Drinking Water:
Protecting Human Health

By Dr. Hans Peterson, *Safe Drinking Water Foundation*

Since the formation of the Safe Drinking Water Foundation (SDWF) in 1997, we have argued that there should be greater accountability and more applied science to ensure that drinking water is not only perceived to be safe but actually is safe.

For years, SDWF has highlighted problems on how drinking water is dealt with in rural communities even before Walkerton and we have written extensively in magazines such as *Canadian Water Treatment*, *Municipal World*, *The Rural Councillor* and *Aboriginal Times*. We have described numerous problems that either originated with various levels of government or with other professional agencies that work on the safety of drinking water.

We are under the assumption that anybody working in the drinking water and wastewater field understands that it is their priority to protect public health. This would mean that drinking water treatment plants should, at least, meet the current Canadian Drinking Water Quality Guidelines which include around 60 health parameters. How many rural communities can meet those guidelines even when

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their plants have been well engineered, the operators are well trained, and they have water treatment processes operating to the design criteria that were set out before construction? The challenges for rural communities are much greater than cities as they typically use much poorer quality source waters, employ less trained people, have fewer financial resources, and typically use fewer treatment processes than cities do.

Let's look at a few of the existing guidelines. Every community in Canada shall use primary disinfection before the water is distributed and using chlorine means that we need to breakpoint chlorinate. Now, look at communities that have ammonium in their source waters. For every ammonium ion, you need up to 15 times the amount of chlorine to get rid of that ammonium and reach breakpoint. If you cannot reach this, you will chloraminate the water, which is a secondary and much weaker disinfection. Many conventional treatment systems trying to deal with ammonium-rich source waters fail to adequately disinfect. If you don't measure ammonium in the source water, you actually will not be aware of this problem and typical chlorine tests will give you phantom residuals.

The maintenance of chlorine residuals in the distribution system and the prevention of carcinogenic chlorination by-products, such as trihalomethanes (THMs), need to be adequately dealt with. It is not until bacterial biofilms have been established in the distribution system that problems with diminishing chlorine residuals and increases in the levels of chlorination by-products become prominent. This means that organic material in the source waters need to be removed. These are overlooked problems with some provinces failing to require THM testing for specific water sources, such as groundwater. Even state-of-the-art ultrafiltration failed to solve the organics problem for one of Canada's largest aboriginal communities in Saddle Lake, Alberta. A community with ammonium in the source water may think it is lucky as its THM levels will always be low and the reason for this is that they don't breakpoint chlorinate, they chloraminate. Big cities may breakpoint chlorinate, then add ammonium, to get a stable residual with chloramines and this is okay as they first used primary disinfection followed by secondary disinfection.

Bacterial nutrients in the form of dissolved organics, phosphorus and nitrogen are not in the Guidelines despite their effects on water treatment as these compounds allow bacteria to grow in the distribution system. These problems will profoundly affect the quality of the water for the end user. By strictly designing to Guidelines, we assume that government agencies actually know a lot about drinking water treatment. However, this expertise is more likely to be found outside government and it should rightly belong to the engineers that design water treatment systems as there are more than 50 additional health parameters in the current Canadian Drinking Water Quality Guidelines.

Then we have the issue of parasites in drinking water. We don't have those enshrined in the Guidelines yet but Cryptosporidium outbreaks in Milwaukee and North Battleford as well as other communities should have raised the awareness of those problems in all professions dealing with drinking water. The one thing to know about Cryptosporidium is that even pure chlorine has a hard time killing this ubiquitous parasite. Turbidity guidelines can start to deal with some of these issues, but how many rural communities will be able to meet new stringent low level turbidity guidelines (<0.3 NTU)? Brand new conventional direct filtration water treatment plants on rural source waters scramble to get to these turbidity levels and when they succeed, check the cost of achievement, skyrocketing aluminum residuals.

Guest Editorial

Cryptosporidium brings us to a legal issue when it comes to drinking water - due diligence. This simply means that if you know something is of concern whether it is in drinking water quality guidelines or not, you need to take it into account to the best of your ability. The Saskatchewan Government settled lawsuits in regard to the North Battleford Cryptosporidium outbreak to the tune of millions of dollars. The Saskatchewan Government was of course nervous about going to court because of the "Due Diligence Clause." They had not warned operators about the Cryptosporidium problem nor had they inspected water treatment plants in an effective or frequent fashion.

Health Canada is ignoring due diligence along with some of the health parameters in the Canadian Drinking Water Quality Guidelines every day on reservations across Canada. Despite the fact that only one-third of waterborne disease outbreaks have positive indicator bacteria (coliforms) associated with them, this is the yardstick for calling and lifting boil water advisories across the country, and it has been the yardstick for judging whether a treatment plant works or not.

To kill coliforms, we don't need water treatment plants, we simply need chlorine. Every professional dealing with drinking water should have realized this scientific fact more than 10 years ago after 100,000 people in Milwaukee got sick and more than 100 people died from drinking water contaminated by Cryptosporidium.

In addition, as Canada will invariably try to align its drinking water quality guidelines with Europe and the U.S., our guidelines will become much more stringent than at present. New guidelines will have to deal with both chemical issues and disease-causing microbes, such as viruses, which in the U.S. are causing two-thirds of all waterborne disease outbreaks.

Many years ago, the Saskatchewan Government stamped an "approved design" for rural sewage treatment consisting of one primary and one secondary lagoon that could be discharged twice per year. Decades later, and with the Saskatchewan Government's own data, we can say that those lagoons will discharge close to raw sewage during the spring. The spring discharges will only meet regulations in a country that doesn't have any (let's hope that Canada will get some federal regulations for sewage). Lagoon after lagoon has been constructed and rubber-stamped, but lagoon after engineered lagoon has failed to meet the "protect public health" criteria.

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We are all in this together, there are more problems that need solutions than we have professionals capable of providing those solutions. Let's just remember our number one priority: "Protect public health."

Unfortunately, in the aboriginal communities that I have worked, perception has been reality. Rural water in Canada has sources that are chemically of poorer quality than many developing countries and we need to use all of our science and engineering skills to make those waters truly safe for human consumption. ■

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