

PRAIRIE Water News

...dedicated to protecting and improving rural water supplies

The Prairie Water News has continued to provide valuable information for the protection and improvement of rural water supplies on the prairies since 1991. The idea for such a valuable tool came out of the Farm Surface Water Quality Conference in June of 1990, and after almost two decades, PWN is issuing its final newsletter. As a final legacy to the successful collaboration, a conference is being planned for those interested in continuing the challenge. The title of the conference is Rural Water Challenges for the Prairies and will focus on three subject areas – Water Supply, Water Quality and Treatment, and Water Protection. It will be held November 17-18, 2009 in Saskatoon, Saskatchewan.

Prairie Water News – What we have accomplished since 1991?

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Bob Buchanan on behalf of the Prairie Water News team

Prairie Water News (PWN) began production in 1991. As we wind down our operations, I offer readers a look back at what we have accomplished.

In June 1990, participants at the “Farm Surface Water Quality Conference” in Saskatoon, SK recommended that a newsletter be developed to provide practical information to rural people on rural water supply issues. The newsletter was also intended to provide a communication link between rural water specialists and sponsoring agencies across the Prairie Provinces. Dr. Hans Peterson and Bob Buchanan developed the format for the newsletter and formed an Editorial Board with representatives from sponsoring agencies including Saskatchewan Research Council, Sask Water Corporation, Agriculture Canada – PFRA, and Alberta Agriculture.

The first edition of the newsletter

contained 11 articles. Over the past 17 years the PWN Team produced 32 issues of the newsletter, containing 280 articles. In that time, approximately 220,000 copies of the newsletter were circulated to rural people across Manitoba, Saskatchewan, Alberta and the Peace Region of British Columbia.

In 1996, PWN offered access to articles through the Internet. In 2006, PWN launched a new website: www.prairiewaternews.ca. Over the years, PWN has received thousands of hits on the website. PWN was promoted through Alberta Agriculture Agri-News and has received many requests from rural newspapers throughout Alberta to re-print articles.

PWN served as a leader for other larger projects. The “Farm Surface Water Quality” Conference was sponsored in June 1995, and attracted 20 participants from Western Canada. In 1996, PWN welcomed Manitoba Environment as a sponsor. In 1999, four Manitoba agencies combined to sponsor PWN, bringing Richard

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Pasquill and the Manitoba Water Services Board to the team. In 2002, PWN published "Quality Farm Dugouts" helping rural people improve dugout water supplies. Approximately 25,000 copies of the manual have been circulated through sponsoring agencies. In 2006, a reader survey was done by PFRA staff of clients who had received copies of the manual. The survey input was used to update the manual prior to its second printing later in the fall of 2007. 'Quality Farm Dugouts' has been adapted by a group in Atlantic Canada to produce 'The Atlantic Farm Water Reservoirs Manual'. In 2005, the Department of Fisheries and Oceans became a partner in PWN and in 2006, Alberta Environment also joined.

PWN supported the development of the Rural Water Quality Information Tool that is now available on the Alberta Agriculture "Ropin the Web" site. The tool assists rural people to understand the suitability of their water supply for various uses including drinking water, livestock watering and irrigation.

Over the years PWN has provided a tool for technical water specialists to deliver practical water information to rural audiences. It has also bridged communications between water specialists across the prairies, helping them keep up to date on research, activities and collaborative projects.

We hope that our efforts to provide you with practical solutions to rural water challenges has been a benefit to you as readers. Thank you for your support.

Thank you for your interest and determination over the years of Prairie Water News to protecting this valuable water resource.

Farewell from Sponsors

It has been a great privilege and honour for the Government of Manitoba to be part of the PWN team providing technical assistance to readers across the prairies. In Manitoba, please contact your local Conservation District office for assistance with water problems.

The Saskatchewan Research Council (SRC) is proud to have supported the Prairie Water News (PWN) over the past 17 years. We encourage you to visit our website

(www.src.sk.ca) to find out more about our environmental resources and research.

Water specialists with an understanding of rural challenges and industry are still an important core of Alberta Agriculture and Rural Development. We can be reached toll-free in Alberta at 310-FARM (3276) or at 'Ropin the Web'

www.agric.gov.ab.ca Questions related to drinking water from private water systems should be directed to Public Health Inspectors who can be reached toll-free in Alberta at 1-866-408-LINK (5465) or www.albertahealthservices.ca

The PFRA Administration (PFRA) is pleased to have been a partner in Prairie Water News. We continue to support the water needs of the rural sector. The services of PFRA are now being delivered by the Agri-Environment Services Branch (AESB) of Agriculture and Agri-Food Canada. Please contact your local AESB office, call us at 1-800-667-7644 or find us on the web at: www.agr.gc.ca

Point of Use Water Treatment for Arsenic Removal from Rural Water Supplies

by Twyla Legault, Water Quality Division, Prairie Farm Rehabilitation Administration

The Canadian Drinking Water Quality Guidelines provide a suggested maximum of 0.010 mg/L as an acceptable concentration (MAC) for total arsenic in drinking water. There are many groundwater aquifers in Canada with arsenic

concentrations over this drinking water guideline. Rural residents whose only source of water is groundwater are the group most likely to be impacted by arsenic. To maintain the value and usefulness of rural water supplies, it is important to understand which water treatment devices are effective for arsenic removal and practical for use on private water supplies.

The Source and Extent of Arsenic

Most arsenic in groundwater is naturally occurring and comes from rocks and minerals such as arsenopyrite. Although arsenic can be found in both surface and groundwater, the levels of arsenic are generally higher in groundwater.

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Arsenic occurs in different forms (organic vs inorganic) and species with different valences. In groundwater, arsenic is generally present as either arsenate (arsenic V) or arsenite (arsenic III). Water treatment technologies tend to be more effective at removing arsenic V than arsenic III.

Further research is needed to provide true estimates of the number of private water supplies and small systems with arsenic concentrations over the Canadian drinking water guideline. Monitoring data for treated municipal water supplies have been submitted by several Canadian provinces. This data is summarized in the Arsenic Technical Document prepared for Health Canada by the Federal-Provincial-Territorial Committee on Drinking Water (Available at <http://www.hc-sc.gc.ca/ewh-semt/pubs/water-eau/arsenic/index-eng.php>). However, very little information is available on the number of private water supplies with arsenic over the guideline as few rural residents test their water for this parameter.

One groundwater investigation performed by the Prairie Farm Rehabilitation Administration (PFRA) in partnership with Flagstaff County in Alberta showed that 17% of 68 water wells sampled in the county contained arsenic over 0.010 mg/L. Water wells with elevated levels of arsenic in the study area were mainly completed in sands and gravels that overlay the bedrock surface. Water wells in other parts of the prairies, completed in geological environments similar to those in Flagstaff County, may also be at risk of containing elevated levels of arsenic.

Point of Use (POU) Devices for Arsenic Removal

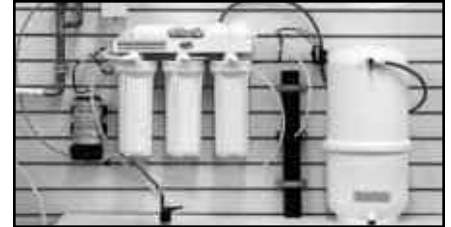
Owners of private water supplies generally do not utilize the same treatment methods as municipal water treatment systems. Arsenic can be removed from private drinking water by certain point of use (POU) water treatment devices. POU water treatment devices are generally installed under the kitchen sink and are used to process water only for drinking, cooking and ice making.

Health Canada recommends that consumers only use drinking water treatment devices that have been certified by an accredited certification body (e.g. Canadian Standards Association International or NSF International) and that they meet the appropriate standards set up by the NSF/American National Standards Institute. To meet these standards, the drinking water treatment device must be able to reduce the concentration of arsenic from 0.3 to 0.010 mg/L which is appropriate for treating well water with high concentrations of arsenic. Devices that are certified to reduce concentrations from 0.05 to 0.010 mg/L are intended for removing arsenic from water previously treated by municipal facilities.

Point of Use (POU) – Reverse Osmosis Membrane Filtration

One common water treatment device that has been shown to effectively remove arsenic from drinking water is a Point of Use - Reverse Osmosis (POU-RO) unit. A POU-RO unit includes a series of components (RO membrane, particulate filters and activated carbon filters) that are designed to work together to remove dissolved substances from water. These units

are widely available and affordable. If properly designed and maintained, they will remove many different chemical contaminants from drinking water.



If properly designed and maintained, a POU-RO unit can effectively remove arsenic from private drinking water supplies.

One disadvantage of a POU-RO unit is that 70 to 80% of the incoming or feed water is sent to waste. The percentage of feed water that comes through the unit as treated water will vary depending on the quality and temperature of the feed water, the pressure exerted on the RO membrane and the type of membrane used. In order to limit the amount of water rejected to waste, residential POU-RO units are generally used on only one dedicated tap. POU-RO units also remove beneficial minerals such as calcium and magnesium, therefore it is important to consume a well-balanced diet to offset the removal of these minerals.

Point of Use (POU) Arsenic Adsorption Cartridge Filters

Newer POU technologies, which use small cartridges containing granular media for arsenic adsorption, are becoming more common for treating private drinking water supplies. These technologies are easy to operate and maintain, however, the volume of water that can be effectively treated by a POU arsenic

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adsorption cartridge will vary greatly depending on the water chemistry, the type of arsenic and the level of arsenic in the feed water. To determine when the cartridge must be replaced, it is very important to monitor arsenic levels in the treated water.

It is extremely important to recognize that pre-treatment is often required to reduce the level of

contaminants and ions in a water supply prior to any POU treatment. Bacteria and some chemicals can foul the filters and membranes in a POU-RO device and certain ions (e.g. fluoride, iron, manganese, sulfate, phosphate and silicate) can compete with arsenic adsorption on granular media. Before installing a POU water treatment device, it is very important to have the water tested to determine what type of pre-treatment

may be required. A water quality professional can be consulted to ensure effective pre-treatment is designed. It is also important to have the treated water tested to ensure that the designed system is reducing arsenic to below the drinking water quality guidelines.

For further information on water treatment for private water supplies, please contact your local provincial water specialist or PFRA office.

Treating High Sulfate Water for Livestock - without the High Expense

By Erin Zoski, P.Eng, Water Quality Engineer, PFRA

High sulfate concentrations in groundwater and surface water are commonplace across the prairies. About 30% of Saskatchewan groundwater exceeds the maximum recommended sulfate concentration of 1000 mg/L for livestock. Many surface water reservoirs may be saline water with high sulfate levels, and in some cases exceed 3000 mg/L. Livestock may be affected by high sulfate concentrations in their drinking water.

Cattle that drink water with excessively high sulfate concentrations can experience numerous health problems such as

poor conception rates, impaired immune response, lower growth rates and low trace mineral adsorption. To compensate for mineral adsorption problems caused by sulfate, farmers can spend substantial amounts on mineral supplements (estimated in the range of \$2 to \$3 per 1000 litres of high sulfate water).

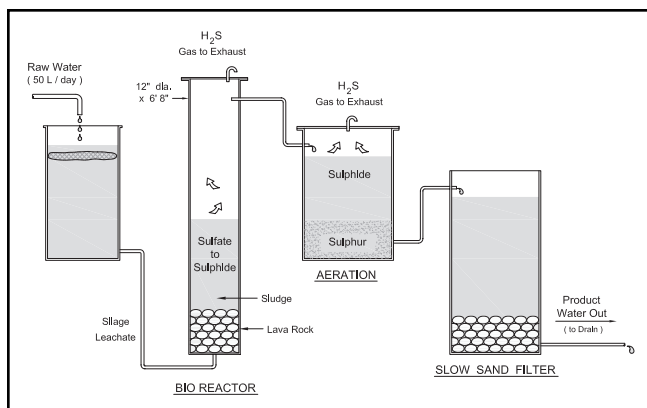
Lower concentrations of sulfate in livestock drinking water will provide producers with a healthier and more productive herd. The most commonly-used methods to reduce sulfates are reverse osmosis, ion exchange and electro-desalinization, however these methods are costly and may also waste large volumes of water. A more affordable method of

water treatment to reduce sulfates is desirable. A robust and economical method might also allow producers to drought proof their operations, allowing mineralized deep wells or saline sloughs to become viable livestock

watering sources (provided any other water quality issues are addressed).

In search of a more robust and affordable method of reducing sulfate for livestock drinking water, PFRA teamed up with researchers at the University of British Columbia. The team is investigating the promising technology of biological sulfate reduction. Experiments are being conducted at UBC and at the Western Beef Development Centre in Lanigan, Saskatchewan. The idea is investigate the possibility of designing a practical, cost effective biological sulfate removal reactor.

The pilot scale design first started with an economical, anaerobic, horizontal lagoon bioreactor constructed in the earth. However, for operational efficiency, the design has evolved to a vertical up-flow bioreactor. The treatment process uses naturally occurring microorganisms called sulfate reducing bacteria (SRB). These bacteria have the ability to convert sulfate to sulfide, using carbon as a food source. Although not at a commercial scale yet, both reactor



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designs have been successful at treating 50 L per day of high sulfate water. The sulfate was reduced from 1500 mg/L to less than 400 mg/L.

The process begins in a holding tank which contains the raw water and silage (*See vertical up-flow bioreactor design diagram*). The lactic acid produced from the fresh silage serves as a carbon source for the SRB growing in the anaerobic bioreactor. Nitrogen and phosphorous are also leached from the silage, which supports bacterial growth and activity for the next step in the process.

Step two in the process is the conversion of sulfate to sulfide in the anaerobic reactor. The SRB in the anaerobic bioreactor reduce sulfate to sulfide by utilizing the carbon, nitrogen and phosphorus which is plentiful in the silage leachate. The bacteria are sensitive to low pH and work most effectively at a neutral or slightly basic pH of 7.5. They also have an optimum growth temperature at 30°C, but will still multiply at

slower rates at temperatures as low as 4°C.

Sulfide is converted to elemental sulfur in the third step. Water flowing out of the anaerobic bioreactor enters a controlled aeration process. Only a small amount of aeration is required to oxidize sulfide to elemental sulfur, a solid yellow precipitate. If the sulfide water is aerated too vigorously, the sulfide will convert back to sulfate, negating the removal process. The first design prototype (horizontal lagoon bioreactor) utilized a cascading aeration system; however, a more compact, controlled aeration system is desired for the vertical up flow reactor.

In the last step of the process, a sand filter removes any suspended solids in the treated water to produce clean drinking water for cattle.

Hydrogen sulfide gas is an undesirable by-product of this biotreatment process and must be properly managed. Proper venting, air scrubbers, and monitoring equipment are required when working

in and around H₂S gas.

Biological removal of sulfate for livestock watering shows technological promise. Future work consists of design optimization of the up-flow reactor and aeration component, as well as testing of the up-flow reactor on surface water in British Columbia. The ultimate test will occur when the design is applied to on-farm situations. It is hoped the technical success of anaerobic biological sulfate reduction will lead to a practical, cost effective and robust method to reduce sulfate in livestock drinking water.

For more information, please contact Erin Zoski at 306-780-7248 or erin.zoski@agr.gc.ca.



Are You Having Difficulty Maintaining Chlorine Disinfection Residuals in Groundwater?

By Erin Zoski PEng, Water Quality Engineer, PFRA

Are you having difficulty achieving a stable free chlorine residual with your groundwater supply? Are you experiencing taste and odour problems with chlorine disinfection? If so, you may have a problem with ammonia (NH₄) in your water source. Ammonia is actually a natural and common constituent in many microbiologically-safe groundwater supplies, however, it can be an indicator of potential contamination.

You should test your groundwater source for ammonia concentrations and microbiological contamination. Also, take corrective measures to prevent contamination and re-test your water to ensure your source is safe. If you have ruled out the possibility of biological contamination, and confirmed your groundwater is not under the influence of surface water, any ammonia present in your groundwater is likely due to natural characteristics of the groundwater.

When ammonia is present in

groundwater, it interferes with chlorine disinfection. The ammonia interacts with chlorine by consuming the chlorine, creating by-products, and inhibiting the production of free available chlorine. Ammonia, whether from a natural or contaminated source, must be fully removed before free residual chlorine disinfection can be achieved.

To achieve effective disinfection when ammonia is present, the chlorine chemical must be added at a sufficiently high dosage to fully react with, and consume all of the

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ammonia. When these ammonia-chlorine reactions have been fully achieved, a “breakpoint” is reached. It is only after the breakpoint that true free available chlorine residuals will be achieved. Achieving free residual chlorine concentrations is necessary for effective disinfection of private water supplies (See chlorine demand curve).

A jug test experiment can be performed to determine the chlorine dosage to achieve breakpoint. If you do a jug experiment, be sure to first verify the concentration of your chlorine. Strengths decrease depending on time and temperature in storage. A simpler method to estimate breakpoint chlorination can also be used. The ratio of 10 Cl: 1 NH₄ (10:1 chlorine to ammonia) is commonly used to estimate chlorine

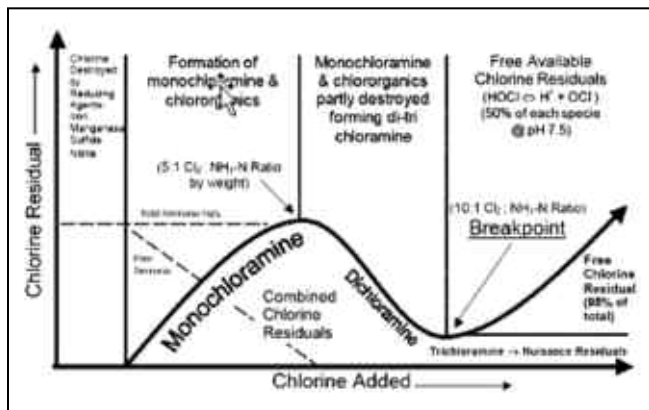
disinfectant dose will need to be slightly higher than 8.0 mg/L before you will begin to achieve free chlorine residuals.

The goal of every water treatment plant should be to maintain a minimum residual of 0.2 mg/L of free available chlorine and at least 0.5 mg/L of total chlorine.

A word of caution:

If you **do** have ammonia in your water, and you are **not** dosing chlorine beyond the breakpoint demand, **then any measured free chlorine residuals will not be true free chlorine residuals**. To safely disinfect water, free chlorine residuals must be achieved. If you do not dose with sufficient chlorine strength, you will not effectively kill bacteriological contamination, and you will develop many taste and odour chlorine-ammonia by-products.

For more information, please contact Erin Zoski at 306-780-7248 or email at erin.zoski@agr.gc.ca.



Chlorine Demand Curve

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breakpoint dosage. Test your water for ammonia (this can be done at a lab). Then simply multiply the amount of ammonia in your source water by 10. For example, if you have 0.8 mg/L of ammonia, breakpoint can be estimated to be 10*0.8 or 8.0 mg/L of chlorine. The chemical

Using Sunlight as a Natural Disinfectant with Irrigation Water

By Serena McIver and Larry Braul, PFRA

“Dole pre-packaged salads recalled for *E. coli*”

“*E. coli* infections traced to contaminated parsley”

“Roma tomatoes linked to US, Canadian Salmonella outbreaks”

Do you remember these headlines? In recent years, waterborne health risks have received a lot of media attention. Microbial

outbreaks such as these have cost the agricultural industry economic losses but also losses in terms of public confidence in the sector. The increased awareness of microbial health risks has led to a much greater importance placed on irrigation water quality.

Water quality guidelines for irrigation practices are set by the Canadian Council of Ministers of the Environment (CCME). These guidelines are provided to protect human health and are based on the best scientific information available. Most pathogens come from fecal

origins and, as such, the guideline for fecal coliforms is set at 100 CFUs/100 mL water. However the measurement of *E. coli* in water gives a better indication of disease-causing organisms. Most provinces in Canada have a recommended guideline for the maximum amount of *E. coli*. For example, British Columbia has a progressive *E. coli* limit of 77 *E. coli*/100 mL for vegetables that will be eaten raw. Research on the fate of pathogenic bacteria is ongoing and will provide information for future refinement of

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the existing guidelines.

Irrigation systems utilize both surface and groundwater as a source. Surface water usually has a lower operational cost than groundwater, however it is generally more susceptible to microbial contamination than groundwater. Microbial contamination can come from:

- point sources such as poorly treated sewage effluent and leaky septic tanks;
- non-point sources from agricultural runoff such as manure spreading; and
- wildlife.

Irrigation water can be managed to reduce risk from pathogenic contamination. A number of on-site technologies can be used to improve irrigation water quality including: natural disinfection practices, chlorination, ultraviolet radiation and ozonation. This article focuses on the use of natural disinfection as a means of reducing microbial contamination, as it is usually the most economical method.

Natural disinfection refers to the use of sunlight as nature's version of an ultraviolet (UV) system. Ultraviolet radiation deactivates pathogens by destroying their genetic material so that they cannot reproduce. Sunlight contains lower quantities of UV radiation than commercial systems and as such this form of water treatment requires longer and more direct exposure, for pathogens to be destroyed. Pathogens may still survive for extended periods of time in water containing high levels of suspended solids because pathogens can attach to particles and be protected from UV radiation.

The advantages of using a natural

disinfection system are the low cost and that it is indeed a natural process with no by-products. The disadvantage is that the effectiveness is highly dependent on factors such as weather, total suspended solids (TSS) and water depth. The disinfection process may take several days to destroy pathogens and is therefore more susceptible to instantaneous contamination from wildlife.

Natural disinfection can be implemented by impounding water prior to irrigation. A multi-year study performed in both Saskatchewan and Nova Scotia found that within days the *E. coli* levels found in the upper layer of irrigation ponds could be reduced by 99 to 99.99% via natural disinfection. As well, aeration appears to provide a significant benefit in increasing this die-off rate. Aeration of the storage pond will keep the water well mixed, and continually moving, which can help increase the exposure of bacteria to the UV rays of the sun. This research has resulted in a conservative recommendation of 3 weeks exposure time to ensure a 99.9% *E. coli* reduction in shallow ponds, provided there are no additional *E. coli* inputs. Further natural disinfection can also occur on the crop following irrigation, provided the crop is not harvested immediately after irrigation.

Disinfection of irrigation water is not meant to produce potable water, but rather to ensure that bacteria levels are below accepted guidelines. Natural disinfection by UV radiation from the sun and environmental exposure can be highly effective at reducing bacteria levels. Natural disinfection could be an ideal, cost-effective solution to improve irrigation water quality but requires further research to develop detailed

management guidelines.

The risk of microbial contamination can be reduced by good management practices. First, knowing and understanding your water supply will go a long way to achieving this goal. This starts with regular water testing, which will help you assess the quality of your source water and help you determine the need for treatment. A minimum of five water samples should be collected and tested within a 30 day period prior to irrigation to determine the microbial quality of a water source. The mean of the samples should not exceed the CCME guideline for fecal coliforms. Secondly, you should understand any changes that are occurring in your water supply and if there are certain peak periods of bacteria populations. For example, in surface water supplies, peaks in microbe populations are generally seen during spring runoff or during intense rain storms. Avoiding irrigation during these time periods or using previously-ponded water will go a long way to reducing the risk of contamination. Timing between water applications and harvest can also help reduce contamination risk. The UV rays from the sun will help to kill any microbes left on the plant surface. Finally, selecting the appropriate irrigation system for high risk crops can also help in managing this risk. Irrigation systems which apply water directly to the root system of the plant (drip systems) instead of irrigation systems which spray water onto plant foliage will reduce contamination of crops that will be eaten raw.

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

Harmful Dugout “Algae” – what to do?

*By Shawn Elgert and Murray Tenove,
Alberta Agriculture and Rural
Development*

During the summer season, “algae” in dugouts can cause various problems such as plugging the pump, reducing livestock water consumption, or worse yet, poisoning of livestock or pets. Poisoning from algae can cause liver or nervous tissue damage that may potentially be long-term or even fatal. Blue-green algae, which are the most common potentially harmful type of bloom, are not actually algae but are comprised of more than 20,000 species of bacteria called cyanobacteria. The term is derived from ‘cyan’ referring the blue-green colour. When the air temperature rises during the summer the temperature of dugout water also rises, providing one of the optimal conditions for harmful blooms. It only takes small amounts of nutrients for some bacteria to grow. Bacteria are also able to survive on the bottom of the dugout throughout the winter and even though your water may appear to be clear in spring, a bloom could still develop. Sometimes a bloom may seem to appear overnight. Since some cyanobacteria have the ability to control their buoyancy, they may sink (or rise depending on conditions) down further in the water column during the day. If they don’t have enough energy stored from the sun, overnight they can float to the top, giving the appearance of a very rapid bloom.

Studies have shown that 80% of cyanobacterial blooms in Alberta are caused by species that can harbour harmful toxins. There are many other different types of growths that can occur in dugouts including various

species of weeds, algae or other types of bacteria. Most weeds and some algae can be treated with a registered aquatic contact herbicide or other appropriate treatment.

Diagnosis is therefore the first important step to determine what actions might be taken. Many harmful cyanobacteria blooms in dugouts appear as a blue-green paint slick with the appearance of grass clippings. Others look like pea soup. However, cyanobacteria that have other appearances can harbour toxins as well. Gloves should be worn if handling the bloom material as it can cause a rash. To determine if toxins are present, send a sample of the dugout water to an appropriate lab for analysis.

In order to ensure the best possible water in a dugout, it is recommended that beneficial management practices that protect the source water, such as grass filter strips, be implemented. In spite of good practices in the runoff area, treatment may sometimes be required when a bloom has already occurred.

If there are suspended solids in the dugout as well as bacterial blooms, a hydrated lime treatment is recommended. If potentially harmful cyanobacteria are present, it helps bind up the toxin at the bottom of the dugout. Liming can be more expensive so other options may be considered if bloom control is the only result you are trying to achieve.

An inexpensive copper treatment can be applied for some blooms, however it will not work for all species. Copper treatment will release the toxins from the cells of toxin-producing species and they may be consumed by animals, pets or

wildlife. Released toxins can remain in the water for several weeks. The appropriate amount of copper to be used must be calculated carefully. Copper is not to be applied where the water may overflow and enter a public stream. Some copper products are not registered for farm dugout usage so check the registration number and contact the Pest Management Regulatory Agency to determine if particular products are appropriate for your situation. Copper products have been more difficult to find recently due to mandatory registration testing and increased copper prices but they are available.

A fairly inexpensive and simple preventative treatment can be done by adding a blue dye to the dugout to prevent photosynthesis, a principle component of cell growth. If you add the dye in early spring, it can help prevent initial stages of growth. Also see the Phoslock article in this publication for another treatment option.

Timing of treatments should be done to maximize their chances of success. For instance, avoid doing an in-dugout treatment just before an anticipated runoff event. Runoff that washes a new load of contaminants into the dugout may nullify the first treatment and create conditions that require yet another treatment. Keeping a record of all dugout treatments and observation of their effect is very good practice.

For more information, contact Shawn Elgert, Alberta Agriculture and Rural Development.

Phoslock - A New Control for Algae?

By Richard Pasquill, The Manitoba Water Services Board

Too often we hear of products hitting the market that make wild claims and promises that never come to pass. The exception to this may be a new product that appears to control phosphate loading in water bodies and the associated algae problems that go along with it. Phosphorus is most often the limiting factor with regard to algae growth. Limiting the phosphorus available in water will drastically reduce the algae growth experienced.

Over the years, many people have tried to reduce the phosphate load entering lakes, ponds, rivers, and dugouts in an attempt to control unwanted algae growth. Despite these actions, in many cases phosphates continue to accumulate in the water column and underlying sediments leading to an increased deterioration of the water body and accelerated algae growth.

Phosphates enter the water course through runoff from nutrient rich areas such as fields, feedlot runoff, lagoon discharge, and general erosion. Soils carried with the flowing water settle in the bottom of the larger water bodies and phosphorus slowly becomes dissolved in the water. Each year, the phosphates continue to accumulate in sediments and be released in dissolved forms. This leads to increasing levels of available phosphorus. Studies have shown that as much as 60% of the phosphate in the water column is recycled from the bottom each year. Over the years, we have encouraged people to reduce the

amount of phosphate entering the water body from outside sources by grassing the edges of the water source and runways, installing fencing to keep cattle out of the water, and keeping trees back. While all these measures help, the recycling of the phosphorus from the bottom of the water body continues to create problems and mask any headway these actions have had in reducing the nutrient problem.

A relatively new product, that has been developed in Australia, claims to be able to not only settle the phosphates in the water column but also prevent them from being reabsorbed. This, in effect, readjusts the time clock to a time before the phosphate levels became a problem and allows the conservation actions undertaken to take effect. The new product is called "Phoslock" and is a type of clay that has been modified with a rare earth element called Lanthium. Phoslock is a dry product that is mixed with water and sprayed on the surface of the water body being treated, creating a milky looking appearance. Over several days, the product settles to the bottom taking with it the phosphates that were dissolved in the water column. Once on the bottom, it forms a thin layer covering the bottom sediment. This layer continues to absorb phosphates being released from the sediment, preventing them from being released to the water column. Prior to treatment, tests have to be conducted to determine not only the amount of phosphate that has to be absorbed from the water column but also the amounts contained in the bottom



Applying Phoslock

sediments.

According to the information available, extensive testing over the last few years has shown that Phoslock has no hazardous effects on fish, wildlife, or other areas of concern. While this product has been tested and used successfully in Australia, New Zealand, parts of Europe, and some Asian countries, it is relatively new to North America and has yet to be approved for use in Canada. In July of 2008, it was used on an trial basis on a drainage channel feeding Lake Simcoe in Ontario by the Lake Simcoe Regional Conservation Authority (LSRCA) in conjunction with the Ontario Ministry of Environment in an effort to assess it's effects and possible licensing for use in Canada. At present, tests are still being run and monitored to assess its impact, effectiveness and overall safety in the environment. While the final reports are still being completed and should become available soon, it appears the product is meeting all the objectives and actually does what the manufacturer indicates it will do in controlling the phosphate levels.

If this product does prove to meet all its objectives, it will finally provide a major tool in controlling

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the phosphate loading already in our surface water bodies and provide a means of controlling unwanted algae growths. While this product may provide control of the existing nutrient loading, it is still imperative that steps be taken to control nutrients

entering the water bodies with spring runoff or the nutrients will simply build up again and we will be back to square one.

The results of the testing carried out at Lake Simcoe will be published on the LSRCA web site @ [http://www.lsrca.on.ca/phoslock/testin](http://www.lsrca.on.ca/phoslock/testin_simcoe.html)

[simcoe.html](http://www.lsrca.on.ca/phoslock/testin_simcoe.html) as soon as they are available. Stay tuned for more information and keep your fingers crossed that all the tests come back positive and this product becomes licensed for use in Canada.

For more information, please contact your local Provincial Water

PFRA expanding under a new name

The Prairie Farm Rehabilitation Administration (PFRA) of Agriculture and Agri-Food Canada has transformed its services to include the rest of Canada. The new

branch represents a national organization with broad national priorities and responsibilities. The organization now known as Agri-Environment Services Branch

(AESB) will continue to pursue solutions to environmental issues facing the agriculture sector, with a focus on competitiveness and sustainability.

Sealing Old Wells

By Richard Pasquill, The Manitoba Water Services Board

Too often, people will drill and hook up a new well while leaving the old well in place “in case they need it for future use”. These wells are seldom ever used again and can be a major cause of contamination of a very valuable water source and often the only water source available in the area. Once contamination of a groundwater source occurs, it is nearly impossible to correct.

It must be realized that wells have been installed across the prairies for well over 100 years. Given the

average useful life span of a well of 25 to 40 years before replacement is required, there are a great number of old wells still in place with all of them having a great potential to cause severe damage to a groundwater formation. Whenever a well is replaced or abandoned, it should be properly sealed to prevent any possibility of contamination from occurring. Too often we encounter problems with a well that is directly linked to an old well that has been abandoned and virtually forgotten about.

Sealing of a well is more than filling it up with stones, debris, and topsoil. It involves the proper placement of impervious layers of material throughout the depth of the well to prevent any water movement downward into the water bearing formation. The exact method of sealing will vary from well to well depending on how it was originally constructed. In parts of the prairies, some mostly shallow, large diameter (12 to 48”) wells are constructed

with an open bottom. Others are developed using a well screen in sand and gravel formations, while still others are developed in bedrock with an open hole drilled below the casing.

Before attempting to seal an old well, as much information as possible should be gathered about the old well to determine the proper sealing techniques to be used and to properly estimate the amount of material required for the sealing process. If you cannot locate any information on the well in your files or from the previous land owner, check with the local well driller or the groundwater section of your provincial government to see if they have any information on file regarding your well. Once as much information as possible has been gathered on the well, the required sealing materials can be amassed in preparation for the sealing.

Bentonite chips or pellets are the recommended material used to provide a proper seal and prevent any



A well may provide a direct path for contamination to travel from the surface to the aquifer.

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downward water movement. Bentonite is a form of clay that will expand 8-10 times its dry volume when wet. Once it is placed in the well, it will become wet, expand, and provide a very water tight seal. These bentonite chip or pellets are normally available from any water well contractor. In general, the bottom portion of the well, up to the bottom of the casing in the case of a drilled well or the static water level in the case of a non-flowing well, is filled by slowly pouring in clean sand. A 1 to 3 foot layer of bentonite chips is then slowly added to provide a seal near the bottom of the well. The rest of the well up to the 10 foot level is filled with a silty type sand

(containing a small amount of clay) with a bentonite layer placed every 10 to 15 feet. If silty sand is not available, a sand and bentonite chip mixture will be sufficient. To prevent any contaminated water that may seep along the bottom of an old trench from flowing down the abandoned well, another bentonite layer is placed at the 10 foot layer to provide a good upper seal. The casing can then be excavated and cut off and the rest of the well filled and the top mounded with good clay to ensure surface water runs away from the area and to provide for some settling. It is always a good idea to contact the provincial groundwater section to let them know the details

of the abandoned and sealed well for their records. If you have any questions regarding the procedures to be followed when sealing the old well, the groundwater section can also provide some valuable information and expertise.

Always remember that you must do your best to protect any groundwater source from contamination. It may be the only source of groundwater available in the area. As the old saying goes "An ounce of prevention is worth a pound of cure".

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



Alberta's Working Well Program

The majority of rural Albertans rely on groundwater for their domestic water supply.

Every year, approximately 3700 new domestic water wells are drilled in Alberta. The highest density of wells surrounds the cities of Edmonton, Red Deer and Calgary and along the Highway 2 corridor. In Alberta's thriving economy, the continued expansion of rural subdivisions, industrial activity and agricultural operations is placing more demands on provincial groundwater supplies. As a result, there is an overwhelming interest in groundwater protection and information on water well management.

To meet the demand for information, several water well management workshops were piloted in 2007. These workshops were designed to help private, domestic water well owners understand and manage their water well and

groundwater supplies. These successful pilot workshops led to the establishment of the Working Well program.

Program Overview

Working Well encourages Alberta's private water well owners to protect their wells and groundwater supplies. The overarching goal of the program is to ensure safe and secure groundwater supplies for private water well users in Alberta.

Working Well provides well owners with the information and tools they need to properly care for their wells. The program has three broad objectives:

- Awareness– to help well owners recognize that proper management of private water wells is their responsibility, and to understand the potential impacts of human activities on groundwater.
- Knowledge – to help well owners gain a basic understanding of groundwater science, how a water

well works, and how a well should be managed, and

- Practice Change – to help well owners acquire the knowledge and skills needed to adopt recommended well management practices.

Partnerships and Program Delivery

Working Well is a collaborative effort, led by Alberta Environment with the support of with other provincial, federal and municipal agencies. To date, several partners have assisted with program planning and delivery including: Alberta Agriculture and Rural Development (ARD), Agriculture and Agri-Food Canada (Prairie Farm Rehabilitation Association (PFRA), Alberta Environment, Capital Health (on behalf of the Public Health Drinking Water Officer project), the Alberta Water Well Drilling Association (AWWDA) and several municipalities.

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Program Approach

Working Well provides information to water well owners primarily through workshops and information resources (e.g. fact sheets). Offered across Alberta, Working Well workshops help well owners learn the basics of groundwater, common well problems, contamination risks and best management practices. During the workshop, participants use their own well drilling report to better understand their water supply source, their well construction, how to

protect it from contamination and the rate it should be pumped to ensure a sustainable water supply.

A suite of information resources, have been developed for well owners including:

- Shock Chlorinating Your Well
- Water Well Design and Construction, and
- Ten Ways to Protect Your Well and Groundwater Supply

Information resources, contact information and related links are also available online at www.environment.alberta.ca/3081.html.

Working Well is generating a groundswell of interest and support in Alberta. Since early 2008, the program has reached more than 600 water well owners. Moving forward, information resources are being developed on topics such as well decommissioning, well owner responsibilities and well pits. Additional workshops are also being planned for 2009.

For more information on Working Well, contact Krista Tremblett, Alberta Environment, at 780-644-8341 or Krista.Tremblett@gov.ab.ca.

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