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COMPLIANCE DATE IS DECEMBER 1, 2009

The new Ground Water Rule – Part I

The U.S. EPA published the final Ground Water Rule (GWR) in November 2006. It becomes effective on December 1, 2009. The goal of the GWR is to provide protection against microbial pathogens, specifically bacterial and viral pathogens, in all public water supplies that use ground water as their source of supply. This also includes consecutive systems that purchase water from other public water supplies that use ground water. EPA estimates that nationwide, this rule will impact more than 147,000 public water systems. Kansas has approximately 700 ground water systems. The GWR uses a risk-targeted approach to identify public water systems that may have fecal contamination and requires corrective action if source water fecal contamination is found.

Hopefully your system was represented at one of the workshops on the GWR held across Kansas during May and June. If not, this article will introduce you to this new rule and how it may impact the operation of your system. In this issue of *The Lifeline*, Part I will examine the relationship between the GWR and the Total Coliform Rule (TCR), and how to calculate "CT" to provide 4-log treatment. Part II will be found in the next issue of *The Lifeline* and will explain Source Water Monitoring and Compliance Monitoring.

Key provisions of the GWR include the following:

- Source Water Monitoring. This includes Assessment, Triggered, and Additional Monitoring. These terms will be explained later.
- Compliance Monitoring. This is basically treatment performance monitoring (chlorine residual monitoring) to confirm that adequate disinfection is provided prior to the first customer. In short, chlorine residual monitoring can now be required at all wells during peak demand.
- KDHE must conduct Sanitary Surveys of all Community Ground Water Systems (CGWSs) every three years and provide written notification of all significant deficiencies within 30 days.
- Systems that are found to have significant deficiencies and/or fecal contamination in their source water are required to take corrective actions. If a significant deficiency is found during a sanitary survey, the system has 30 days to inform KDHE how the deficiency will be corrected. Previously, KDHE allowed systems 45 days in which to respond.

This photo shows a typical vertical turbine pump on a municipal water well in northeast Kansas. The well is adequately sealed; the vent is screened to prevent entrance of contaminants.

Relationship between GWR and TCR

It is important to note this new rule works in conjunction with the existing Total Coliform Rule (TCR). Routine total coliform positive samples in the distribution system can indicate possible source water contamination. Consequently, if a distribution system sample tests positive for total coliform under the TCR, this can "trigger" source water monitoring under the GWR. For example, if your system has a total coliform positive sample at one of the locations on your TCR sample site plan, KDHE will continue to send you three check (repeat) samples. These are to be collected as in the past: one at the original location that tested positive, one upstream and one downstream of the original site. However in addition to the three check samples, KDHE will also send sample bottles for each of your wells as required by the GWR (unless you provide 4-log virus treatment, which will be explained later). The GWR requires systems to collect all triggered source water samples within 24 hours after notification of a total coliform

Proper collection techniques need to be practiced for TCR sampling.

positive distribution system sample. According to KDHE, triggered source water samples will probably not be collected until the following week.

It becomes very apparent that in order to avoid triggered source water monitoring, proper sample collection, proper operation of the distribution system, and proper construction and maintenance are now more important than ever. Carefully review how all TCR samples are collected to ensure they are not contaminated during the collection process. Please refer to the TCR sampling tips in the opposite column.

It is also important to properly operate and maintain the distribution system in order to avoid total coliform positive samples. This requires maintaining adequate chlorine residuals throughout and at the far ends of the system, periodic flushing of mains, proper disinfection of new and repaired mains, and ensuring a fully implemented cross-connection control program. I also suggest routinely inspecting storage facilities to ensure vectors such as birds have not gained access and constructed nests inside the tank. All vents should be properly screened and access hatches gasketed to form a watertight seal.

I recommend systems conduct their own inspections to ensure the structural condition of all wells. If improvements are needed, they should be made. The inspection should include the following:

- Wells with concrete slabs that are cracked or have settled should be repaired or the slab replaced. The slab should slope away from the well.
- If the slab does not form a watertight joint with the pitless unit to prevent the entrance of surface water, it should be properly sealed.
- The sanitary well seal should be securely fitted to create an air and watertight seal. The pitless unit should also have contamination-proof conduit for receiving electrical power.
- The well vent should be properly screened with 16-mesh screen that terminates in a 180-degree return bend not less than two feet above the 100-year flood level.

TCR SAMPLING TIPS . . .

Ensuring proper collection of all bacteriological water samples under the TCR becomes even more critical with the arrival of the GWR. Total coliform positive distribution system samples can result in water systems being required to collect source water samples from each well. Consequently, operators should carefully review how TCR samples are collected to ensure they are representative of water in the system and not contaminated at the time of collection. The following tips should help in this regard:

- ✔ Wash hands before collecting samples.
- ✔ Collect cold water only.
- ✔ Only use sterile bottles furnished by the KDHE Laboratory or your private lab.
- ✔ Remove the bottle lid just before collecting the sample. Do not touch the inside of the bottle or lid. Never place lid on the counter. Keep lid in hand opposite the bottle and keep pointed downward. Place the lid back on the bottle as quickly as possible.
- ✔ Fill the bottle to the shoulder. Do not overflow or rinse the bottle.
- ✔ Remove any aerators or filters on the end of the tap.
- ✔ Avoid collecting samples at outside locations.
- ✔ Avoid collecting samples where point-of-use treatment devices are in use. This includes water softeners, carbon filters and reverse osmosis units.
- ✔ Avoid swivel faucets if at all possible. Try to use rigid faucets.
- ✔ Avoid leaking faucets.
- ✔ Avoid threaded faucets.
- ✔ Avoid single-control faucets that may allow some hot water to flow out of the tap even with the control all the way on cold.
- ✔ Avoid faucets that flow upward such as drinking fountains.
- ✔ Flush the faucet for at least three to four minutes and longer is better. You might consider checking temperature and/or the chlorine residual to confirm you have thoroughly flushed the service line and house plumbing, and are now receiving water directly from the system's water main.
- ✔ Do not change flow from the tap just prior to collecting the sample as it could dislodge contaminants. Run the water at a steady rate that will not cause water to splash out of the bottle.
- ✔ Always check the chlorine residual before collecting the sample and record the result on the enclosed submission card.

- Proper drainage should be provided around all wells to prevent the accumulation of surface water within 100 feet.
- Livestock should be kept at least 100 feet away from all wells.
- All test holes should be properly plugged if not used for a beneficial purpose.
- All well house floor drains should carry drain water at least 20 feet away from the well or at least four feet from the well house wall. The end of the drain line should be covered with screen to prevent the entrance of vectors.
- Since systems may be required to collect source water samples from each well, sample taps should be provided. In the absence of sample taps for each well, the system must have a strategy to allow collecting individual water samples from each well. Blending of water from more than one well is not allowed.

Providing 4-log treatment and calculating "CT"

According to the GWR, if a system provides 4-log treatment and conducts compliance monitoring (monitoring of chlorine residuals at each point-of-entry), triggered source water monitoring will not be required even if there is a total coliform positive distribution system sample. So, what is 4-log treatment? Log refers to the percent of microorganisms that are either removed or inactivated by treatment. So, 4-log treatment mean 99.99 percent of all microorganisms have been either removed (filtration or reverse osmosis) or inactivated (disinfection); 2-log represents 99 percent treatment; 3-log represents 99.9 percent, and so on.

Notice the patch in concrete slab on this municipal water well. The repair was made to eliminate entrance of surface water.

A calculation must be made to determine Contact Time (CT) in order to confirm if there is 4-log treatment at each point-of-entry. "CT" is obtained by multiplying the chlorine residual concentration (in mg/L) by the contact time (in minutes) between the point of chlorination and your first

Example of Calculating CT

Calculate the CT of a water system that has the following:

- Liquid sodium hypochlorite solution is injected at the chlorination house into water pumped by Well 1
- 500 feet of 4-inch line between the point of chlorination and the first customer
- The well pumps 135 gpm during peak demand
- A free chlorine residual of 1.5 mg/L at the first customer

First, calculate the pipe cross-sectional area:
= ($\pi \div 4$) x (diameter^2)
Convert 4 inches to feet = 4 inches ÷ 12 inches/foot = 0.333 feet
= (3.14 ÷ 4) x (0.333^2)
= 0.087 ft^2

Second, calculate the pipe volume:
= pipe length x cross-sectional area
= 500 feet x 0.087 ft^2
= 43.5 ft^3
= 43.5 ft^3 x 7.48 gallons/ft^3
= 325 gallons

Third, calculate the chlorine contact time:
= pipe volume ÷ flow
= 325 gallons ÷ 135 gallons/minute
= 2.4 minutes

Fourth, calculate CT:
= chlorine residual x contact time
= 1.5 mg/L x 2.4 minutes
= 3.6 mg-min/L

Since the CT value of 3.6 mg-min/L is less than the required CT value of 4.0 mg-min/L to achieve 4-log inactivation at 59°F water temperature, this source does not provide 4-log inactivation.

Increasing the free chlorine residual and/or lowering the well output will increase the result of this calculation. For example, if the free chlorine residual in this example were increased to 1.7 mg/L, a CT value of 4.1 mg-min/L is obtained. Well 1 would then have 4-log inactivation as the calculated CT value exceeds the required CT value of 4.0 mg-min/L. See if you can calculate the CT value if the free chlorine residual is increased to 2.0 or 2.5 mg/L. You can also experiment with reducing the flow rate of the well in order to achieve 4-log inactivation. For example, if the chlorine residual is left at 1.5 mg/L and well output is decreased to 122 gpm, 4-log inactivation is achieved as the calculated CT value equals 4.0 mg-min/L.

customer. CT is expressed in CT units as milligram-minutes/liter (mg-min/L). KDHE has several tools, including a spreadsheet, to help calculate CT. Information needed to calculate CT includes:

- The measured chlorine residual in mg/L at or before the first customer.
- The form of chlorine disinfection used (free or combined).
- The diameter of each size pipe between the point of chlorination and the first customer.
- The length (in feet) of each size pipe between the point of chlorination and the first customer.
- The volume of water (in gallons) of any storage tanks or clearwells that may provide additional contact time. These storage facilities must be prior to the first customer. Storage tanks out in the distribution system cannot be used in this calculation.
- Maximum daily flow (gpm) during periods of peak demand.

The result of this calculation must then be compared to the CT value necessary to provide 4-log virus treatment. At a water temperature of 59° F (15° C), which is typical for Kansas ground water, a minimum CT value of 4.0 mg-min/L must be provided. It is important to note that the GWR does not require all systems to provide 4-log treatment for all wells. However if 4-log treatment can be provided, triggered source water monitoring will not be required. If you determine that your system can provide 4-log treatment, I suggest notifying KDHE prior to the GWR taking effect on December 1, 2009. KDHE has a form letter that can be used to provide this notification.

It is important to note that the GWR does not require all systems to provide 4-log treatment for all wells.

The GWR can be complicated. Should you have questions or need assistance interpreting the rule, please contact Kelly Kelsey, KDHE Public Water Supply Section in Topeka at (785) 296-6297, or me at (913) 850-8822. I would be more than glad to meet with you to access your situation and provide any technical assistance that might be needed.

Jeff Lamfers began work for KRWA in November 2008. Jeff has more than 30 years of regulatory experience in the oversight and operation of water and wastewater systems with the Kansas Department of Health and Environment. He is a graduate of the University of Kansas with a degree in Environmental Studies with an emphasis in aquatic biology.