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Technical Assistance for Public Water Systems

The Idaho Drinking Water Newsletter

Department of Environmental Quality Idaho Drinking Water Program

www.deq.idaho.gov/water/prog_issues.cfm

July 2009, Issue 52

4-Log Virus Treatment: Part 3 in DEQ's series on the new Ground Water Rule (GWR)

Demonstration of virus treatment and associated compliance monitoring requirements

In Issue 50, Part 2 of this series of articles described the triggered source water monitoring* requirements of the GWR. DEQ believes that most Idaho ground water systems will be likely to conduct the triggered source monitoring under this rule because of simplicity and cost considerations.

Systems that practice disinfection may choose, however, to demonstrate to DEQ that they are capable of reliably achieving 4-logs* of virus treatment - a treatment method that is the subject of this Part 3 article.

If this demonstration is successful, the system will be required to conduct compliance monitoring and reporting to ensure that the required level of treatment is achieved at all times. (See Part 1 of this series in Newsletter # 49 for a description of compliance monitoring requirements.)

Meeting these requirements at all ground water sources will exempt the system from the triggered source water monitoring requirements of the GWR. Some important exceptions to this straightforward situation are described below.

Demonstrating the 4-log virus treatment. Calculations showing that the raw ground water is in contact with a disinfectant for a long enough period of time to achieve 4-log virus treatment *prior* to the first customer ***must be submitted to DEQ by December 1, 2009.*** This period of contact is called "CT,"* which stands for concentration of disinfectant multiplied by time.

A system will be subject to triggered source monitoring until DEQ has reviewed and approved the 4-log calculations.

Guidelines for preparing this demonstration are under development and will be available later this year to assist systems that wish to comply with the GWR in this manner. The five preparation steps are listed below:

A smooth-nose tap prevents possible contamination of a water sample.

1. **Determine the disinfectant residual** at or prior to the first customer **(C = residual in milligrams per liter [mg/L])**. Most systems will need to measure this value under peak flow conditions, but there are exceptions.

2. **Determine the contact time** between the point of disinfection application and the point where disinfectant residual is measured *prior* to the first customer **(T = time in minutes)**. This is a function of flow rate and the volume of the pipe, contact tank, and any other structures that contain the water while it is traveling to the first customer.

3. **Calculate C x T** in milligrams per minute per liter (mg-min/L).

4. **Look up the calculated CT value** in a table of values, to be furnished this fall in DEQ's information mailings, for 4-log inactivation of viruses by chlorine (or another disinfectant if applicable).

   Temperature of the water is a variable that is required in order to use the table. In general, but not always, this will be the coldest average temperature of the ground water, usually reached in late winter or early spring.

* Definition of Terms

Triggered Source Monitoring. Each time a routine Total Coliform Rule (TCR) sample is found to be positive for total coliform bacteria, it "triggers" the requirement that a ground water system must collect a sample from each ground water source in use at the time the positive TCR sample was taken.

4-Log Virus Treatment. In the Ground Water Rule, this term describes treatment of water in which 99.99% of the viruses are removed or inactivated. The term "4-log treatment" is a form of shorthand used in the drinking water industry based on a logarithmic scale (abbreviated as "log").

CT. CT stands for concentration (C) and contact time (T). It is the result of multiplying the disinfectant residual concentration by the contact time. CT is a measure of disinfection effectiveness for the time that the water and disinfectant are in contact.

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GWR Requirements, *continued from page 1*

5. If the calculated CT falls in a part of the table that indicates 4 or more logs of virus treatment, your system meets the requirements of the GWR, and as long as *daily* compliance monitoring is conducted and reported, no triggered source water monitoring will be required.

A quick glance at these steps should make it clear that calculating CT may be fairly straightforward in some situations and much more complex in others. For example, storage tanks may provide a lot of contact time when they are full, but very little contact time if they are drawn down due to high demand.

All CT calculations must take into account worst case conditions to ensure that the level of treatment is not overstated.

DEQ strongly recommends that this CT analysis be performed by a qualified engineer. This is particularly good advice if a first pass at CT demonstration falls short of the required treatment, but operating changes (such as higher residuals, different flow rates or points of residual measurement, and so on) have the potential to improve the amount of virus treatment.

Life is not always simple. Two other potential complications need attention before concluding this article.

First, large systems that have a variety of pressure zones and treatment processes may want to demonstrate 4-log virus treatment and conduct compliance monitoring in some parts of the system and not in others. It will be necessary to address these situations in a triggered source water monitoring plan.

Systems that fall into this category will want to start developing such a plan in advance of the December 2009 effective date of the GWR in order to avoid the potential for unnecessarily large numbers of triggered source samples.

Second, systems that are currently disinfecting a ground water source or sources because of a known or suspected ground water contamination problem will be required to continue this treatment. These systems may be subject to the 4-log virus treatment and compliance monitoring requirements of the rule without having the option of conducting triggered source monitoring.

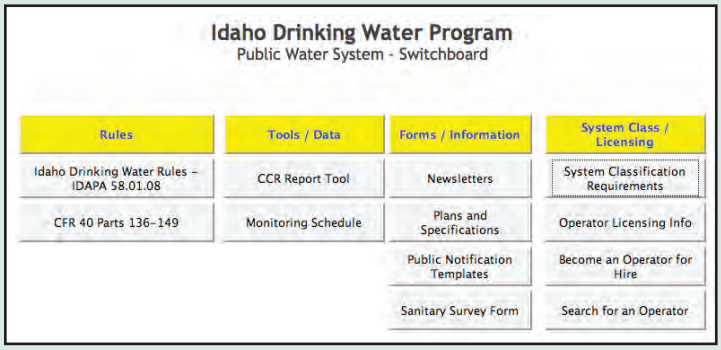
It is also possible that systems in this category may be required to demonstrate CT if it has been some time since disinfection was first installed and the effectiveness of disinfection treatment is poorly documented.

These systems may be required to conduct a year of monthly source water assessment sampling to further characterize the quality of their ground water source or sources.

GWR information mailings are planned in the fall of this year. DEQ will target these mailings by system type and configuration, based on the information we have in our records.

On-line information for PWSs

Public Water System Switchboard now available



PWS Switchboard: Making information more readily available for public drinking water systems.

DEQ has added more online information for Idaho's public drinking water systems. "The Public Water System Switchboard" located at www.deq.idaho.gov/Applications/SDWISReports/pws_index.cfm provides quick links to state and federal rules, monitoring schedules, plans and specifications, public notification templates, sanitary survey forms, drinking water system classification requirements, operator licensing, becoming an operator for hire, and searching for a licensed operator. ■

ARRA funding comes to Idaho

Idaho's State Revolving Fund loan programs received $53.7 million in **American Recovery and Reinvestment Act (ARRA)** that will be invested in the repair, replacement, and rehabilitation of the state's vital infrastructure, e.g., drinking water, wastewater facilities, and nonpoint source needs.

DEQ has posted relevant information on its web site at www.deq.idaho.gov/water/arra/arra_water_projects.cfm. As DEQ signs more loans and makes detailed reports on how ARRA funds are used, more information will be available at the above site. ■

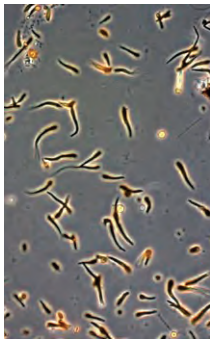
However, if you think that your system may need to develop a triggered source water monitoring plan or a CT demonstration as described above, DEQ recommends that you start thinking about these matters soon.

Questions? Contact your regulatory agency or check the EPA GWR website at http://www.epa.gov/safewater/disinfection/gwr/compliancehelp.html to learn about resources that are available to assist you in meeting these requirements. ■

Photo: ***Seen and Unseen, Discovering the Microbes of Yellowstone*** *by Kathy Sheehan, David Patterson, Brett Leigh Dicks and Joan Henson - published by Globe Pequot Press.*

Prevention is the best protection

Iron bacteria pose problems for well water



Microscopic view of Gallionella ferruginea (iron bacteria)

Iron is very common in ground water supplies used by many small water systems because of the large amounts of iron present in the surrounding soil, shallow aquifers, and some ground water fed by surface water.

Iron in well water can lead to a common problem known as iron bacteria. Iron bacteria, which are a natural part of the environment in most parts of the world, are not pathogenic (disease-causing) bacteria. Even though iron bacteria pose no health risk, they can cause "nuisance problems" for drinking water systems.

The bacteria feed on iron

The bacteria are actually living organisms, which feed on the iron in water to survive. In the process the bacteria transform the iron into a protective layer of slime around the cells of the bacteria, making the troublesome layers very difficult to eliminate.

New bacterial growth occurs on top of older growths forming a layer-like gelatinous structure, which in some cases can overtake and immobilize a water system. In turn, these layers can create a favorable haven for the infestation of more harmful bacteria such as *E. coli.*

Effects on drinking water and system operation

Once the layers are established, the iron bacteria affect the system's drinking water supply by producing a bad taste (often metallic), "rotten egg" odors, a reddish-brown color which stains laundry, and gelatinous formations on the surface of the water in toilet tanks.

Iron accumulations can also become an economic problem when water supply or water softening equipment must be replaced. Iron bacteria can grow on pump intakes and screens openings causing plugging, corrosion, and reducing the yield and efficiency of the well. In addition, the slime produced by the iron bacteria reduces the ability of regular chlorine treatments to kill disease-causing organisms.

Controlling iron in water systems

Without chemical treatment, iron bacteria cannot be eliminated by most common water filtration methods. Considering the problems iron can cause, however, it is actually very easy to control – just oxidize, then filter. To explain: by adding large doses of certain chemicals such as chlorine, the iron in the water system can be oxidized (i.e., combined with oxygen) changing it from a dissolved state to a solid form (rust particles), which filtration easily removes.

The most common method to oxidize and remove the iron bacteria is "shock chlorination." Shock chlorination is a method of treating a well and all the piping with heavy amounts of chlorine for an extended period of time.

The chlorine concentration for the shock chlorination procedure is 100 to 400 times that of treated "city" water. The amount of chlorine needed to shock chlorinate is determined by the amount of water standing in the well. The highly chlorinated water must remain in the pipes for 12 to 24 hours before it is flushed out, making the system ready for use. (For the details of shock chlorination, see the Idaho Water Resources Research Institute's "Iron Bacteria in Water Wells" at www.webs.uidaho.edu/gwemo/reports/Iron_Bact_Remediation.pdf.)

Prevention is the best protection

Iron bacteria contamination can occur when a well is installed or when repairs are made to the pump or plumbing. During installation of a well, check to make sure that the pipe, pump, tools, and water used are disinfected.

Soil containing bacteria can be introduced into the ground water from pipes or pumps that were laid on the ground. Surface water used as drilling water may also infect the well with iron bacteria.

Because you never really get rid of iron bacteria, prevention is the best safeguard against the bacteria and their accompanying problems. The bacteria will eventually grow back so be prepared to repeat the shock treatments from time to time. And always make sure that everything that is related to your systems is disinfected.

Remember, when having your well system installed, tested, or repaired, DEQ recommends that you always use a professional contractor. ■

Safe Drinking Water Hotline

For general information on drinking water, contact EPA's Safe Drinking Water Hotline at 1-800-426-4791. The Safe Drinking Water Hotline is open Monday through Friday, excluding Federal holidays, from 9:00 am to 5:00 pm Eastern Time. You can also contact EPA's Safe Drinking Water web site at www.epa.gov/safewater/hotline/.

Training Schedule

Class/Sponsor	Location/Date
Drinking Water 101 (BE) - W	Pocatello, 07/01/09
2-Day Professional Development/ Generator Seminar (IRWA) - W/WW	Coeur d'Alene, 07/13-14/09
Pumps & Motors (BE) - W/WW	Soda Springs, 07/14-15/09
2-Day Professional Development/ Generator Seminar (IRWA) - W/WW	Lewiston, 07/15-16/09
Cross Connections Basic (BE) - W/WW	Craters of the Moon, 07/16/09
Water Conservation/Rates/ Line Locating (IRWA) - W	Hayden, 07/27/09
Pumps & Motors (BE) - W/WW	Sandpoint, 07/28-29/09
Fun With Numbers (BE) - W/WW	Worley, 07/30/09
2-Day Professional Development/ Generator Seminar (IRWA) - W/WW	Weiser, 08/03-04/09
Water Conservation/Rates/ Line Locating (IRWA) - W	Jackpot, NV, 08/06/09
Collections III-IV Licensure Review (BE) - WW	Boise, 08/11-12/09
Structural Rehabilitation for Sanitary Survey Sewer Systems (IRWA) - WW	Lewiston, 08/12/09
Disinfection of Water/Wastewater (BE) - W/WW	Post Falls, 08/18-19/09
Basic Cross-Connections (IRWA) - W	Chubbuck, 08/20/09
Wastewater I & II Licensure Review (BE) - WW	Idaho Falls, 08/25-26/09
Water I & II Licensure Review (BE) - W	Nampa, 09/01-02/09
Sampling Plan Development (BE) - W	Nampa, 09/03/09
Collections I & II Licensure Review (BE) - WW	Coeur d'Alene, 09/09-10/09
Simplified Water/WW Analysis (BE) - W/WW	Twin Falls, 09/22/09
Simplified Water/WW Analysis (BE) - W/WW	Idaho Falls, 09/24/09
Leak Detection (BE) - W	Caldwell, 09/29/09
Biological Nutrient Removal (BE) - WW	Paul, 09/30/09

(BE) = Brown Environmental, Inc. *(IRWA) = Idaho Rural Water Association,*

For further information, contact the following:

Brown Environmental, Inc. 1-800-543-4358
or for the Boise area, 1-208-465-5725.
Web site: **www.idahooperatortraining.com/**

Idaho Rural Water Association 1-800-962-3257
or 1-208-343-7001, Fax: 1-208-343-1866.
E-mail: irwa@idahoruralwater.com.
Web site: **http://www.idahoruralwater.com/training.aspx**

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