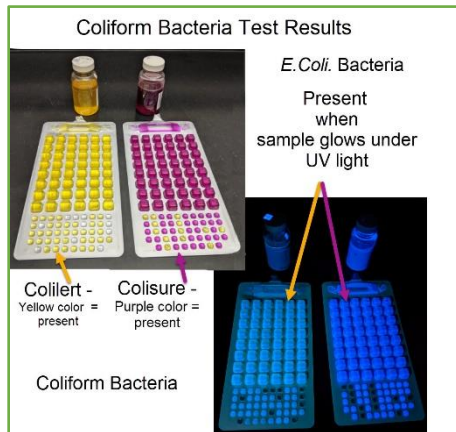




Strategies for the removal of bacteria in public water systems:

Well disinfection and cleaning techniques used in removing bacteria in water systems



The confirmed presence of bacteria indicates there is a problem with your water system and action is needed to correct it. In response county or department staff will assist the water system owner with a Level 2 Assessment to identify sanitary defects and identify corrective actions.

These corrective actions usually include some type of a water system disinfection/cleaning process. In most cases the bacteria in a water system is eliminated with the combination of fixing existing sanitary defects along with disinfecting the water system.

The First Step – Fix any level 2 sanitary defects identified BEFORE the water system is disinfected. *It is highly recommended to work with a licensed well driller or pump installer during a well disinfection procedure.* Well drillers and pump installers may have additional tools and experience to do a more thorough chlorination. These tools include chemical enhancements and bulk tanks to prepare a large volume of solution to place in the well and water system.

Some facility owners do choose to do the work themselves by doing a simple chlorination. A simple chlorination may not be as effective as a professional batch chlorination.

Regardless of who completes the disinfection, it is important to first determine the volume of water in the well and distribution system to determine the concentration of chlorine solution needed.

For most water systems a concentration of 300 parts per million (PPM) of chlorine is recommended.

In arsenic sensitive areas of the state the concentration should not exceed 100 PPM. [Click here](#) for information on chlorinating in arsenic areas.

More chlorine is NOT always better. Stronger chlorine concentrations can change the water pH and yield less of the active chemical that inactivates bacteria and other microbes.

Leave the chlorine solution in the water system for an extended time period (8- 24 hours is best). Flush the chlorine solution out of your entire water system until the bleach smell is gone. The chlorine must be gone to obtain a valid water sample.

[Click here](#) for instructions on well disinfection.

Top Ten Reasons why chlorination attempts (disinfection) are not successful.

Occasionally, two or even three attempts are made before the bacteria are successfully removed.

- 1. The wrong dose of chlorine was used.** Use of too much chlorine will increase the water pH. An increase in pH decreases the amount of the active chemical that inactivates bacteria and other microbes. Use of too little of chlorine may not be strong enough.
- 2. The chlorine solution did not have a long enough contact time in the water system to inactivate the contaminants.**
- 3. The water system may have a biofilm.** Biofilm is created when bacteria build slime layers inside water systems or within the well. In cases with significant biofilm development a simple disinfection may eliminate some, but not all the biofilm layers. Tiny crevices or corrosion marks in piping may protect the bacteria from exposure to chlorine.
- 4. The placement of the chlorinated solution was ineffective.** The solution may not have been distributed through the entire plumbing system. The solution may not have been mixed and circulated in the entire well.
- 5. There may be physical problems with the well.** Possible problems include grout failures, cracked casing, failed weld joints, leaky pitless adaptor or lateral line leak.
- 6. The aquifer may be the source.** Fractures in the bedrock aquifer or nearby unsealed wells could allow surface water to travel to the open borehole of the well.
- 7. Mineral content in the well water may use up the available chlorine.**
- 8. Aging chlorine bleach loses strength.** Use of an old chlorine product may provide less chlorine than expected. Chlorine test strips can be used to determine strength of chlorine in water.
- 9. Material that settled at the bottom of a well can protect bacteria from exposure to chlorine.**
- 10. Plumbing problems may be growing or introducing bacteria into the water system.** Examples: cross connections with non-potable piping, dead end piping and water heater temperature set low.

More advanced steps to better clean wells

More advanced disinfection/cleaning techniques are needed when simple disinfection attempts are unsuccessful. Utilizing well drillers or pump installers with the tools and skills to perform these steps are best. Some of these options may be used together as part of the cleaning process.

Physical Methods

1. Physical scrub

A physical scrub of the well casing involves a tool like a chimney sweep which physically scrubs the entire casing depth. This removes any biofilm layers on the inside of the well casing.

2. Remove debris from bottom of the well

Air Methods



Air vacuuming is an option where an airline is attached near the bottom of a 2 to 4-inch diameter steel pipe that is lowered in the well. The air exits up the pipe. The flow creates suction and vacuums up debris a few feet below the pipe.

Air lifting is a method that pushes a large surge of air in the well. The large surge of air could blow biofilm and crud further into the aquifer in addition to the material if blows out the top of the well. If air lifting is utilized the use of a device that reduces or prevents contaminants from being pushed into the aquifer is recommended.

The use of air is not recommended for arsenic sensitive areas.



Bailer

A bailer is an option that may be used in arsenic sensitive areas. A bailer is a pipe with a valve flap on the bottom that opens when it hits the bottom to allow material in. When the bailer is raised the flap closes. The material that entered the pipe is pulled up in the pipe and removed from the well.



Physical methods are followed up with a chlorination procedure.

Chemical Methods

It is very important to work with a state of Wisconsin licensed well driller or pump installer with access to the products approved for use in a water system and have the experience to use them safely. The costs associated with these disinfection techniques are higher than a standard chlorination. The chemicals used in treating a water system are flushed from the well and water system before the water system is put back into use.

1. Well disinfection with pH adjustment



The procedure involves adding an acidic product to decrease the water pH and buffer the increase in water pH that occurs with the addition of chlorine. A chemical reaction occurs at higher pH levels that changes the active disinfectant form of chlorine to a form that is less effective. The addition of an acid product allows use of higher concentrations of chlorine solution or tablets while maintaining chlorines microbial disinfection properties. This makes the chlorination procedure more effective at inactivating microbes. Acid products include vinegar, muriatic acid or chlorine tablets/solutions that are made with pH control built in them.

Hire a contractor experienced with performing this procedure. Adding too much of an acid product along with chlorine could create *chlorine gas* which can *injure* or *kill* someone. Acid treatments can also be used separately to dissolve mineral scales or penetrate biofilm.

- 2. Well disinfection with the addition of salt** – Salt helps kill bacteria by sucking water out of the cell and replacing it with a high concentration of salt solution which in effect kills the organism. Salt may also have an abrasive quality to break up biofilm. Salt also may help bind small particles like clay in water together to make them easier to remove from water. While doing this procedure it is useful to have a contractor that can pull the pump to clean it if salt clogs the screen during the procedure.



- 3. Addition of Department of Natural Resources approved biocides or biodispersants** – Biocides are used to inactivate bacteria in the water system. Biodispersants are used to break down bacterial biofilms.

For a listing of licensed well drillers [click here](#).

For a listing of licensed pump installers [click here](#).

[Click here](#) for a list of Wisconsin DNR Approved Well Disinfectant, Rehabilitation and Development Products.

For more information regarding Transient Non-community Public Drinking Water, please visit our website <https://dnr.wisconsin.gov/topic/DrinkingWater/TNownerOperator.html> or contact the DNR Service Center Desk for assistance at (888) 936-7463