

# Continuous Disinfection of Groundwater

## FOR NONCOMMUNITY WELLS WITH RECURRING TOTAL COLIFORM CONTAMINATION

### Background

When a well serving a Noncommunity Public Water Supply (NPWS) has ongoing or recurring total coliform bacteria contamination, the source of the contamination cannot be attributed to any known defect in the well or water system, and the well is in a vulnerable geologic setting, the Minnesota Department of Health (MDH) has identified this situation as a significant deficiency under the Ground Water Rule (GWR) provision of the Safe Drinking Water Act. The presence of total coliform bacteria is an indicator that a pathway for contamination by microbes, including bacteria and viruses that can make you sick, exists in the water supply.

### Applicability of Regulations

When a significant deficiency is identified, the GWR requires that corrective action be taken. If the source of contamination cannot be eliminated or an alternative water supply cannot be utilized, continuous disinfection treatment of the contaminated well must be provided.

### Treatment Requirements

The goal of continuous disinfection treatment is to inactivate bacteria and viruses that might be in the water. Viruses are used as the benchmark for treatment because they are more difficult to inactivate than bacteria. Treatment must be designed to achieve 4-log, or 99.99% inactivation of viruses.

Disinfection treatment is achieved using chlorine. Liquid chlorine, also known as bleach

or sodium hypochlorite, is injected into the water supply at low dosages using a chemical feed pump. A storage tank known as a contact tank is used to allow time for the chlorine to react with the water. The amount of virus inactivation is calculated based on the concentration of chlorine and the amount of contact time with the water.

Complete plans and specifications must be submitted to MDH for approval prior to the installation of any treatment equipment (Minnesota Rules, part 4720.0010).

### Monitoring Requirements

A PWS using continuous disinfection to address a significant deficiency must monitor for free chlorine residual and total coliform bacteria. Free chlorine residual measurements must be taken daily from the Entry Point, defined as the first available tap after all treatment and contact/storage tanks. The measurements must be recorded and submitted to MDH each month. A total coliform bacteria sample must be collected from the distribution system once per month and sent to a certified laboratory for analysis.

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04/30/2025

To obtain this information in a different format, call:  
651-201-4700.

# Free Chlorine Residual Measurement Guide

## What methods can I use for chlorine residual measurement?

Free chlorine residual measurements must be made using a DPD colorimetric method. Test strips are not allowed for compliance measurements. Both digital and visual color-comparator style instruments are allowable if the range and precision of the instrument allows for:

- Minimum measurement range of 0.1 mg/L or lower.
- Maximum measurement range of 3.0 mg/L or higher.
- Increments of 0.1 mg/L or less in the range of 0.1 mg/L - 0.5 mg/L.
- Increments of 0.5 mg/L or less in the range of 1.0 mg/L to 3.0 mg/L.

## Where should I measure chlorine residual?

Daily chlorine residual measurements should be taken from the first tap available after the final storage or contact tank, defined as the Entry Point. These measurements must be recorded on the monthly monitoring form that is submitted to MDH at the end of each month. In addition to the daily measurements, a single free chlorine residual measurement is required to be taken each month at the same time and location as the monthly total coliform bacteria sample. This sample should be taken from a tap on the distribution system (e.g. at a cabin or other building downstream of the treatment facility).

## How can I ensure my measurements are accurate and reliable?

- Old water will rapidly lose chlorine residual. Sample at the time of peak water usage and flush the tap for at least 1 minute prior to sampling.
- Fill the sample vial to the correct level for the corresponding DPD reagent packets (usually 5 milliliter (mL) or 10 mL).
- Ensure that DPD reagent packets are not expired.
- Rinse the sample vial after usage to prevent staining. Store dry.
- When using a visual color-comparator, read the sample in good lighting. Ensure that the sample vials are not stained and that the color-comparator is not faded.
- When using a digital instrument, refer to the manual to ensure you are using the correct mode (e.g. low range or high range) and vial size for the intended measurement.

## What if my chlorine residual is lower than the required value?

If the chlorine residual is lower than the required minimum value, action must be taken to restore the residual within four hours. Failure to restore the residual to the required minimum value within four hours is a violation of the Safe Drinking Water Act.

To troubleshoot low chlorine residuals, use the table on the following page:

## Troubleshooting Low Chlorine Residual

Cause	Indications	Solution
Low water usage	The water meter reading hasn't changed The water storage tank level hasn't changed The feed pump hasn't been heard running There are very few people on-site using water	Flush system until required residual is achieved
Broken roller tube (peristaltic pumps only)	The pump runs but the chlorine level in the feed tank doesn't go down Leaks or puddles under the pump motor	Replace roller tube
Broken diaphragm or check valve seats (diaphragm pumps only)	The pump runs but the chlorine level in the feed tank doesn't go down The pump won't prime	Replace component
Broken discharge line	The pump runs and chlorine level in the feed tank goes down Leaks or puddles under the discharge line	Replace discharge line
Broken suction line	The pump runs but the chlorine level in the feed tank doesn't go down Air bubbles are visible in the suction and/or discharge lines No leaks or puddles Other pump components are in good condition	Replace suction line
Old bleach	The pump runs and chlorine level in the feed tank goes down The pump speed needs to be increased or the chemical tank needs filling more frequently The bleach is older than 3 months	Refill chemical tank with new bleach
Clogged injection point	The pump runs and the chlorine level in the feed tank may or may not go down Leaks or puddles under injection point	Clean or replace injection quill
Chemical tank is low/empty	The pump runs The level of chemical in the feed tank is at or near the bottom	Refill chemical tank
Residual is >20 mg/L	When measuring residual, the DPD reagent flashes a dark color that quickly disappears The pump runs and chlorine level in the feed tank goes down You have increased the pump speed or refilled the feed tank recently The water smells/tastes like chlorine.	Flush entire system and reset pump speed to regular level
Electrical issue	The pump does not run	Check power to pump and pressure switch. Consult electrician