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Version 1

Quick Guide
Disinfectant Residual

Colorado Department of Public Health and Environment

PROVIDED TO PUBLIC WATER SYSTEMS FROM THE COMPLIANCE ASSURANCE SECTION OF THE WATER QUALITY CONTROL DIVISION

Purpose

Disinfection of drinking water is one of the major public health advances in the 20th century. One hundred years ago, typhoid and cholera epidemics were common throughout American cities. Disinfection was a major factor in reducing these epidemics.

Once drinking water is disinfected to meet public health standards, the residual disinfectant level in the distribution system must be maintained as a final barrier in protecting against disease outbreak. Maintaining this residual disinfectant prevents bacterial regrowth and protects against the intrusion of microbial contamination (viruses, bacteria, parasites, etc.), especially in the unfortunate event of a pipe break or backflow event.

Even under normal conditions, disinfectants degrade based on demand and water age. Operators must manage disinfectant levels on a frequent and ongoing basis to protect consumers.

Common Reasons for Noncompliance

- Failing to measure a distribution system disinfectant residual with each total coliform sample (including repeats)
- Sampler forgets to write the residual down on the total coliform lab slip
- Failing to maintain a trace residual in the distribution system
- Entry point monitoring equipment failure (SW/ GWUDI)

Chlorine injection system. Photo by Paul Kim.

Gas chlorine cylinders. Photo by Serenity Valdez.

Overview of the Disinfection Residual Requirements for Colorado Public Water Systems

Colorado Primary Drinking Water Regulations Articles 7 and 13

- Applicability: All public water systems must use disinfection unless the system has received a disinfection waiver from the Water Quality Control Division.
- All systems must maintain a detectable disinfectant residual in the distribution system. This must be measured at the same time and place as total coliforms are sampled.
- Systems that filter surface water (SW) or ground water under the direct influence of surface water (GWUDI) have special disinfectant requirements because surface water can contain viruses, *Giardia lamblia*, *Cryptosporidium* and other disease-causing organisms. The risk for disease outbreaks increases when treatment is not adequate. Therefore these systems must maintain 0.2 mg/L disinfectant residual at the entrance to the distribution system. (See reverse for more details.)

EPA Guidance Documents

- *Microbial and Disinfection Byproduct Rules Simultaneous Compliance Guidance Manual* (EPA 815-R-99-015) August 1999
- *Alternative Disinfectants and Oxidants Guidance Manual* (EPA 815-R-99-014) April 1999
- *STEP Guide - Complying with the Stage 1 Disinfectants and Disinfection Byproducts Rule: Basic Guide* (EPA 816-B-05-004) March 2006

Questions?

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TIPS

Sampling and Compliance Tips

DISTRIBUTION SYSTEMS

Measure the distribution system residual disinfectant at the same time and place as total coliform bacteria samples (including any repeat total coliform samples).

Use a field test kit that is designed to comply with approved analytical methods for distribution system monitoring. A list of approved methods can be found in Article 10.

Make sure the sampler knows how to follow the method and how to maintain the accuracy of the field test kit. Check with the manufacturer if you are not sure how to do this.

For distribution system compliance reporting purposes, systems using chlorine should report **free chlorine** as the residual. Systems using chloramines should report **total or combined chlorine** as the residual.

For operational purposes, operators should regularly monitor chlorine demand in the distribution system by measuring total versus free chlorine residual. Microbiological contamination, as well as accumulation of sediments in a pipe, corrosion conditions, biofilm growth, and pipe materials all can cause chlorine demand.

To protect public health, systems are allowed to temporarily increase disinfectant residual, beyond the maximum residual disinfectant level (MRDL), to address a specific microbiological contamination problem.

The Water Quality Control Division expects wholesalers to cooperate with consecutive water systems to ensure their compliance, but each water system is ultimately responsible for its own compliance.

ENTRY POINTS

Entry-point residual disinfectant (EPRD) should be taken after contact time but before the distribution system.

If a SW/GWUDI system's entry point is at a storage tank, the system must monitor its EPRD at the minimum frequency assigned by the Water Quality Control Division even if the plant is not producing water at the time.

Distribution System Standards (All System Types)

- Do not exceed 4.0 mg/L on a running annual average. Exceeding this level is considered a violation for community and non-transient water systems and will require public notification.
- Maintain a detectable residual in all locations in the distribution system. Detectable is considered at or above the detection limit of the method. For example, the DPD colorimetric method (Standard Method 4500-Cl G) cannot reliably measure residual below 0.05 mg/L.
- If a public water system fails to have a trace residual in more than 5 percent of samples per month, for two consecutive months, this is considered a violation and will require public notification.

Entry Point Standards for Surface Water (or GWUDI) Systems

In-line chloramine analyzer. Photo by Serenity Valdez.

- Maintain a 0.2 mg/L disinfectant residual at the entrance to the distribution system.
- If your entry point disinfectant falls below 0.2 mg/L, you must call the Water Quality Control Division as soon as possible. Call the surface water treatment rule manager at 303-692-3519. When you can't reach the rule manager, call 303-692-3583 or after hours call 877-518-5608. If you can't call right away, you must call by the end of the next business day. If you are doing grab sampling, you must begin taking samples every four hours until the disinfectant is at least 0.2mg/L.
- When you call, make sure you know (1) when the disinfectant level dropped below 0.2 mg/L, (2) how long it was below 0.2mg/L, and (3) what was the lowest disinfectant level. According to rounding rules, 0.15 mg/L is not below 0.2 mg/L, but 0.14 mg/L is.
- An exception to the requirement to call is when the residual drops below 0.2 mg/L on continuous meters due to backwashing or no flow, but in reality the disinfectant in the water was never low. Anytime your Monthly Operating Report shows a low disinfectant level, make sure you include comments about why and how long.

Reporting Made Simple

Distribution System Reporting

Systems must report a field residual measurement to the lab **with each total coliform sample**. All labs certified for total coliform analysis report the field residual measurement to the state with each total coliform sample result. Only water systems taking 40 or more total coliform samples per month may report summarized data using the **revised** Form 1- Routine Safe Data reporting form.

Surface Water (or GWUDI) System Entry Point Reporting

Systems must use the appropriate Monthly Operating Report Form for their specific treatment type. Monthly Operating Reports can be submitted to cdphe.drinkingwater@state.co.us or faxed to (303) 758-1398.

ALL laboratory and system reporting forms can be found at http://www.cdphe.state.co.us/wq/drinkingwater/FormsAndTemplates.html.