

## Disinfection and Testing

### YOU ARE THE PRESIDENT OF YOUR OWN WATER COMPANY

#### TAKE THE OBLIGATIONS OF MAINTENANCE AND WELL HEAD PROTECTION SERIOUSLY!

The Effect of chlorine on the pH of water:

Generally speaking the more chlorine you add the higher the pH and the less effective the chlorine becomes as a biocide. This means you won't kill bacteria as much or as efficiently as you should unless you control the pH of your water.

When chlorine is mixed into water pH rises dramatically. Chlorine is 100% biocidal at a pH of 5.5 but is 100% oxidative at a pH over 10. When 50 ppm chlorine is mixed into water with a natural pH of 7.1, pH will rise to 7.6. The biocidal effectiveness is now 34%. As pH rises, chlorine becomes more oxidative in nature. When 200 ppm chlorine is mixed into water with a pH of 7.1, the pH rises to 8.1 and the biocidal effectiveness decreases to 9%. So you can see that by adding more chlorine is not always better or more effective.

Basically we need to control the pH of your water during the disinfection of your well. Follow these procedures and the process should be much more effective than just dumping bleach down your well. REMEMBER THE ONE THING THAT SHOULD BE YOUR GOAL! Get the disinfection chemistry in every part of the well and distribution system. Casing rises and falls between pumping cycles. 'Dead' zones in piping can hide bacteria. Get the chemistry everywhere!

## WELL DISINFECTION PROCEDURES

### READ ALL PROCEDURES AND CAUTIONS BEFORE PROCEEDING!

CAUTION: Hypochlorite solution (chlorine) added to water with a pH below 5.0 will release chlorine gas, which is extremely toxic. This procedure should only be done in the open with good ventilation. Do not mix vinegar and chlorine together above ground. Always mix solutions in well with water circulating using a clean garden hose or in a clean pail of water. The use of gloves and eye protection is recommended.

All procedures based on regular 5.5% bleach, not scented or ultra. Must be new product due to reduction in potency with shelf life.

### GET READY

1. Determine the amount of water in the well (Standing Well Volume, SWV). This is accomplished by knowing the total depth of the well and subtracting the depth to water multiplied by the gallons per foot the well can hold.

SWV = depth of well – depth to water x gallons per foot in well

6" well retains 1.469 gal/ft.

8" well retains 2.611 gal/ft.

2. Consider the general water quality of your well. Does it have hard water, high iron, sulfur or gas? These conditions in high levels will influence the effectiveness of the disinfection of the well. Select either Table A or Table B for the disinfection quantities. If the water does exhibit high hardness or presence of methane gas, double the amount of pH control (vinegar). This will compensate for the elevated alkalinity these conditions are typically associated with.

3. Take your SWV and find out on the Table what quantities you need and have them on hand. Also have on hand enough 5 gallon pails to use for the Flooding Volume at the end of the procedure.

### BEGIN

4. Start the disinfection procedure by running a clean garden hose to your well. Fill the required volume of water for the flooding of the well into the pails. Then place the hose into the well (making sure you don't get the wire connections wet) to circulate the water.

5. Pour the required amount of vinegar into the well followed by the required amount of chlorine. Continue to circulate this mixture at least 20-30 minutes after chlorine can be smelled coming from the hose. This may last for at least 40 or more minutes. Make sure the casing is disinfected by washing it down with the hose.

While this mixture is circulating, mix the flooding volume. Flooding Volume is the amount of water held available at well head (usually in clean 5 gal. buckets) to be poured into well at the completion of the disinfection procedures. To mix: add ½ cup vinegar and ¼ cup chlorine to each 5 gallon pail of water.

6. Once the well has circulated the required time, turn off the hose. Go into the house and run the water at each cold water tap one at a time until chlorine can be detected. This means every outside spigot, shower, toilet, faucet, washing machine or dish washer, anywhere cold water flows to. Run hot water only 10 to 15 seconds to disinfect inlet to hot water tank. If you question your system, then by all means run the hot water as well. The hot will be discolored much longer in order to flush the large volume of water from the hot water tank through the system.

7. Wait approximately 30 minutes for the well to recover. Then go back to the well and pour the pails of dosed water (flooding volume) into the well. You will have effectively created an artificially high water level that will fall to the normal static level. A well that makes water will take water. You have now accomplished disinfection outside of the well itself and into the surrounding bedrock or sand and gravel. Close the well up.

### COMPLETE THE PROCESS

8. Allow the well to set at least overnight with only minimal use. Two days is better. I wouldn't wash your hair with it unless you want to be a bleached blond. You can flush toilets but don't over do. Too much chlorine is not good for septic systems.

9. After the system has been allowed to set it can be flushed to remove the chlorine and the discoloration that usually accompanies this procedure. If the well produces greater than 4 to 5 gallons per minute the well can be flushed by opening the garden hose at a 1 to 3 gpm rate and discharge the water from the well to an area where the grass won't be burnt. If the well produces less than 4 gpm discharge the water slowly (<1 gpm) as above or discharge ½ the volume in the well and use normally until odors and discoloration dissipate.

10. If you are disinfecting your well as simply a maintenance procedure you are almost done. Once you are getting chlorine free water again, take the hose back to the well and rinse the steel well casing down. This will stop unnecessary oxidation of the steel.

If you are disinfecting your well to obtain a C of O as part of a new home or property transfer, the next thing to do is to get ready for proper sampling of the well. See Proper Well Sampling Protocol.

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### WELL DISINFECTION TABLES

#### READ ALL PROCEDURES AND CAUTIONS BEFORE PROCEEDING! MIXING OF VINEGAR (ACID) AND CHLORINE (BASE) SHOULD BE DONE IN WELL!

Table A. 50 ppm Disinfection quantities for average well water quality

(i.e. no gases, no sulfur, low to moderate bacteria and low to moderate hardness)

Table based on regular 5.5% bleach

Standing Well Volume (gallons)	Flooding Volume (gallons)	pH Control * (white vinegar) Food Grade	Chlorine ** Required
50	5	1 ½ cups	1 cup
100	10	3 cups	2 cups

150	15	1 quart	2 ½ cups
200	20	.33 gal. (5 ½ cups)	3 ½ cups
250	25	.41 gal. (6 ½ cups)	1 quart
300	30	.5 gal. (8 cups)	5 cups
350	35	.58 gal. (½ gal + 1 cup)	6 cups
400	40	.66 gal. (½ gal + 2 ½ cups)	7 cups

Table B. 200 ppm Disinfection quantities for more difficult well water

(high iron (Fe), sulfur, iron or sulfide bacteria, methane or hydrogen sulfide gas)

**Table based on regular 5.5% bleach**

Standing Well Volume (gallons)	Flooding Volume (gallons)	pH Control * (white vinegar)	Chlorine ** Required 5.25%
50	5	.33 gal. 5 ½ cups	3 ½ cups
100	10	.66 gal (½ gal + 2 1/2 cups)	6 ½ cups
150	15	1 gallon	½ gal + 2 cups
200	20	1.32 gal (1 gal + 5 cups)	½ gal + 5 ½ cups
250	25	1.65 gal (1 ½ gal + 2 cups)	1 gal + 1 cup
300	30	2 gallons	1 gal + 1 quart
350	35	2.31 gal (2 gal + 5 cups)	1 ½ gallons
400	40	2.64 gal (2 ½ gal + 2 ½ cups)	1 ½ gal + 3 cups

\* Double amount of vinegar to be used if water exhibits excessively high amounts of hardness or presence of methane gas. Use white vinegar (food grade).

\*\* Recommend using NSF or UL approved chlorine.

**LARGE VOLUME WELL FLOODING**

In the event that you do not know your well depth, depth to water and therefore well volume, you can use a larger scale well flooding technique that can accomplish a great deal of bacterial disinfection. This technique has proven very effective on wells set up for storage systems and on other low producing water wells. Again use the above tables to create the proper chemistry for a specific flooding volume.

Basically, a well that makes water will take water. What this means is that every well has its own static water level and when you add water (or in this case disinfecting chemistry) to a well, the water level will eventually reach this original static water level. The idea is to flood the well and the surrounding water producing formation adjacent to the well with disinfection chemistry. This is done in an effort to reduce or sometimes eliminate bacteria growth that can plug a well. This technique requires a tank(s) of water that you will mix the chlorine and vinegar in. This volume is then placed into the well to flood it with chemistry. While flooding the well, you can circulate the chemistry in the well with a garden hose as described previously to ensure mixing and washing the casing down with disinfectant. Follow all previous directions to ensure that the disinfectant reaches all portions of the pumping and piping system.

Allow the proper waiting (contact) time for the disinfection chemistry to do its job and then pump the well out to waste and dispose of properly. Allow several days for the well to clear up. If significant bacteria debris was removed and an improvement of the well was noticed it may be beneficial to repeat this process in 2-3 weeks. Doing this a second time may remove additional layers of bacteria and improve the effectiveness of this technique.

NOTE: Please make sure there are no other wells nearby that could be affected by this flooding technique. Turning your neighbors hair to strawberry blond may not go over very well!

**TO REDUCE BACTERIA BUILD UP IN A STORAGE SYSTEM**

There are a few important things to remember when you have a storage system. The first is to set the system up so that you DO NOT completely remove the water in the well when filling the storage tank. This will only promote bacteria growth by putting more oxygen into the well. Take just enough water from the well to keep the tank filled...just like taking the cream off the top of milk. To accomplish this, make sure there is a timer or at least a flow restrictor included in the system. Additionally keep the float switch in the storage tank near the top. By making sure the float switch turns on near the top of the tank this will assist in not over-pumping the well. Remember, if the well only makes 1/2 gallon per minute times 1,440 minutes, that is 720 gallons per day. If you have a 180 gallon tank and you need 100 gallons per day per person, set the timer to fill 300 to 400 gallons per day. The tank will always be full and the well will not be over-pumped.

Note: You can also add a little vinegar and bleach once a month to help control bacteria in storage tanks.

**WHY BACTERIA TESTS FAIL?**

1. Poor sample collection. If you haven't taken your aerator off the tap and not disinfected the sampling point it probably will not pass.
2. Integrity problem with the well. This is usually caused because the well cap is not sealed and bugs can get in. This matters. Other well bacteria causing problems include: improperly installed pitless adaptor (connection to the house), broken casing, not enough casing. All of these conditions are somewhat common and can be diagnosed.
3. Pump installation or repair that had the well assembly laid on the ground thus picking up what ever it was dragged through...yummy! Just think, a brand new, clean well just contaminated. If a well is repaired it should be disinfected when the work is completed.
4. The pump was installed high in the casing (not near the bottom). In this case there is a 'sump' area that is created and not disinfected. This area may not be reached without flooding it with disinfection chemistry, adding dry-pellet chlorine tablets that would make it to the bottom or cleaning by a drilling rig.

**PROPER WELL SAMPLING PROTOCOL**

1. Get sample bottle from an approved New York State licensed laboratory. Get small cooler with ice in it, latex gloves and isopropyl alcohol (rubbing alcohol) preferably 91 % (70% will work).
2. Remove aerator from the sampling point faucet (usually kitchen sink).
3. Clean the faucet, the threads and as far internally as possible with paper towel and either isopropyl alcohol or bleach. Try to squirt some disinfectant into the faucet. Let stand 4 to 5 minutes.
4. Run water slowly for 4 to 5 minutes. Note: water must be free of sediment, color and chlorine prior to sampling.
5. While water is running, label the sample bottle properly. Then rinse latex gloves or if not available your hands with isopropyl alcohol to disinfect them.
6. After running the water for the required 4 to 5 minutes, open the top of the sample bottle without touching the inside or even the top. This can be done by using your thumb to lift and pop off the top.
7. Place the bottle under the slow stream of water until it reaches the fill line. DO NOT over fill the bottle and dump out some. This will likely cause a false positive. Immediately close the top and seal. Place on ice (lab won't accept unless cooled), keep out of the sun and deliver directly to lab or drop off location.

BMI has a sample drop off at the office in Penn Yan for Life Science Laboratories in Syracuse, New York.

**IMPORTANT:** If this is a re-test, do not get alarmed. The report of coliform is only an indicator of a potential problem. A positive for coliform can come from any number of places and for any number of reasons. When you eat chicken wings, you get coliform. A positive for e-coli is considered much more of a concern. Normally, bacteria results are reported as present or absent. Particularly on a second or third sample this is inadequate. Therefore request an MPN (bacteria count). This may cost a little more but it at least will give you a quantitative value to help determine the severity of the problem causing the positive results. If you do receive a second positive result, please do not hesitate to contact BMI to go over your particular situation personally.

**IF YOU HAVE ANY QUESTIONS REGARDING THESE PROCEDURES OR PROTOCOL, PLEASE DROP US AN E-MAIL AT BMIWELLS@MORAVECWATERWELLS.COM OR CALL US AT 315-536-3911.**