

Is Unsafe Drinking Water Really Less Expensive?

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The *E. coli* outbreak in Walkerton sent a wake-up call across Canada. Among rural residents, it instilled fear that the water their family is drinking may not be safe. To governments, it instilled the realization that unsafe drinking water may be more expensive than safe drinking water. The Walkerton tragedy will likely cost in the hundreds of millions of dollars. It could have been prevented for much less and, more importantly, without loss of life.

If a disease outbreak can be traced to a community's distributed drinking water, it will be very costly. In 1993 the City of Milwaukee distributed the protozoan parasite *Cryptosporidium* in its water. Half of Milwaukee's 800,000 people became sick and more than 100 people died. In 1999 the National Research Council in the U.S. estimated that this one incident has now cost at least \$25 billion U.S.

Health Canada estimates that water borne illness costs Saskatchewan \$10 million per year.

Crass though it may be to put tragedies like Walkerton or Milwaukee into terms of dollars, it is necessary if cost has been an excuse for not taking action to ensure that rural Canadians have reliable safe water to drink. There is no doubt that "fixing" the problem will not be cheap. But it is certain that, over time, not fixing it will carry a much higher price.

What does it take to determine water quality? Two used tools are the Canadian Drinking Water Quality Guidelines and Saskatchewan's Drinking Water Quality Guidelines. But are these guidelines stringent enough tests?

A typical rural water treatment plant or water treatment in an individual rural household processes poor quality water (often from a well or dugout source) for *only a couple of minutes*. Normally, this is sufficient for it to pass

the guidelines and it is presumed to be safe.

By comparison, the South Saskatchewan River provides a high quality water source for the City of Saskatoon. Indeed, the water (which is collected upstream of its own sewage release) nearly meets every Saskatchewan Drinking Water Quality Guideline without treatment and with the addition of chlorine alone would likely pass the test. Still, the City takes up to two hours to treat the river water before they are confident it is safe to drink.

An even better water source is used at Calgary's Glenmore water treatment plant. They employ 17 people in a research laboratory that experiments daily on how to improve the quality of their water. Untreated, that water would have likely passed with flying colours Saskatchewan's Drinking Water Quality Guidelines.

Why are these cities going to such expense to produce water that is much better than what is required?

The answer is disease-causing bugs. Most of these bugs (bacteria, viruses and protozoan parasites) are not measured for in any Canadian guidelines yet, but they can make people sick. And it is increasingly recognized that the potential cost of urban outbreaks is worth more intense water treatment than is required to merely "pass" the guidelines.

A city typically has a number of different treatment steps with processing times counted in hours while rural water treatment uses just a couple of steps with processing times counted in minutes. As the rural water source is many times poorer than most city water sources, the fundamental challenge of producing safe drinking water with existing systems is formidable and for many water sources, impossible. It is not realistic to expect

that people can move to a large lake - preferably Lake Diefenbaker, some northern lake or alternatively to the South Saskatchewan River to have access to high quality source waters.

This is where finding solutions through innovative research and development comes in. To define effective water treatment processes and the speed with which water should be treated are the first required steps. Depending on the source water and the desired quality of water after treatment several different types of treatment will be required in rural areas.

This is how the treatment process is supposed to work: Treatment units or processes need to remove particles including viruses, bacteria and protozoan parasites from the water. The effectiveness of each step in removing these microbes is documented. Each step will get a "removal credit" attached to it. For example, a process or treatment unit that consistently removes viruses 100-fold will get a credit for this. Another process may remove viruses 10-fold giving it a 10-fold virus credit. Credits are then added and the entire treatment process (including disinfection) needs to reach the desired goal.

The same credit system needs to be implemented for bacteria and protozoan parasites. Removal of these microbes should typically range from 1,000 to 10,000 times. If there are 10,000 microbes in the raw water, the treated water should have no more than 10 for a 1,000-fold reduction or 1 for a 10,000-fold reduction. Through its Surface Water Treatment Rule (SWTR) and Ground Water Rule (GWR) this is how drinking water is regulated in the United States. This is also how the City of Saskatoon and Buffalo Pound Water Treatment Plant operate their treatment processes.

How many removal credits for different microbes would water treatment systems in rural Saskatchewan get? When boil water advisories are issued because of contamination by coliform bacteria in the treated water, it can be expected that the effectiveness of the water treatment system is low. Instead of reaching 1,000 to 10,000-fold microbial reductions these numbers are most likely well below 100 and in some cases below 10.

In Saskatchewan we also need to be concerned about dissolved organic material, which will give colour, taste and odour to the water as well as generating problems when we try to disinfect the water. Virtually all surface water that is contained in small reservoirs, such as dugouts, will have dissolved organic carbon levels that are high enough to generate problems in water treatment.

The most commonly used treatment to remove this material is called Granular Activated Carbon (GAC) treatment. Trying to treat water with a high organic matter content using GAC is quite short-lived as the capacity is exhausted many times faster on Saskatchewan water than water this treatment was designed for. Buffalo Pound Water Treatment Plant is successfully treating its water using GAC, but they have an economical way of regenerating the GAC so it can be re-used. This does not exist for rural water treatment plants or individual users who need to replace the GAC, which is expensive and can be a messy process.

The fundamental challenge of producing safe drinking water with existing systems is formidable.

Innovative treatment techniques include biological treatment for the removal of dissolved matter. Such innovative treatment techniques can also be used to remove arsenic, manganese and iron from ground water sources. While some work has been

done on biological treatment in Saskatchewan, these techniques have not been developed to a stage where they are suitable for mass production. Therefore, this is another fruitful area for productive research.

The Safe Drinking Water Foundation was formed to lead work into the production of drinking water that is low in or free from disease-causing microbes and unwanted dissolved material. Our mission is to do this for rural areas in Canada and to help such efforts across the world. The advantage of having SDWF lead this work is our independence from government agencies, which frequently are more concerned about appearing to do something than actually doing something.

For example, the provincial Saskatchewan Government through Sask Water is implementing a subsidized water testing program. We estimate that for each farmer that gets his or her water tested a subsidy as large as \$900 may be applied (the farmer pays \$100). The farmer then gets the analytical results and some advice on how to treat the water using conventional technologies. The data generated is only available to SaskWater and the individual client that requested the analysis. When public money is spent, the public needs to have access to all the data, not just an individual agency for it to use as it sees fit.

While this provincial water testing program may be worthwhile, its cost has now exceeded half a million dollars to help only around 500 people (as more people are helped the costs are escalating). Compare this with SaskWater's \$5,000 water quality research expenditure in 1998. No amount of water testing can solve the fundamental problems rural Saskatchewan is facing. In contrast to individual water testing, research solutions would be applicable to tens of thousands of rural Saskatchewan people.

The Province is far overdue in dealing with water quality issues, in becoming a part of the solution rather than a part of the problem. Whether federal agencies, which lack official responsibility for safe drinking water, will also start to constructively help rural Canada to address these

fundamental water quality issues remains to be seen. Judging from past experience, the outlook is not good.

It should, however, be remembered that it is the municipalities and rural people themselves (and I am one), that have thought poor water quality was not an issue. Lack of knowledge and complacency has got us into this situation. Unless municipalities and individual rural water users become active to affect changes towards safe drinking water, the major costs will remain high for ill-health relating to drinking water. ■

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