

When Water Can Make You Ill

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To determine if a water is safe for human consumption in rural areas it is common practice to measure two things, the amount of nitrates and total coliform bacteria in the water. If the nitrate levels are less than 45 milligrams per litre (10 milligrams as nitrate-nitrogen) and there are no total coliform bacteria the water is deemed safe, even for infants. Many rural waters will pass these tests, but the water may still make you ill.

The reason is very simple: this testing does not cover other possible contaminants in the water. In fact, if the water is chlorinated there will not be any coliforms in the water as they will be among the first microbes to be killed. Unfortunately, the disease-causing microbes (pathogens) are not

that easily affected and may not be killed by chlorine.

One of those parasites is *Cryptosporidium*. This parasite was distributed in the City of Milwaukee's drinking water in 1993. Half of Milwaukee's population became ill, more than one hundred people died. The U.S. National Research Council in a 1999 book (Setting Priorities for Drinking Water Contaminants) claims that the accumulated costs for this incidence has now reached \$25 billion U.S. But, there were no coliforms and low levels of nitrates in Milwaukee's water, suitable for infants according to Saskatchewan provincial agencies.

This incidence is so significant that there is likely not one large water treatment plant anywhere in the world that does not know what potential costs

can be associated with distributing unsafe drinking water. This is why both City of Saskatoon and the Buffalo Pound Water Treatment Plants pay close attention to how the United States treats drinking water! Both these Saskatchewan treatment plants are operated to be within the U.S. Environmental Protection Agency's Surface Water Treatment Rule. This U.S. rule simply states that parasites in the water need to be removed a thousand-fold by the treatment system before the water can be distributed to consumers. Around the world at virtually all larger water treatment plants this rule is implemented, not because of provincial guidelines (like Saskatchewan's), but for the very simple reason if people get sick from drinking their water the potential liability can be staggering.

For the first time ever the water industry's lobby group, the American Water Works Association, started to complain that the U.S. Environmental Protection Agency was not strict enough (they always used to complain that they were too strict). Water treatment plants are not protected from lawsuits when things go wrong. This has produced an unprecedented improvement in treated water quality for many cities around the world. This is one of the reasons that you will find scientists and engineers working in the laboratories of city treatment plants. Improving the quality of water to levels that are far better than what government agencies suggest actually makes economic sense.

It is now recognized in the scientific literature that in addition to gastrointestinal diseases, other diseases including cardiovascular, respiratory, liver, central nervous system, and chronic skin infections can all be caused by waterborne microorganisms. Some people exposed to disease-causing organisms may not have any

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symptoms, while others may suffer mild to severe effects.

What could be in rural Saskatchewan drinking water that could make you ill? There are several microorganisms commonly associated with drinking water and their presence in prairie waters is likely common. The microbes include parasites, bacteria and viruses. For example, viruses have been found in extraordinary quantities in drinking water dugouts in Saskatchewan with levels up to 2,500 billion per litre. A statement by Saskatchewan Health that one virus (hepatitis A) with a known waterborne transmission path is not waterborne in Saskatchewan does not fit with pending actions by both the U.S. and Europe to limit hepatitis A and several other microbes in treated drinking water.

The biggest challenge is not to determine every microbe under the sun in drinking water sources and in treated drinking water, the biggest challenge is to remove a majority of these particles (including microbes) so that high levels of removal can be achieved before disinfection (for example chlorination). For disinfection to be effective the dissolved organic material present in the water also needs to be reduced. Particle and dissolved organic material removal are two major priorities of the Safe Drinking Water Foundation. Unfortunately, the treatment systems that can deal with these two components for prairie surface and ground water sources have not been developed to a stage where they can be used routinely.

There are not only microbes in the water. The Safe Drinking Water Foundation was asked by a concerned Health Inspector to evaluate the water supply and water treatment facility serving 800 people in a Saskatchewan rural community in July 1999. This treatment plant is receiving regular contractual support from a Provincial

Crown Corporation to ensure that the water treatment process and operator training is adequate. The Safe Drinking Water Foundation discovered problems with virtually every stage of the water handling, from collection through storage, through treatment and distribution.

These problems included adding a chemical oxygen scavenger (a hydrazine-based chemical that removes oxygen to very low levels, which in itself is highly undesirable). This chemical is almost exclusively designed for water boilers not drinking water. Several health problems could be caused directly by this chemical apart from the fact that it also made the water more difficult to treat. The use of this chemical was stopped when the Safe Drinking Water Foundation made its recommendation.

However, there were additional problems with the treated water even after this chemical was no longer used. Testing showed that the number of particles of the same size as major waterborne parasites was 1,000 times higher in tap water in this community compared with tap water in Saskatoon. If Saskatchewan implemented U.S. style drinking water quality regulations this community missed by more than 1,000-fold as there was no removal of parasite-sized particles by the water treatment.

High levels of chlorine were added at the treatment plant, but by the time the water reached the residents there was no chlorine residual left (too much material in the lines removed the chlorine). The water was high in oxygen at the water treatment plant, but by the time it reached the community it had also disappeared. Now, what happens when we don't have any oxygen in the water? It starts to smell. Crack open a rotten egg if you don't know what water without oxygen

smells like. Unsafe drinking water does, however, not always smell.

Was the source water at least of high quality for this community? The community pumps its water from a creek that flows only 1-2 weeks in the spring. As many multipurpose creeks in Saskatchewan, this creek is used by a community upstream to discharge its sewage lagoon. The only time there is enough water in the creek to move the sewage away from that community is also during the few days of spring runoff.

Saskatchewan in 1996 had an 18 times higher level of hepatitis A than 6 other provinces combined. In the North-West Territories there were only two reported cases in 1996. While Saskatchewan Health is claiming success in decreasing the hepatitis A cases through vaccination, the underlying causes which can also cause high infant mortality and other medical problems have not been dealt with. Safe drinking water is part of dealing with the causes of these statistics.

For some of these problems there are no existing solutions, research is required to find the solutions. Saskatchewan's lead agencies to fulfill the safe drinking water mandate (Saskatchewan Health, Saskatchewan Environment and Sask Water) jointly spent an estimated yearly average of \$40-50 thousand on water research over the past ten years. If we use the same method as the U.S. Environmental Protection Agency to calculate health costs of poor drinking water, the costs to Saskatchewan could be more than 1,000 times greater than what was spent on research to resolve the problem.

Doing very little to ensure that difficult to treat rural water is safe is the most expensive approach available. No city can afford it. But, rural people are expected to put up with it. ■