

PRAIRIE Water News

...dedicated to protecting and improving rural water supplies

How Safe is the Water Cooler?

By Richard Pasquill, The Manitoba Water Services Board

Each year, many people turn away from municipal tap water in favour of a water coolers/dispensers of bottled water. In most cases, the thought behind the change is that bottled water is “safer than tap water” and “tastes better”.

Unfortunately, there are some major problems brewing across the country with the water coolers/dispensers of bottled water. The problem is proper maintenance. If the proper maintenance of the

water cooler is not being carried out, the safety of the water will be very much in question.

Bacteria are known to be able to grow and reproduce at an extremely fast rate. Because it can take several days to a week to use a 5 gallon jug of water, the bacteria count in the water can become excessive. Unlike tap water, the bottled water does not contain any residual of chlorine to control bacterial growth and therefore is very susceptible to contamination.

Health Canada recommends the cooler/dispenser be cleaned and sanitized **EVERY TIME A BOTTLE IS CHANGED**. While this recommendation may sound excessive, the need to follow these guidelines has been examined by numerous engineers and related companies and found to be sound. In general, people are the principal source for bacterial contamination of coolers. Once the outside of the cooler or bottle is contaminated by a person’s hands, it is simple for the bacteria to be carried into the water within the cooler.

The cleaning instructions as outlined by Health Canada are fairly simple and are as follows.

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- Prepare a disinfectant solution by diluting 15 ml of household laundry bleach (5.25% sodium hypochlorite) in 5 L of clean warm water.
- Disconnect the water cooler from the electrical supply.
- Remove the empty water bottle and completely drain the remaining water through the spigots.
- Remove the “no-spill” guard and baffle (if applicable) taking care not to break or damage the components. Clean and wash these items in the dishwasher or kitchen sink.
- Using protective gloves, face shield and clothing, fill the reservoir with the disinfectant

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solution and scrub the interior of the reservoir with a clean long-handled, soft bristled brush.

- Drain some of the disinfectant solution through the spigots and allow the solution to sit for at least 2 minutes but not longer than 5 minutes (to be effective but to prevent corrosion).
- Drain the disinfecting solution from the reservoir through the spigots and dispose of it through the sanitary system.
- Rinse the reservoir and spigots thoroughly with clean tap or bottled water 2 to 3 times to remove traces of the disinfectant.

- Reassemble the baffle and the “no-spill” guard.
- Disinfect the top and outside of a new bottle of water and place the bottle into the cooler.
- Run water through the spigots and reconnect the cooler to the electrical outlet.

If you refill your own water jugs, always disinfect the empty jug when you change the bottle and clean the cooler. Add a 1/8 cup of disinfection solution to the jug, replace the top and swish the solution around the interior of the jug making sure to include the hollow handle. Do not empty the disinfectant from the jug until ready to refill.

When multiple bottles of water are purchased at one time, store the full

bottles in a clean, cool, dark place away from chemicals, paints or other dangerous substances. Due to possible bacterial growth, do not store water for more than 30 days even if the bottle is unopened.

To ensure proper operation of the water cooler/dispenser, clean the cooling apparatus, fan, fins, drip tray, and general exterior of the unit on a regular basis. Refer to your operational manual for specific details and procedures.

By following the proper procedures for cleaning and disinfecting the cooler/dispenser on a regular basis, the bottled water can remain as bacterial free and good tasting as hoped.

For further information, please contact your Provincial Water Technologist or PFRA.

Disinfecting Water Wells with Chlorine

by Rachele Ormond, Alberta Agriculture, Food and Rural Development, and Bob Buchanan, Alberta Agriculture, Food and Rural Development

Water well disinfection questions are among the most common questions that water specialists, public health inspectors and water well drillers receive from rural residents across the Canadian Prairies. Understanding well disinfection is complicated because there may be considerable differences in the information provided by different people. It seems everyone has their own favorite recipe on how to cook the bugs in a well.

Some people believe that if a little bit of chlorine does a good job, then a lot of chlorine will only do a better job. Some folks are adamant that only granular chlorine and not liquid chlorine bleach should be used to

disinfect a well. Many people feel that just pouring some liquid chlorine down the well with a small amount of water and pumping it out is a satisfactory well disinfection treatment.

The terms ‘well disinfection’ and ‘shock chlorination’ are often incorrectly used interchangeably. In fact, well disinfection involves a much lower chlorine dosage than shock chlorination. Well disinfection is intended to provide routine control of nuisance bacteria and correct periodic contamination of a well by pathogenic bacteria. It usually involves chlorine dosages of 50 to 200 parts per million (ppm).

Shock chlorination is recommended to remediate biofouled wells, and to control problems caused by high levels of nuisance bacteria such as iron or sulphate reducing bacteria. Shock chlorination uses a much

higher chlorine dosage of 200 to 1000 ppm and is only effective if an acid is used to lower the pH of the treatment solution. Regular well disinfection will reduce the chances of needing to perform a much more costly shock chlorination that is best done by an experienced water well driller.

This article focuses on well disinfection and provides some of the latest information regarding proper well disinfection procedures. By doing regular disinfection, you may be able to save yourself from requiring more costly and technically difficult shock chlorination treatment.

How Chlorine Works

Disinfection is the treatment of water to inactivate, destroy, and/or remove pathogenic bacteria, viruses, protozoa, and parasites. This can be accomplished by either physical or chemical means. The most common

chemical method is to use a strong concentration of chlorine bleach.

Chlorine is a very reactive substance. When added to a well, it first combines with inorganic compounds such as hydrogen sulphide gas, ferrous iron and manganese. No disinfection occurs at this stage. After the chlorine reacts with these compounds, the remaining chlorine reacts with organic matter. This reaction helps to eliminate some bad tastes and odour, but there is little disinfection at this stage. If the chlorine demand exerted by inorganic and organic compounds has been met, any excess chlorine will combine with nitrogen compounds (primarily ammonia) to form chloramines.

The formation of chloramines results in long lasting disinfection, produces minimal chlorine taste/odour, and controls microbial growth. Chloramines, however, are slow acting disinfectants and require long contact times for effective disinfection. If more chlorine is added to the water, the chloramines are destroyed and excess chlorine, known as the free chlorine residual, forms hypochlorous acid (HOCL). HOCL is a potent, fast acting disinfectant.

The addition of more chlorine may be beneficial for disinfection; however there is a point where excessive chlorine concentrations can cause more damage than benefit. Recent research has shown that low dosages of chlorine (around 200 ppm) are most effective. Previously recommended dosages of 1000 ppm of chlorine are in fact less effective due to a change in water pH.

Liquid chlorine and granular chlorine are both extremely alkaline. This results in an increase in pH when mixed with water. As the pH of the water/chlorine solution rises, the

Water pH	Biocidal Effectiveness	Oxidative Effectiveness
5.5	100 %	0 %
8.0	12 %	88 %
9.0	2 %	98 %
10.0	< 1 %	> 99 %

effectiveness of chlorine to kill bacteria is dramatically reduced. At a chlorine dosage of 1,000 ppm, the pH of a water/chlorine solution may be over 10. This may be beneficial in removing some plugging materials; however, the biocidal effectiveness becomes less than 1% (see Table 1). High dosages of chlorine are also very corrosive and could be harmful to metal well casings, water piping, and fittings over time.

Scheduling Well Disinfection

Water wells should be disinfected for preventative maintenance every 6 to 12 months to control the population of iron and sulphate-reducing bacteria. In addition, water wells should be disinfected at the time of construction and completion, whenever the distribution system is opened for repairs or maintenance, or when pumping equipment and water piping are removed for repair or replacement. Disinfection should also occur when lab results indicate the presence of coliform bacteria, following contamination by flood water, or after any change in water clarity, color, odour or taste.

Well disinfection will not be sufficient if biofouling has occurred. Chlorine cannot effectively penetrate the heavy layers of biofilm to reach the bacteria and kill them. Wells that have not been maintained regularly will likely require shock chlorination and may require hiring a well driller to agitate and acidify the well to

penetrate the biofilm and restore well production and water quality.

Well Disinfection Methods

The two most common methods of well disinfection are simple chlorination and bulk displacement chlorination. Simple chlorination involves adding a small volume of chlorine solution into the top of the water well, followed by running a garden hose down the top of the well to circulate the water and chlorine solution through the water system. This method can provide some temporary benefit; but it is not nearly as effective as the bulk displacement method.

The bulk displacement method involves preparing a predetermined volume of chlorine and water and then siphoning or pumping this down the well. The chlorine solution displaces all the water in the well casing, screen/borehole and immediate aquifer. This results in a much more effective well disinfection treatment. Research has shown that 70% granular, 5.25% liquid and 12% liquid chlorine solutions all work effectively. The key is to ensure that the chlorine dosage is calculated correctly. Liquid chlorine solutions have the advantage of being less expensive and readily available.

*For more information about water well disinfection, refer to **Water Wells...That Last for Generations** publication or contact a water specialist in your area.*

Constructed Wetlands Successfully Treat Town Effluent

By Richard Pasquill, The Manitoba Water Services Board

Through foresight and inventiveness, the town of Roblin has shown that post secondary treatment of waste water with constructed wetlands is possible and has many advantages. The most important advantage is reduced nutrient loading of downstream water bodies. While there is still some reluctance, on the part of the regulatory bodies within the province, to promote or accept post secondary treatment of town effluent with the use of wetlands, this project has more than adequately shown the benefits of constructed wetlands. As our lakes and rivers become richer in nutrients, treating waste water with wetlands may become more commonplace across the prairies.

The town of Roblin, in western Manitoba, like most small centres that dot the prairie landscape, relies on lagoons as part of the town's effluent treatment process. Once the effluent reaches a quality sufficient to meet the environmental requirements for disposal, most towns discharge the secondary cells into local streams or rivers. This is usually done at times of high water flow to dilute the waste. However, since 1979, Roblin has utilized all of the liquid processed through its lagoon system to irrigate cropland adjacent to the lagoons.

With the wetter weather encountered in the 1990s, too much liquid was being produced to be properly disposed of through the



irrigation system. This prompted the town to investigate a number of other alternate disposal methods that might be incorporated into their overall effluent management scheme. As a

result of the investigation, in 1998/99 the town elected to build a 40 acre wetland and an adjacent 15-20 acre

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hybrid poplar plantation for post secondary treatment of a portion of the effluent.

Constructed wetlands are marshes that have been designed to treat waste water. Often they are built on sites that were not previously wetlands and are composed of a series of cells through which the waste flows. As the liquid passes through the various cells, a natural purification process takes place as bacteria break down organic matter. In addition, the floating and rooted plants remove plant nutrients such as nitrogen and phosphates from the liquid, further improving the water quality. Constructed wetlands are normally seeded down to a variety of reed, sedge, rush and other marsh grass plants. In order to properly optimize plant growth and longevity, the liquid

levels within the cells are maintained at an optimum level of 30 cm (12 inches). Due to the shallow nature of the flow in the wetlands, the area covered, and the large mass of plants present, much of the liquid is lost to evaporation and evapotranspiration.

While it took some time for the establishment of the plants, growth has now exceeded expectations with the cattails exceeding 6-8 feet in height with very dense growth throughout the various cells. The quality of the effluent has improved drastically as it slowly moves from cell to cell of the wetlands and plants take up nutrients. By the time the liquid has passed through all the cells, it easily meets the very stringent discharge requirements laid down by Manitoba Environment. In order to keep the mineral content

from accumulating in the liquid and causing problems for the plants, a slow summer discharge has been undertaken from the last cell. Tests that have been carried out to this point show that nearly all the nitrogen and phosphorous that was carried over from the lagoon treatment was removed as the effluent passed through the first few cells of the wetland. Since its development, wildlife has proliferated throughout the wetland with a wide variety of birds, frogs, and other wetland creatures migrating to the area.

For further information, please contact the Town of Roblin or The Manitoba Water Services Board

Quality Farm Dugouts – A report card

In 2002, Prairie Water News released a publication called 'Quality Farm Dugouts'. The book is a technical manual intended to provide readers with the latest research information about improving both the quantity and quality of dugout water. 'Quality Farm Dugouts' has been distributed at no cost to the public for the past four years.

An evaluation of the manual was undertaken through a survey to assess the usefulness of the book to its readers. A questionnaire was administered to a sample of people who requested the manual.

The results indicate very clearly that the audience for 'Quality Farm Dugouts' is the farm population who either already own dugouts and have existing water quality problems or are intending to build a new dugout. The

majority of respondents were mixed livestock/cropping farmers and livestock producers. Watering livestock was the most important use of dugout water for most respondents. Other important uses were lawn and garden irrigation and spray mixing. Based on the reported needs of these dugout owners, future editions of this manual will include sections on best management practices and/or operating guidelines for livestock watering systems, backflow prevention devices, and water distribution/conservation with respect to lawn/garden watering.

In general, the publication was evaluated very favourably. People reported being satisfied with the organization and layout of the book and that the level of technical complexity and detail was

appropriate. The sections of the book that people reported as being most useful included the modules about operating systems, water quality, water treatment, and design and construction. Sections containing more general information and the schedules/forms were regarded as less valuable.

'Quality Farm Dugouts' is available in hardcopy from any of the Prairie Water News partner agencies. It is also available on line at:

[http://www1.agric.gov.ab.ca/\\$department/deptdocs.nsf/all/eng4696](http://www1.agric.gov.ab.ca/$department/deptdocs.nsf/all/eng4696)

We are always eager to hear from our readers. Any comments or criticisms you may have about 'Quality Farm Dugouts' are welcome.

Lakes Disappearing on the Prairies? An Aquatic Whodunnit

Reprinted with permission from EnviroZine, *Environment Canada*.

[Aussi disponible en français]

Prairie residents often lament their shrinking and disappearing lakes, remembering a shoreline now hundreds of metres away from the beaches where they paddled as

resources to future changes – and can develop plans and strategies to offset impacts.

Garth van der Kamp, Marlene Evans, and Dwayne Keir at the National Water Research Institute of Environment Canada are studying seventeen lakes across the Canadian Prairies to get a clearer picture of

rarely if ever overflows through an outlet. Water level records of closed-basin lakes can therefore serve as long-term indicators of hydrological changes.

With the support of the Prairie Adaptation Research Cooperative (PARC), the researchers analyzed water level records from several sources including the Water Survey of Canada's Hydat database, the Saskatchewan Watershed Authority, Alberta Environment and historic aerial photographs. They also interviewed local communities to get more information on past conditions.

Results

Their data for closed-basin lakes across the prairies show a general trend of decreasing water levels throughout the twentieth century, with the decrease ranging from 4 to 10 meters. Manito Lake in western Saskatchewan, for example, has dropped 7 meters since 1920. The water level change at Manito Lake has altered the shoreline to the point where Sugar Loaf "Island" is now a



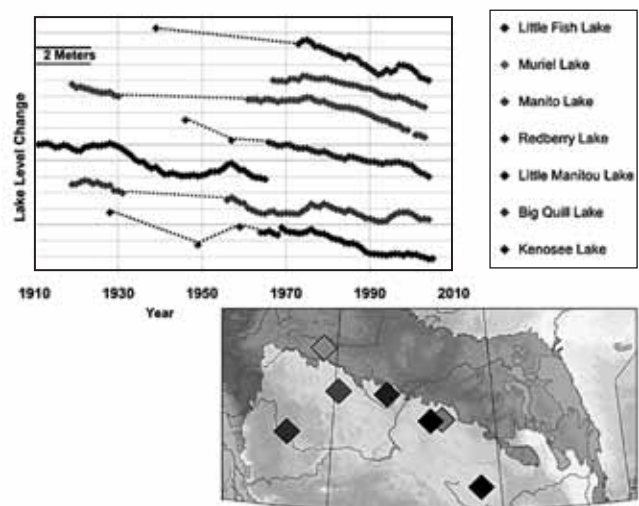
Manito Lake, 2005

children. Speculation about a dwindling water supply appears frequently in the media, with shrinking glaciers and a warming climate cast as villains that threaten prairie agriculture, the economy, and a sustainable supply of freshwater for public consumption.

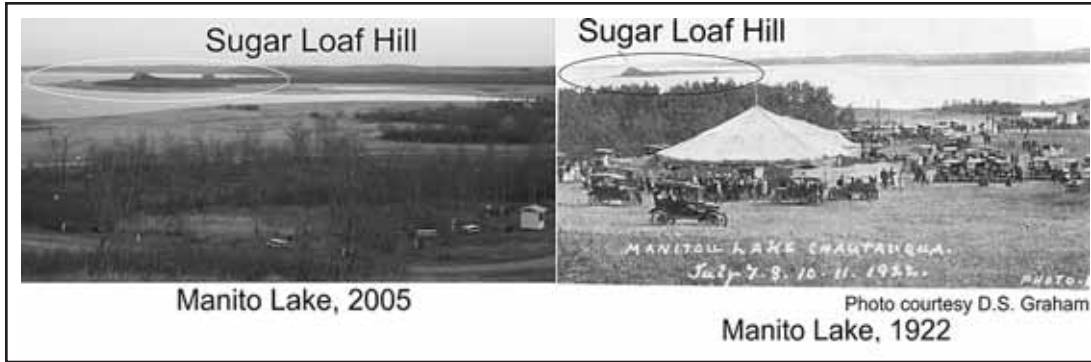
But is there really less water on the Prairies than there used to be? If so, how much less? And what does that mean for the future? Water managers and decision-makers need a better grasp on what changes have actually occurred over time so they can assess the vulnerability of prairie water

their history over the last 100 years and, ultimately, to find explanations for a disappearing natural resource.

They are focusing on closed-basin lakes. Unlike through-flow lakes where the higher the lake level rises, the faster the water flows out through an outlet creek, a closed basin lake



Lake water level change.



Manito Lake in 2005 compared to photo taken in 1922 by D.S. Graham.

peninsula! Little Fish Lake in Alberta had 5 meters of water in 1975, but was completely dry in May of 2005. Kenosee Lake in south-eastern Saskatchewan is down by 6 meters since the 1920s.

The water input to the lakes, whether by runoff from the watershed or by precipitation on the lake, has obviously been less than the loss by evaporation through most of the last 100 years. There have been temporary increases of water level, notably during the high snowfall years of the mid-1950s, the mid 1970s and the late 1990s, but then normal years return and water levels continue on downward.

Why is it happening?

For these and many other lakes, the impact has been profound. The loss

of lake recreational areas hits local residents and the economy; fish and wildlife habitat is disrupted and the aquatic ecosystem altered; and the available water supply for public use is diminished.

Theories abound as to why lake levels are going down. Perhaps it is because dams upstream are impounding the water and not letting it through to the lake? Perhaps changes in agricultural practices such as continuous cropping and minimum tillage are decreasing runoff? There are lots of beavers now in most watersheds and perhaps they are doing the damage by trapping water behind their dams.

Or is it climate change? Environment Canada records do not indicate any clear change in precipitation since about 1900;

however, perhaps there was more snow and rain over 100 years ago, before anyone was measuring precipitation, and the lakes are still coming down from that high. The prairie climate is getting warmer. Winters are shorter now by a month compared to 50 years ago and so summers are a month longer. Is the resulting

increased evaporation enough to account for declining lake levels?

All these explanations have a degree of truth in them and the challenge now is for researchers to work out how important each one is. The research team will continue its work investigating long-term records and present day conditions to find the answers – information that will help predict what the future may hold for prairie water resources and assist policy and decision makers with plans to meet changes.

For more information contact Environment Canada on the web at: www.ec.gc.ca

The original article can be found at: www.ec.gc.ca/EnviroZine/english/issues/63/print_version_e.cfm

FAST FACTS

- **Data for closed-basin lakes across the prairies show a general trend of decreasing water levels throughout the twentieth century.**
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