicated by rapid shifts in water quality indicators such as turbidity or conductivity, the presence of diatoms, plant debris, rotifers, insect parts, larvae, Coccidia, or Giardia cysts in the source water."

1.3 Enhanced Health Surveillance

On page 14 in the executive summary enhanced health surveillance is noted primarily as a tool for rapid outbreak detection. It certainly functions in that respect, but it could be much more useful as a preventive tool if better surveillance systems were in place that were able to pick up low levels of waterborne disease occurrence.

It is very likely that waterborne disease events occur over a full spectrum from single cases to community-wide scenarios; the point at which an outbreak is picked up will depend on the capabilities of the surveillance system in place. Currently waterborne disease surveillance systems are only effective in identifying large-scale outbreaks; but if better tracking and evaluation of disease cases were carried out, it should be possible to pick up small scale outbreaks, which are no doubt occurring on a much more frequent basis than the large-scale events.

The National Enteric Disease Surveillance Committee (of Health Canada's Centre for Infectious Disease Prevention and Control) has already being doing some work along these lines, looking at better tracking and reporting systems for waterborne disease surveillance, and investigating the relationship between water quality and gastrointestinal disease (Aramini et al).

1.4 Chemical versus Microbial Contamination

In the introduction (page 16) the report refers to chemical contamination as being secondary compared to microbial challenges. While it is true that microbial challenges to

the system pose the highest risk, and can result in severe short term impacts if treatment is not adequate, I believe that they understate the effort that water utilities have to go through to balance effective disinfection against the creation of disinfection byproducts (DBPs). Minimising of DBPs to meet regulatory requirements (and likely more stringent DBP requirements to come) will often restrict treatment process selection, and must be taken into account when new plants/upgrades/improvements are being considered.

Chemical spill contamination is much less likely as a drinking water health risk, based on recorded occurrences. However this risk does suffer from the disadvantage that the lack of adequate online monitoring equipment for all possible spills will result in only the more obvious spills being detected as they enter the treatment facility (obvious colour, odour, change in pH, conductivity, surface sheen, etc). It is unlikely that a toxic spill without these characteristics would be picked up before it was impacting the consumer, unless the appropriate authorities were notified of the spill, and they in turn notified the water utility.

1.5 Relative Abundance of Pathogens

In chapter 4 (page 82) the report states that protozoan pathogens are usually present in low numbers. While this is likely true on average, there is a lot of evidence to indicate that these microbial contaminants are ubiquitous, and some evidence to suggest that high numbers are present on occasion.

A 3-year project (1998-2000) on the North Saskatchewan River with Alberta Agriculture, Alberta Health and Alberta Environment suggests that sewage plant treated effluents routinely discharge *Giardia* in the order of 10,000 cysts/100 litres, and that Spring runoff peak concentrations of *Giardia* and *Cryptosporidium* can reach those levels in tributary creeks draining off agricultural land. Preliminary data on this project was presented at the Watershed 2000 conference in Vancouver (Cooke et al).

It is important that adequate monitoring be done in runoff and heavy rainfall conditions, when pathogen levels would be expected to be highest, to characterize the source water. Enough monitoring should be done to identify the ranges of pathogens that are present, plus monitoring of surrogates such as colour, turbidity, particle counts, and fecal coliforms/*e.coli* so that the water plant can be designed to be adequate for the range of raw water conditions, and so that surrogate relationships can be defined so that daily routine process monitoring is performed using some of the simpler surrogates. There is enough data to suggest pathogen levels can be variable from year to year and from background to peak events (Gammie et al). If this monitoring is not done, there is a danger that plants will assume that they only need the minimum treatment requirements.

1.6 Studies on the Effect of Drinking Water on Human Health

The report references a number of studies on the relationship between turbidity and gastrointestinal disease (page 93). It should be noted that Health Canada (Centre for Infectious Disease Prevention and Control) is currently carrying out a number of studies on treated water turbidity versus cases of gastrointestinal disease (5 years worth of daily

data). The results for Greater Vancouver are completed and released, work on data from the City of Edmonton is currently underway and should be completed by year end 2001 (Aramini et al)

Results of the Greater Vancouver study supported the hypothesis that during the study period, enteric pathogens present in each of Greater Vancouver's three drinking water supplies contributed to endemic gastroenteritis among Greater Vancouver residents. Relative disease rates declined as turbidity values decreased below 1 NTU. Over a 6 year period variations in drinking water quality explained 17,500 physician visits, 85 hospital admissions, and 138 emergency room visits.

1.7 Detection of Outbreaks

On page 158 of Krewski et al, surveillance program activities are identified systems that will pick up local trends that are then co-ordinated sequentially through provincial and federal reviews to pick up country-wide outbreaks. This is often true for foodborne disease (packaged cheeses, distributed bean sprouts, etc), but is not generally true for waterborne outbreaks. These are usually centred in one municipality, the cases are picked up locally, and classification of an outbreak occurs locally.

The only time where a waterborne disease becomes a wider provincial or federal problem is when people travel from the outbreak location and their disease case is identified in an other municipality, or they pass the disease on to others in another location by person-to-person contact. It is good practice in that case to alert other municipalities to the presence

of disease in a community so that the cause can be properly identified (although the media usually does a good job of getting the news out ahead of any formal channels).

The provincial and federal agencies should also be incorporating the information in their outbreak reporting databases for an accurate overall view of waterborne disease, and Health Canada should keep a national database of outbreaks to provide information on the occurrence and prevalence of these events.

1.8 Other Issues

Uses of Water

Section 5.1 of the report states that standards are for drinking or culinary purposes. This should be corrected to the use of drinking water for all domestic purposes, including personal hygiene (see Health Canada Drinking Water Guidelines 1996).

Latest Version of Canadian Drinking Water Guidelines

The report (page 102) lists the 1996 Sixth Edition as the latest version of the Canadian Drinking Water Guidelines. The latest version is actually on the Health Canada website and is dated March 2001. The decision was made to update the Guidelines on a more frequent basis, but only to publish another paper edition when a significant number of changes had occurred. The latest (valid) version thus includes new or updated guidelines for Aluminum, Bromate, Chloramines, and Uranium, and a modified list of radiological parameters, that are not in the 1996 version.

Advising on the Adequacy of Potable Water Treatment

On page 105/106 of the report the Drinking Water Subcommittee's role is listed as including reviewing the adequacy of potable water treatment technology and operating procedures. While this may have been done, Health Canada has traditionally stayed away from making any recommendations in the guidelines about specific water treatment technologies, on the understanding that approval of water treatment plant design, operating conditions, and operational water quality limits were the right and responsibility of the provincial governments. Thus provincial governments would set out approved technologies in their own standards and guidelines, and/or incorporate them into water plant licenses or approvals-to-operate.

Guideline for Protozoans

There is currently no Canadian Drinking Water Guideline requirement for Protozoa. The March 2001 Canadian Drinking Water Guidelines includes a general statement that if viable human-infectious *Giardia* cysts or *Cryptosporidium* oocysts are present or suspected to be present in source waters, or if these protozoa have been responsible for past waterborne outbreaks, then a treatment regime and watershed or wellhead protection plan should be implemented. There is no specified treatment technology listed for control of protozoans. Current monitoring methodologies for protozoans, with poor recoveries and a lack of information on viability, are not recommended for compliance monitoring, but can provide much useful information on order-of-magnitude levels in surface waters, to assist in design of suitable multiple-barrier treatment systems.

Bacteriological Sampling Requirements

The Canadian Drinking Water Guidelines lists the minimum bacteriological sampling requirements as 4 samples per month under 5,000 population, then 1 sample per thousand from 5,000-90,000 population, and 90 plus 1 per 10,000 over 90,000 population. This is generally used as the standard sampling frequency across the country unless provincial requirements are specifically listed otherwise. There is no requirement for weekly as opposed to monthly sampling. The 1994 and 2000 Ontario Objectives/Standards are both more stringent than the Canadian Drinking Water Guideline requirements (see Section 2.6 - page 28).

Treatment Requirements

On page 111 of the report, it states that the Drinking Water Subcommittee considers a well-managed adequately treated (e.g. effective disinfection and maintenance of a free chlorine residual) water treatment system should be effective in ensuring removal or inactivation of disease causing organisms. This is NOT what the Guidelines say. The statement should read "A water treatment system that provides effective filtration and disinfection and maintains an adequate disinfectant residual should produce water of an acceptable quality…" (an important distinction).

2.0 Drinking Water Standards

The Krewski report compares drinking water standards from Ontario (MOE), Canada (Health Canada), US (USEPA), Australia (National Health & Medical Research Council), and the World Health Organization. I have also added some comments on the UK (England and Wales)/EEC standards.

I would agree with the report's conclusions in section 6.5 that Ontario's present drinking water risk management system is using many of the current best procedures in assessing and managing the risks of drinking water.

In fact I would go further and say that even the previous set of Ontario Drinking Water Objectives (MOEE 1994) were very good, in that they incorporated all of the Health Canada Drinking Water Guidelines, and added a number of other objectives for health-related parameters such as NDMA, Dioxins and Furans, and PCBs, as well as a number of additional pesticides. They also had non-health related objectives or operational guidelines for aluminum, dissolved organic carbon, organic nitrogen and methane. Their only significant shortcomings were in not being regulations, and having no requirements for control of protozoans.

For the national/international guidelines/standards listed below (Canada, World Health Organization, USA, Australia, UK/EEC) I have commented on areas where the standards are different, either as regulations or guidelines, whether water treatment processes are

recommended, the size of community affected by the regulations, or on any other significant differences, and how they compare to the Ontario standards.

Framework for development of guidelines

All countries are basically working with the same data set of health-related information, (although they may put more emphasis on their own studies) but they do manage to come up with guidelines or standards which are slightly different, in that different parameters are included, and different maximum allowable levels are listed.

Each country has a process of evaluating the health risk information and deciding on which level provides an adequate safety factor for protection of health. Many of the health-related limits are extrapolated from effects at much higher levels, then various safety factors are added to account for uncertainties in the data. Countries also have different approaches to regulating contaminants either as individual contaminants or as groups, or may rely on treatment technologies rather than setting numerical contaminant limits.

Each country will also have an additional priority list of contaminants which are currently under review as possible future regulated parameters; the ranking on that list will depend on factors such as the amount of use of the contaminant in the country, its perceived health risk and its prevalence in drinking water supplies.

2.1 Canadian Drinking Water Guidelines

The Krewski report explains the current practices in setting drinking water guidelines in Canada, and setting out the role of the federal Drinking Water Subcommittee. The Guidelines are not regulations, but are used by the provinces and territories as the basis for setting their own guidelines or regulations. Health Canada develops the basic toxicity information and supporting documentation for any proposed guideline, and that information is presented to the federal-provincial drinking water sub-committee for a decision on inclusion in the guidelines and the setting of a guideline limit.

The sub-committee members can have the proposed guideline reviewed by stakeholder groups in their own provinces, and can then accept, reject, or modify the proposed guideline based on importance, treatment availability or cost considerations. Once a guideline is accepted, it is published on the web version of the guidelines, and each province/territory has the responsibility of informing its own stakeholders of the change. In Alberta for example, the federal-provincial subcommittee representative will canvas 8-10 stakeholders (including water utility staff, engineering consultants and university professors) for comments on any proposed regulation, but will rely on organizations such as the Canadian Water and Wastewater Association to inform most municipalities of the draft guidelines.

The latest version of the Guidelines was produced in March 2001, and is accessible on the Health Canada website (the last published paper version was the 6th edition in 1996). Guidelines are meant to apply to all water supplies of any size, both public and private,

but are legally enforceable only where they are adopted by a province as a regulation (or under a particular operating license for a water treatment facility), under provincial legislation. In Ontario the new regulations apply to any system serving more than 5 private residences.

Health Canada has traditionally not recommended any water treatment processes as a means of reducing contaminants, having viewed that as a right and responsibility of the provinces, who may incorporate treatment requirements into their regulations/standards or into water plant approvals-to-operate.

In comparison with other standards/guidelines the Canadian Guidelines (CDWG) list some parameters which are not present in other national guidelines:

1) CDWG lists limits for aldicarb, aldrin/dieldrin, azinphos-methyl, bendiocarb, bromoxynil, carbaryl, chlorpyrifos, cyanazine, diazinon, dicamba, diclofop-methyl, dimethoate, diuron, malathion, metribuzin, paraquat, parathion, phorate, terbufos, and trifluralin but USEPA and WHO do not (WHO does list aldicarb, aldrin/dieldrin, and trifluralin). The Australian guidelines do include a good number of these but not bendiocarb, cyanazine, malathion, and phorate.
2) Radioactive contaminants: the Canadian guidelines have a much more extensive list of parameters than most other countries. The guidelines list 30 different radioactive parameters, with the additional comment that meeting gross alpha and beta limits will ensure compliance. Most other countries only regulate the gross alpha and gross beta

levels, and would require investigation of sources of the radioactive contamination if the gross alpha/beta levels were exceeded.

3) The Canadian guidelines have no requirements for control of protozoans or viruses other than general statements on the need to apply adequate treatment to reduce risk.

The Canadian guidelines have no limits for parameters such as DDT, PCBs, polycyclic aromatic hydrocarbons (PAHs), chlordane, asbestos, radon, and others, because data indicate that the compounds are either not used in Canada, or are not likely to be found in drinking water at levels that pose a risk to human health.

The Canadian Guidelines have a current priority list of contaminants for consideration as future regulated parameters or updating of current limits and these include algal toxins, bacteria, chlorate, chlorite, chlorine dioxide, cyanogen chloride, haloacetic acids, MCPA, trichloroethylene, trihalomethanes, turbidity, viruses. Further down the priority list are parameters such as aluminum, arsenic, chloral hydrate, copper, dichlorprop, haloacetonitriles, MTBE, acrylamide, chlorine, nitrate, and nonylphenols.

While Canadian limits for pesticides are often not as strict or as comprehensive as in other jurisdictions, there is no evidence that there are widespread pesticide contamination issues. Most utilities appear to be reporting pesticides at non-detectable or very low (part per trillion) levels. There is however a likely need to do more monitoring at the time of application of pesticides as well as baseline monitoring, to ensure that peak events are not occurring.

2.2 World Health Organization (WHO) Guidelines

The most recent WHO Guidelines for drinking water quality were published in 1993 (2nd edition), with updates in Volume 2 and Addendum in 1996 and 1998. The Guidelines are very similar to the Health Canada Guidelines, although they do have some different limits for disinfection byproducts, which also include haloacetic acids, haloacetonitriles, and formaldehyde, and a number of additional pesticides. The guidelines are meant to serve as a basis for national organizations to set standards or regulations applicable to their particular situation.

The WHO guidelines do provide some recommendations as to the removal efficiency of different water treatment processes for various contaminants, and on the treatment recommended for various types of water source (e.g. protected and unprotected groundwater, protected surface waters, impounded water supplies, and unprotected river supplies with various levels of fecal contamination).

Some of the areas where WHO guidelines are different from the Canadian guidelines:

1) Polymer Residues:

   WHO has set limits for monomer content of polymers for Acrylamide and Epichlorohydrin. If Canadian plants use National Sanitation Foundation (NSF) Standard 60 approved polymers at less than the prescribed doses then they should meet these requirements.

2) Additional pesticides:

WHO has guidelines for quite a number of pesticides which are not on the CDWG: these include alachlor, bentazone, chlordane, chlorotoluron, DDT, 2,4-DB, dichlorprop, fenoprop, heptachlor (and heptachlor epoxide), isoproturon, lindane, MCPA, mecoprop, molinate, pendimethalin, permethrin, propanil, pyridate, and 2,4,5-T. Some of these are not used in Canada, and for others the risk is considered to be low.

3) Different pesticide limits:

WHO has set lower limits for the following pesticides (Canadian guideline in brackets): Aldrin/dieldrin 0.00003 mg/L (0.0007 mg/L), atrazine 0.002 mg/L (0.005 mg/L), dibromochloropropane 0.001 mg/L, carbofuran 0.005 mg/L (0.09 mg/L), 2,4-D 0.03 mg/L (0.1 mg/L), methoxychlor 0.02 mg/L (0.9 mg/L), simazine 0.002 mg/L (0.01 mg/L), and trifluralin 0.02 mg/L (0.045 mg/L).

4) Additional disinfection byproducts:

WHO lists a number of haloacetic acids and haloacetonitriles, as well as individual trihalomethanes: Bromodichloromethane 0.06 mg/L, bromoform 0.1 mg/L, chloral hydrate 0.01 mg/L, chlorite 0.2 mg/L, chloroform 0.2 mg/L, cyanogen chloride 0.07 mg/L, dibromoacetonitrile 0.1 mg/L, dibromochloromethane 0.1 mg/L, dichloroacetic acid 0.05 mg/L, dichloroacetonitrile 0.09 mg/L, formaldehyde 0.9 mg/L, trichloroacetic acid 0.1 mg/L, and trichloroacetonitrile 0.001 mg/L.

5) Placticizers:

WHO has added two limits for contaminants found in plastics: Di(2-ethylhexyl)adipate 0.08 mg/L, and di(2-ethylhexyl)phthalate 0.008 mg/L.

6) Additional limits for other organics (solvents, etc):

   WHO has limits for EDTA 0.2 mg/L, hexachlorobenzene 0.001 mg/L, hexachlorobutadiene 0.0006 mg/L, and trichlorobenzene 0.02 mg/L.

2.3 USEPA Drinking Water Standards

The US drinking water industry is regulated by the Safe Drinking Water Act of 1974 (as amended in 1986 and 1996). Drinking water standards are produced on a parameter by parameter basis as National Primary Drinking Water Regulations (health-based) and as Secondary Standards (aesthetic). Maximum Contaminant Levels (MCLs) are set at "feasible" levels (using best available treatment technologies) and are legally enforceable. Individual states can assume primary responsibility for enforcement of regulations, but must set water quality limits as low or lower than the federal standards.

One major difference is that USEPA also sets out treatment standards for various contaminants in "Rules" which are also enforceable. For example control of *Giardia* and viruses was set out in the Surface Water Treatment Rule as demonstrable treatment design and operating criteria under a disinfectant CT model (concentration of disinfectant residual times contact time). Minimum requirements are 3-log (99.9% reduction) for *Giardia* and 4-log (99.99%) for viruses, with higher requirements based on high raw water levels. Similarly a minimum 2-log requirement for *Cryptosporidium* has been proposed (effective Jan 2002). In addition USEPA has also set out an enforceable Consumer Confidence Report procedure which requires all utilities to provide consumers

with a yearly statement on water quality, with explanations of any levels approaching or exceeding MCLs.

The US system has much stricter requirements for cities over 10,000 or over 100,000 population, with the result that small communities are less regulated and have longer to comply with any regulation. This may provide less protection for smaller communities.

Some of the areas where the USEPA standards differ from Canadian Guidelines:

1) Polymer Residues: USEPA has set limits for monomer content of polymers for Acrylamide and Epichlorohydrin. If Canadian plants use NSF approved polymers at less than the prescribed doses they should meet these requirements.
2) Additional pesticides: USEPA has guidelines for quite a number of pesticides which are not on the CDWG: these include alachlor, chlordane, dalapon, dichloropropane, endothall, endrin, ethylene dibromide, heptachlor (and heptachlor epoxide), lindane, oxamyl, toxaphene and 2,4,5-T. Some of these are not used in Canada, for others the risk is considered to be low.
3) Placticizers: USEPA has added two limits for contaminants found in plastics: Di(2-ethylhexyl)adipate 0.4 mg/L, and di(2-ethylhexyl)phthalate 0.006 mg/L.
4) Additional limits for other parameters: USEPA has limits for beryllium 0.004 mg/L, chlorite 1 mg/L, dioxins 0.00000003 mg/L, and haloacetic acids 0.06 mg/L (2002), hexachlorobenzene 0.001 mg/L, hexachlorocyclopentadiene 0.05 mg/L, PCBs 0.0005 mg/L, styrene 0.1 mg/L, trichlorobenzene 0.07 mg/L, 1,1,1-trichloroethane 0.2 mg/L, and 1,1,2-trichloroethane 0.005 mg/L.

2.4 Australian Drinking Water Guidelines

The 1996 Australian Drinking Water Guidelines are produced by the National Health and Medical Research Council, and the Agriculture and Resource Management Council of Australia and New Zealand. The guidelines are not mandatory, but are used by States to set regulatory requirements. They are meant to apply to all water supplies.

Some of the areas where the Australian standards differ from Canadian Guidelines:

1) Polymer Residues:

   Australia has set limits for monomer content of polymers for Acrylamide and Epichlorohydrin. If Canadian plants use NSF approved polymers at less than the prescribed doses they should meet these requirements.

2) Additional pesticides:

   Australia has guidelines for a large number of pesticides (63) many of which are not on the CDWG: these include ametryn, amitrole, bromacil, carboxin, chlordane, chlorothalonil, clopyralid, DDT, dichlorvos, diphenamid, disulfoton, EDB, endosulfan, endothall, EPTC, ethoprophos, etridiazole, fenarimol, fensulfothion, hexazinone, lindane, methiocarb, methomyl, mevinphos, molinate, napropamide, norflurazon, oxamyl, pebulate, permethrin, propachlor, propanil, propazine, propiconazole, propyzamide, temephos, terbacil, terbutryn, tetrachlorvinphos, triadimefon, toxaphene, 2,4,5-T, and vernolate. Some of these are not used in Canada, and for others the risk is considered to be low.

3) Plasticizers:

   Australia has added limits for a contaminant found in plastics:

   di(2-ethylhexyl)phthalate 0.01 mg/L.

4) Additional limits for other parameters:

   Australia has limits for chlorite 0.3 mg/L, chloral hydrate 0.02 mg/L, cyanogen chloride 0.08 mg/L, dichloroacetic acid 0.1 mg/L, formaldehyde 0.5 mg/l, hexachlorobutadiene 0.0007 mg/L, monochloroacetic acid 0.15 mg/L, tributyltin oxide 0.001 mg/L, styrene 0.1 mg/L, trichloroacatic acid 0.1 mg/L, and 1,2,4-trichlorobenzene 0.03 mg/L. Current Trihalomethane limits are 0.25 mg/L

One interesting area that the Australian Guidelines are moving into is the development of an overall management plan for drinking water as a preventive strategy. This is a recognition of the need for water quality protection all the way through the system from catchment through the water plant to the customers tap, with adequate monitoring, ongoing system evaluation, corrective actions, defined responsibilities, and proper training of personnel. This is a good approach, and is something that Health Canada, Environment Canada, and the Provinces, could consider as a means of coordinating the approach to drinking water and the protection of human health.

The management framework for drinking water quality is intended to set an integrated risk management approach which provides protection from the source to the customer. The overall process draws strongly on ISO 9000, ISO 14000 and HACCP components, and includes recommendations for input from customers, stakeholders and regulators.

Elements include:

1. Commitment to drinking water quality management
2. Assessment of the drinking water supply system
3. Planning - preventive strategies for drinking water quality management
4. Implementation - operational procedures and process control
5. Verification of drinking water quality
6. Incident and emergency response
7. Employee awareness and training
8. Community involvement and awareness
9. Research and development
10. Documentation and reporting
11. Evaluation and audit
12. Review and continual improvement

Australia is moving towards implementation of this process in a structure which includes water resource departments, environment departments, agriculture departments, local governments, watershed management boards, and community based groups, as well as the water utilities. The roles and responsibilities of these partners have yet to be defined.

A late update (June 2001) has been issued to the Australian Drinking Water Guidelines. The update contains guidance on microbiological contaminants such as Microcystins, Nodularin, Saxitoxins, and Cylindrospermopsin, as well as new information for aluminum, boron, copper, monochloramine, atrazine and Radium-226 and -228.

2.5 UK/EEC Drinking Water Standards (Dec 2000)

The new UK (England and Wales) Standards were issued in December 2000. The UK has generally followed the WHO model, but has produced these amended regulations to conform to the European Economic Community requirements. The UK seta a strict regulatory process where limits must be adhered to, or reported as violations.

Areas where the UK standards differ from Canadian guidelines:

1) Microbiological parameters:

   the UK has set limits for Enterococci bacteria (a limit of 0 per 100mL) and *E.coli* (0/100 mL) at customers' taps, as well as for total coliforms (0/100 mL) and *E.coli* (0/100mL) at service reservoirs and waterworks (95% compliance for total coliforms).

2) Additional pesticides/PAHs:

   the UK has limits for "total pesticides" at 0.0005 mg/L for listed pesticides, plus a limit of 0.0001 mg/L for all other pesticides. They only list Aldrin, Dieldrin, Heptachlor and Heptachlor Epoxide as separate limits. They have also set a limit of 0.0001 mg/L for polycyclic aromatic hydrocarbons (a group of 4 PAHs).

3) Polymer Residues:

   the UK has set limits for monomer content of polymers for Acrylamide and Epichlorohydrin. If Canadian plants use NSF approved polymers at less than the prescribed doses they should meet these requirements.

4) Lower limits for parameters:

   the UK has set lower limits (Canadian guidelines in brackets) for arsenic 0.01 mg/L (0.025 mg/L), benzene 0.001 mg/L (0.005 mg/L), cyanide 0.05 mg/L (0.2 mg/L), tetrachloroethylene 0.01 mg/L (0.03 mg/L), trichloroethylene 0.01 mg/L (0.05 mg/L), and vinyl chloride 0.0005 mg/L (0.002 mg/L).

5) Higher limits:

   they have set limits for lead of 0.025 mg/L until 2013, when it will be reduced to 0.01mg/L, at the customers' tap.

6) *Cryptosporidium* limit:

   the UK has set a limit of 1 oocyst per 10 litres for *Cryptosporidium*, to be monitored daily (24 hour sampling).

7) Precision and detection limits for data:

   they have set out acceptable limits for precision and detection limits for analytical methods for regulated parameters (at roughly 10-25% of the regulated limit).

8) Indicator parameters:

   they have also set requirements to monitor for indicator parameters: ammonia, clostridium, conductivity, total organic carbon, tritium, and colony counts (HPC).

2.6 Comparison of Ontario 1994 "Objectives" to the 2000 "Standards"

These older objectives included recommendations on good water quality management with instruction on such items as:

- choice of best source water for a water supply
- frequent surveys of impacts on source water

- minimum treatment requirements for surface and groundwater sources
- coagulation-flocculation, filtration and disinfection minimum requirement for surface water treatment
- disinfection as minimum treatment for groundwater sources
- adequate treatment to consistently meet water quality objectives
- frequency and location of sampling for microbiological quality
- instructions to notify the district MOE officer of any non-compliant samples
- information that the MOE officer would inform the local Medical Officer of Health of any non-compliant sample
- A minimum of 8 bacteriological samples per month, plus 1 for each 1,000 population served (this is more than the basic Canadian Drinking Water Guidelines recommendation for a minimum of 4 samples per month, plus 1 per 1,000 over 5,000 population).

The new Ontario Drinking Water Standards (August 2000) build on the excellent base of the 1994 objectives, but, unlike their predecessor, are enforceable regulatory requirements. The additions to the new "standards" over the older "objectives" includes:

- setting of minimum treatment requirements as a regulation
- requiring that only licensed and properly classified waterworks operators and water quality analysts may engage in certain water sampling and analysis activities

- all testing to be done by SCC accredited laboratories except for certain parameters that may be tested onsite at the waterworks by qualified operators/analysts.
- notification of positive bacteriological results to be sent by the lab and the waterworks to the MOE and to the local Medical Officer of Health.
- setting out the rationale for monitoring and analysis
- defining sampling locations (raw, treated, distribution system)
- surface water must provide treatment for 3-log *Giardia* inactivation and 4-log virus inactivation (as per USEPA Surface Water Treatment Rule).
- for groundwater under the influence of surface water, for avoidance of filtration the system must demonstrate 3-log*Giardia* & 4-log virus inactivation by disinfection alone.
- application of the standards to waterworks treatment and distribution systems serving more than five private residences.

Thus the standards themselves are not significantly different in terms of the parameters or limits that existed before. The difference is in making them regulations, and listing more stringent requirements on monitoring, treatment, testing and reporting, and adding some requirements for control of protozoans and viruses. Water quality standards promulgated as regulations, are more likely to result in fuller compliance by water utilities because they are legally enforceable limits that cannot be challenged in court. Consequently, they are easier to enforce than guidelines, which have no legal effect and can be challenged (unless the guideline limits are incorporated into a specific water utility license or

approval). Consequently, the obligation to comply with regulations also helps water utilities and municipalities justify the costs of water system improvements or upgrades.

What may still be open to improvement are items such as an ongoing program of validating water quality data at water utilities by spot-checking or split sampling, defining of groundwater sources under the influence of surface water, and setting up of communication channels between health, environment and utility staff.

3.0 Conclusions and Recommendations

3.1 The current Ontario Drinking Water Standards (2000) compare favorably with those in the rest of Canada and are on a reasonable par with international regulations.

3.2 There is an absence of coordinated overall water supply management strategies from the watershed to the customer's tap. Water quality standards, guidelines, and regulations may have to be modified or developed to the point of being all-inclusive in protection of drinking water from source to tap. Management strategies should include reference to requirements for adequate monitoring, ongoing system evaluation, corrective actions, defined responsibilities, and proper training of personnel. That would require a meshing of current responsibilities from various diverse areas of government, including environment, health, municipal affairs, industry and agriculture.

3.3 Ontario should maintain one set of standards for all waterworks systems in the province, but should ensure that small systems have the technical and financial capability to meet those standards.

3.4 Guideline limits for pesticides are more extensive and often set at lower limits in other jurisdictions (WHO, USEPA, Australia - see Section 2 above). Health

Canada should explain more clearly the rationale for the setting of the Canadian guideline levels, and why they differ from other jurisdictions.

3.5 The Federal-Provincial Sub-Committee and Health Canada should apply more resources to the task of evaluating the risks and setting of guideline values for the current backlog of possible contaminants on their drinking water priority list.

3.6 Health Canada should proceed with the Drinking Water Materials Safety Act which would require accreditation of materials in contact with drinking water. This would provide protection for contaminants such as acrylamide and epichlorohydrin by mandating approval procedures such as those of the Canadian Standards Association or the National Sanitation Foundation. The Act should consider and encompass procedures and certifications already in place in other jurisdictions in order to avoid duplication of effort and the possible impacts on one product needing to meet different standards in similar geographic areas (e.g. Canada and the United States).

3.7 Health Canada and/or Provincial Health Authorities should maintain an online database of waterborne outbreaks, with information on causative organisms, number of people affected, dates of duration, and follow-up actions, so as to highlight the incidence of waterborne disease, and help justify improvements in treatment and watershed protection.

3.8 MOE, in conjunction with the Federal Provincial Sub-Committee and Health Canada should look at setting some requirements for control of protozoans and viruses. The approaches should recognize existing requirements such as the US Surface Water Treatment Rule.

3.9 Adequate monitoring for microbiological risks should be carried out over a number of years to ensure that the full range of contaminant loadings has been identified, and the overall treatment system designed accordingly.

3.10 Watershed protection and source evaluation should be emphasized as an integral part of the multiple-barrier concept of drinking water protection. This would require more regulatory support and coordination between multiple agencies with responsibilities for source water protection and drinking water production.

3.11 The provincial members of the federal-provincial sub-committee on drinking water should institute a formal system of review by stakeholders in each province/territory for any proposed guideline.

4.0 References

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Appendix 1

Comparison of Water Quality Standards/Guidelines