Testing for Free Chlorine

Operators with water systems that provide chlorine disinfection must test for free chlorine to ensure effective treatment. Most small water systems usually use a digital colorimeter or color wheel to test for free chlorine. However, only the digital colorimeter uses a method approved by the U.S. Environmental Protection Agency (EPA) for this purpose.

Systems that disinfect do so to either provide required source treatment (4-log virus treatment or CT6) or to maintain a distribution residual.

Source Disinfection Treatment

Systems required to provide source treatment must use a digital colorimeter; test strips and color wheels are **not** approved for these systems.

Distribution Residual Treatment

Systems that disinfect only to provide a distribution residual may use either the digital colorimeter or color wheel; test strips are **not** approved for these systems. A distribution residual of 0.2 mg/L is required for these systems.

Both testing devices include the use of an indicator chemical DPD that develops a color when added to chlorinated water. The color turns darker with higher chlorine residuals. To read the chlorine residual in milligrams per liter (mg/L), compare the intensity of the color change to a color scale. If there is no color change, there is no chlorine in the water. If you have color blindness, you may have difficulty reading the true color using a color wheel.

Although these test methods are simple and reliable, operators can get poor results if they don't use proper techniques.

For More Information

If you have questions about sampling, testing, or disinfection, call our regional office:

- **Eastern Region**
  Spokane Valley
  509-329-2100
- **Northwest Region**
  Kent
  253-395-6750
- **Southwest Region**
  Tumwater
  360-236-3030

Our publications are always available online at **doh.wa.gov/odwpubs**.

Visit our disinfection webpage at **doh.wa.gov/CommunityandEnvironment/DrinkingWater/Disinfection**.

Related Publications

Chlorine Contact Time for Small Water Systems (331-343)

How to Handle Chlorine Gas Safely (331-364)

Distribution Chlorine Residual Report Form (331-593)

Source Disinfection Treatment Plant Report Form (331-430)

Washington State Department of Health

DOH PUB #331-442
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Measuring Free Chlorine

Tips for Sample Collection

- Take samples only from cold-water taps.
- Samples in the distribution system should be collected from actively used connections.
- Let the water run for a while before collecting the water sample to ensure you are getting a representative sample.
- Fill the sample container directly from the sample tap.
- Rinse the sample container and cap three times with sample water prior to filling for measurement.
- Thoroughly clean the sample vial after using; the vial can be stained over time.

For any test field kit, be sure to read and follow the manufacturer's instructions. Also, check the expiration date for the reagents prior to use. If it's expired, don't use it. For best results, measure the reagent blank value for each new lot of reagent and mark the result on the lot; you would then subtract the reagent blank value from the sample results. To measure the reagent blank value, use deionized water in place of tap water in the test procedure.

General Guidelines

Color Wheel

- **This device is not recommended because**:
  - It does not use an EPA approved method.
  - The instrument cannot be calibrated, nor can the user determine if the colors printed on the wheel have faded over time.
  - Real-world testing shows differences of 0.4-0.6 mg/L when different people test the same water.
  - Any reading less than 0.2 mg/L is essentially equivalent to zero.
  - It cannot be used by people who are colorblind.
- For these reasons, this device can only be used to roughly estimate the chlorine residual at concentrations greater than 0.2 mg/L and is not allowed when accurate measurements are needed.

Digital Colorimeter

- This device must be used for systems with a source treatment requirement.
- Zero the device before each measurement using the same sample vial.
- Make sure that your device is on the correct setting; low range generally measures up to 2.0 -2.5 mg/l (depending on manufacturer).
- If you need to use the high range setting (up to 8.0 mg/l) you will use a different method and/or device and different sample vial.
- Keep the sample vials clean and scratch-free. Return the vials to their storage cases to help reduce damage. Replace discolored or damaged vials.

DPD Colorimetric Method

Limitations

- Manganese can make the reading higher than it should be by reacting with the DPD indicator chemical.
- Discolored or cloudy water can change the color and produce inaccurate results.
- The free chlorine DPD test may measure combined chlorine if you don't follow the manufacturer's directions.
- The DPD method also measures other oxidants such as permanganate and ozone.
- High levels of combined chlorine in the water can cause false free chlorine residual results. If the color darkens over several minutes, the results may not be accurate.

Prevent DPD Free Chlorine Test Errors

- Use the free (not total) chlorine indicator.
- Read the results within 1 minute after adding the indicator chemical.
- Use the stopper or cap, not your finger, when mixing the indicator chemical in the sample vial.
- Fill the sample vial to the level specified in the instructions, usually 5-10 milliliters (ml), model dependent.
- The indicator chemical does not have to dissolve completely for accurate readings.
- Very high chlorine residuals cause the pink color to fade quickly.