Clean Drinking Water: British Columbia and the Tsunami

By Dr. Hans Peterson, Safe Drinking Water Foundation

In February the B.C. government launched a new $80 million safe drinking water program. There were a number of reasons for implementing this program which included curbing boil water advisories that jumped from 19 in 1986 to 304 in 2001 and the reduction of disease-causing waterborne microbes (pathogens) such as E. coli and Hepatitis A.

It is gratifying that Hepatitis A is recognized by a provincial government agency as a cause for concern when it comes to water safety. Years ago, the U.S. EPA demonstrated that 7% of studied wells in that country contained the Hepatitis A virus and its presence was one of the reasons for the implementation of the U.S. Groundwater Rule.

While this was common knowledge among scientists years ago, the then Chief Medical Health Officer for Saskatchewan, Dr. Butler-Jones, proclaimed publicly that Hepatitis A was only waterborne in developing countries. It appears that with time, provincial and federal health agencies will concede defeat and stop playing politics and start using rather than abusing science.

Acute drinking water concerns have been raised during the recent tsunami disaster in Asia and Africa. Sewage contaminated water supplies have raised fears that pathogens will proliferate and humans exposed to these water sources will become ill. The World Health Organization has warned that the number of deaths from preventable diseases including cholera, diphtheria, dysentery and typhoid could rival the death toll from the disaster itself. Some waterborne diseases take years after exposure to actually manifest themselves so it will be a while before the full story from this will be known.

Microbes of concern in drinking water include protozoan parasites, bacteria and viruses. While some microbes are killed by chlorine, others are not. However, if there is no means of boiling water, then it is better to chlorinate it before consumption. Canada's initial response to the disaster was to send 1 million chlorine tablets and buckets to the affected area. That is, fill bucket with water, add the chlorine tablet and wait until, hopefully, most of the bugs are dead. This will help overcoming the immediate disaster phase and simply chlorinating tainted water will not make it safe to drink.

Unfortunately this approach is used widely in rural Canada to treat tainted water sources not in an emergency phase, but routinely. We add chlorine to marginally treated water which will remove the discolourization of the water and it will kill some bacteria and viruses, but many survive including most protozoan parasites. This is especially so when there are a lot of particles in the water. The amount of particles can be determined by measuring the water's turbidity. New guidelines will be introduced where turbidity levels of less than 0.1-0.3 NTU must be met depending on the water treatment process. Many rural communities with conventional treatment cannot consistently meet such turbidity guidelines and with high turbidity, the effectiveness of chlorine is further reduced as pathogens "hide" among other particles.

In regard to the tsunami, it was a relief to see an additional response from the Canadian government a few days after the pill and bucket approach was announced. This time Canada's Disaster Assistance Response Team (DART) was to be sent to affected areas with a primary goal to supply safe drinking water. My first thought was, not more pills and buckets! I was put at ease when I saw what they were going to do.

According to DART "it is understood that the biggest problem is the availability of clean water". The DART team brought with them four reverse osmosis water purification units. According to the Globe and Mail, the RO units "are designed to suck up thousands of litres of water from an external source and filter out all the grime and microbes that wreak havoc with local water supplies. Canadian Forces members say that the RO units can make sewage water as pure and drinkable as tap water.

The efficiency of the RO units depend on the condition of the water - the dirtier the water, the longer it takes to clean".

An RO membrane unit will indeed remove all microbes including protozoan parasites, bacteria and viruses and is the most effective way of making any tainted water source safe to drink. The technology is now available to do this rather inexpensively (even if the DART ROs are not). As the Canadian Forces stated, "the dirtier the water, the longer it takes to clean". This actually points to the Achilles heel of tight membrane treatment (RO and nanofiltration membranes), they need good quality water to treat.

The key in the full-scale implementation of nano and RO membrane treatment is in the pre-treatment of the water so that the membranes can finish off the job without being fouled by dissolved and particulate inorganic and organic compounds or indeed microbes growing on the membranes. Conventional pre-treatment technologies, such as coagulation and filtration for surface waters and manganese greensand filtration of groundwater sources may actually increase rather than decrease membrane fouling.

At Yellow Quill First Nations, a native Saskatchewan community of around 1,000 people, the Safe Drinking Water Foundation (SDWF) experimented with several different pre-treatment technologies and continued to develop an integrated biological and membrane treatment process. This proved to be a good strategy as membrane cleanings are only required around every eight months while similar installations using manganese greensand have not only needed to be cleaned more often, but the lifespan of the membranes has been as short as eight months.

The treatment process is based on "friendly bacteria" cleaning up the water before the RO membranes. This is a truly integrated biological and membrane treatment process where few chemicals are used, the water is rapidly treated and within half an hour the entire process is complete. There are now three more communities that presently are replacing manganese greensand with biological filtration. The key to get high quality drinking water from poor water sources is to understand the chemistry and biology of the water so that effective and inexpensive solutions can be devised.

Maybe the tsunami disaster will do what Walkerton and North Battleford never managed to do, generate a realistic debate on drinking water quality in rural communities across Canada.

Congratulations to B.C. for showing leadership. ■

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