by Lonnie Boller

Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBPR) monitoring and reporting issues

Recently, water systems were advised of the new Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBPR). What's the purpose of this new rule? It comes down to the fact that when chlorine and chloramines are used as disinfectants, excess amounts of these disinfectants can be a threat to health and can increase the formation of harmful disinfection byproducts (DBPs). Other disinfectants, such as ozone and chlorine dioxide, have their own health risks because they also produce by-products. The U.S Environmental Protection Agency (EPA) has determined that there is a risk of health problems associated with disinfectants and disinfection byproducts at high levels of exposure over long periods of time. Chlorine and chloramines have been shown to affect the blood and liver of lab animals exposed to high doses for extended periods of time. In addition, some people who use water containing chlorine or chloramines in excess of the maximum residual disinfectant levels (MRDLs) could experience stomach discomfort and irritating effects to the eyes and nose. People who drink water containing chloramines in excess of the MRDL could also experience anemia. While not all plant operators agree with this rule, there is logic behind it.

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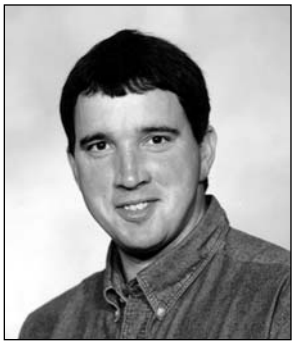

The Kansas Department of Health and Environment (KDHE) and Kansas Rural Water Association (KRWA) have tried to ease the burden of understanding and implementing procedures for water plant operators by producing a small instructional guide - a "bare bones" version of the three-inch thick guidance manual provided by EPA. It was our hope that this would assist not only seasoned operators but especially new operators who will be jumping head first into a sea of intimidating rules and regulations.

These "laymen's term" instructions were developed to assist operators and managers of surface water treatment plants serving 500 to 3300 people to complete quarterly monitoring reports required under the new Stage 1 Disinfectants and Disinfection Byproducts Rule (D/DBPR). If you would like a copy of these instructions or need assistance, please contact the Kansas Rural Water Association.

The following information contains the most important things to keep in mind in order to stay in compliance with the monitoring and reporting requirements of the new Rule:

1. Quarterly reports: Are due no later than the 10th day of the month following a monitoring period. Therefore, these reports are due no later than April 10, 2004 (1st Quarter 2004); July 10, 2004 (2nd Quarter 2004); October 10, 2004 (3rd Quarter 2004); and January 10, 2005 (4th Quarter 2004), etc.

KDHE recently provided forms for your use in making calculations necessary to determine compliance with this new Rule. KDHE prefers that you utilize their forms unless you have something comparable. When submitting the forms to

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KDHE, the forms should be accompanied by a signed and dated cover letter. Electronic submission is permissible so long as you send hard copies later. The receipt of an electronic version will satisfy the reporting deadline so long as the electronic files are submitted by the 10th day of the month following a monitoring period.

The Stage 1 Rule holds water systems responsible for compliance, not KDHE. Compliance with this and other rules requires a proactive approach by systems. This includes taking steps to deal with problems that might arise like broken sample bottles, delayed reporting of lab results, etc. If KDHE has not sent you the results for some parameter, call them. Too often I find that the tests were conducted by the report of analysis was not provided to KDHE by the system.

Until KDHE achieves primacy for this new rule, EPA will assign violations after consultation with KDHE. Systems will be required to notify the public of violations as required in the federal regulations. KDHE will assist systems in understanding the Public Notification Rule (PN) requirements.

Each compliance report requires that your water system's account number be provided, which is typically a 5-character identification with a letter followed by a series of four (4) numbers (e.g., H0304). Also, provide the name of your water system and the name or number of the plant for which this monitoring has been completed. The plant name may be the same as a well number or point of entry (POE) number.

2. TTHM/HAA5: Provide the sampling location(s) for which the samples were collected. Monitoring plans should identify which sample was at maximum residence time. KDHE is not responsible for selecting sites for TTHM and HAA5 samples; it is the responsibility of the system to select these sites. Changes in the distribution system may necessitate new sites to accurately reflect maximum residence time. Consultation with KDHE is needed before changing sites. Surface Water Systems serving 500 - 9,999 population are required to collect one (1) sample per plant per quarter from a site identified as being the maximum residence time (MRT) in the distribution system.

3. Compliance Determination: For water systems monitoring quarterly (all surface water systems serving > 500 persons and groundwater systems serving >10,000 persons), compliance is based on a running annual average calculated quarterly, using the averages of all samples collected by the system.

For water systems monitoring less frequently than quarterly; (surface water systems serving < 500 persons and groundwater systems serving <

How to Determine Compliance with the MCLs for TTHM and HAA5 for Systems Monitoring Quarterly:

1. Determine the running annual average. To determine the running annual average, add the four most recent consecutive quarterly averages together, then divide by four. This is your running annual average.

2. Compare your running annual averages for TTHM and HAA5. If your running annual average for TTHM and HAA5 is less than or equal to 80 µg/L or 60 µg/L respectively, the facility is in compliance with the MCLs.

10,000 persons) compliance is demonstrated if the single sample collected in the month of the warmest water temperature at a location representing the maximum residence time is in compliance with the maximum contaminant level (MCL) of 80 µg/L for TTHMs and 60 µg/L for HAA5. If the average of these samples exceeds the MCL, the facility is not immediately out of compliance. The system must increase to quarterly monitoring immediately. Compliance is then based on the running annual average, computed quarterly, using all of the quarterly sample results. (Note if the sum of fewer than four quarters of data exceeds 320 µg/L for TTHM or 240 µg/L for HAA5, then the system is immediately in violation since they will exceed the applicable MCL even if the remaining quarters are zero.)

Maximum Residual Disinfection Levels (MRDLs) for chlorine and/or chloramines: The residual must be tested when taking coliform samples at sites stipulated in your coliform-monitoring plan. Identify the sites you are using for Stage 1 D/DBPR MRDL compliance in the required monitoring plan. You are required to report an average of all chlorine residuals collected at the same time of coliform samples every month.

Sample Locations: Within the distribution system at the same time and locations where samples for total coliform are collected.

Compliance Determination: Compliance is based on a running annual arithmetic average computed quarterly, using the monthly averages of all samples collected.

1. Each month, add together the disinfectant residual results of all the samples taken during the month at the total coliform sampling locations. Divide by the total number of total number of samples. This is your monthly MRDL average.

2. Determine the running annual average. To determine the running annual average, add the twelve most recent consecutive monthly MRDL averages

together, and then divide by twelve. This is your running annual average.

3. Compare your running annual average to the MRDL for chlorine / chloramines of 4.0 mg/L. If your running annual average for the MRDL is less than 4.0 mg/L, the facility is in compliance with the maximum residual disinfectant level.

TOC Form: (For Surface Water Treatment Plants only) TOC calculations demonstrate if the system is achieving compliance with the precursor removal provisions of the rule.

If you take more than one set of TOC samples in a month, average the results for that month and enter the average in the chart sent out by KDHE. Make sure the monitoring sites are consistent with the monitoring plan. Send a modified monitoring plan when changes in monitoring sites are made. If your population is under 3,300, the plan will not need to be sent to KDHE but will have to be kept on file for review by KDHE during a plant inspection. If the population is over 3,300, the plan will need to be sent to KDHE for approval.

The reporting form notes that there are six alternatives to the removal percentages obtained from the matrix at the top of the sidebar "How to determine compliance with the treatment technique for monthly TOC removal." A column has been added to the form mailed out by KDHE in November to identify which of the six alternative criteria you believe apply. If you choose to use an alternative criterion, you should consult with KDHE for compliance.

Compliance Determination: Compliance is based on a running annual average of removal ratios computed quarterly, using the monthly averages of all removals achieved.

How to determine compliance with the treatment technique for monthly TOC removal:

Source Water TOC (mg/L)	Source Water Alkalinity (mg/L)		
	0 to 60	>60 to 120	>120
>2.0 to 4.0	35%	25%	15%
>4.0 to 8.0	45%	35%	25%
>8.0	50%	40%	30%

To determine compliance for monthly TOC removal:

Collect one sample of source water alkalinity, one sample of source water TOC, and one sample of treated water TOC (also known as TOC paired samples) every month. The alkalinity and raw water TOC are used to figure out how much TOC removal is required that month using the table.

1. Determine the monthly removal ratio. Once you know the required TOC removal percentage for a given month you calculate how much TOC you have removed for that month. One way to calculate the removal is to use this formula: (source water TOC minus treated water TOC ÷ source water TOC) × 100. To calculate the monthly removal ratio divide the removal % achieved by the removal % required from the table on this page.

2. Determine the running annual average. To determine the running annual average, add the 12 most recent consecutive monthly removal ratios together and then divide by twelve. This is your running annual average.

If the running annual average for TOC removal ratio is greater than or equal to 1.0, the facility is in compliance with the treatment technique.

Finding a Solution

Over the last few years of working with water systems, I know there are two ways to reduce TTHMs and HAA5s. One factor is temperature. We know that when the water temperature is lower, the results are lower. The second is to minimize the contact time with free chlorine. We can't change water temperature but we can change the points where chlorine is added. In some plants, it is possible to move the chlorine further into the system (with the approval of KDHE).

Some operators are having a difficult enough time simply understanding the rule, let alone knowing the techniques needed to actually comply with the rule. In some plants, you can make a simple change from free chlorine to chloramines as a residual disinfectant and other plants will have to make upgrades, such as adding a chlorine contact basin to limit the contact with free chlorine. Plants can also utilize chlorine dioxide and ozone. Some systems have put a granular activated carbon cap on their filters to minimize TTHMs (total trihalomethanes) and HAA5s (haloacetic acids). Many systems working to meet this rule are switching to chlorine dioxide (as a primary disinfectant) rather than chlorine to minimize the disinfection byproducts (such as TTHMs and HAA5s). Other systems have

tried switching to chloramines to minimize the production of TTHMs and HAA5s.

The City of Yates Center recently switched to chlorine dioxide as their primary disinfectant and it seems to be lowering their TTHMs and HAA5s. Public Wholesale 5, the City of Paola, and others have also changed to chlorine dioxide. It is not certain how effective the chlorine dioxide is, but the biggest advantage is minimizing free chlorine contact time which decreases the rate of byproduct production. The City of Iola and Council Grove, Emporia and other cities have chosen to use ozone as treatment. The advantage of ozone is again to minimize free chlorine contact time. Ozone also increases water quality by reducing taste and odor problems. The down side of ozone is that it is costly due to the amount of energy used. Ozone however produces high-quality water. The City of Iola chose to build a new, $11 million water plant and incorporate ozone with it to replace their old conventional treatment plant. Construction will be complete sometime in 2005. The City of Moline has switched to granular activated carbon in its filters to help reduce TTHMs and HAA5s. This is the only small system in Kansas that we are aware of using this method. We don't know as yet what the results will be. The City of Eskridge has installed a chlorine contact basin. This will help by settling out the organics before free chlorine is introduced in the system. Once it leaves the 20 to 40 minute contact basin, the city will be adding ammonia to turn the free chlorine into chloramines which will lower the TTHMs and HAA5s. This has shown to be very effective also for the City of Osage City who has had a chlorine contact basin for some time. One of the drawbacks to this is that the uncovered outside basins will tend to have an algae problem. Some plants have chosen to cover the outside basins, a somewhat costly solution. The City of Altoona years ago covered their outside basin with a grain bin. This approach was less expensive.

KRWA appreciates the opportunity to help water operators with the new regs. Above, KRWA Surface Water Tech Lonnie Boller reviews the new Stage 1 Rule with Max Kraus, City of Alma superintendent.

The City of Ottawa has started using chlorine dioxide, not as a primary disinfectant but for its oxidizing strength to oxidize the TOCs. Ottawa has had problems reducing TOCs to compliance levels.

I appreciate the review of this article by David Waldo and Kelly Kelsey at KDHE. I also encourage you to attend the sessions at the KRWA conference that address these and other important water quality and compliance issues. Know what you need to do so that your system produces the best possible quality of water and meets the requirements of the regulations. Also, I am available to work with operators in plants and if necessary, to attend board and council meetings to provide more informaton on treatment issues.