SOLUTION: Shock chlorinate the system, blow out the distribution system, and shock chlorinate again.

SYMPTOM: Clothes turning grey. Scum on wash and bath water after using soap. Water heater functioning improperly. CAUSE: Hard Water **TEST** : Calcium and Magnesium. **SOLUTION:** Install a water softener. Use small amounts of packaged water softener in baths, washer, etc.

SYMPTOM: Smelly water. Rapid tarnishing of silverware. Staining of a black color. CAUSE: Hydrogen Sulfide. **TEST** : Hydrogen Sulfide. **SOLUTION:** Install a continuous chlorination system and carbon filter or aerate the water and install a sediment or carbon filter.

SYMPTOM: Cloudy Water. CAUSE: Particles of suspended matter. **TEST** : Turbidity **SOLUTION:** Install a sediment filter or use activated carbon to remove color due to organisms.

SYMPTOM: Gassy water, or water with suspended air bubbles. CAUSE: Decay or organic matter **TEST** : Methane **SOLUTION:** Install gas release valve on pressure tank and vent outdoors or aerate water in a non-pressurized storage tank.

Table 1: Approximate Quantities For Preparing Disinfecting Solution

Approximate amount of dry powder or liquid bleach required to make a 100 mg/l chlorine solution:

Diameter of Well Casing (Inches)	Volume of Water Per 100 Ft. Depth (Gallons)	Dry Powder (70% Chlorine) (Cups)	Liquid Bleach (5% Chlorine) (Cups)
4	65.5	1/4	3
6	147	1/2	5
8	261	3/4	9
10	408	1	14
12	587	1 5	19

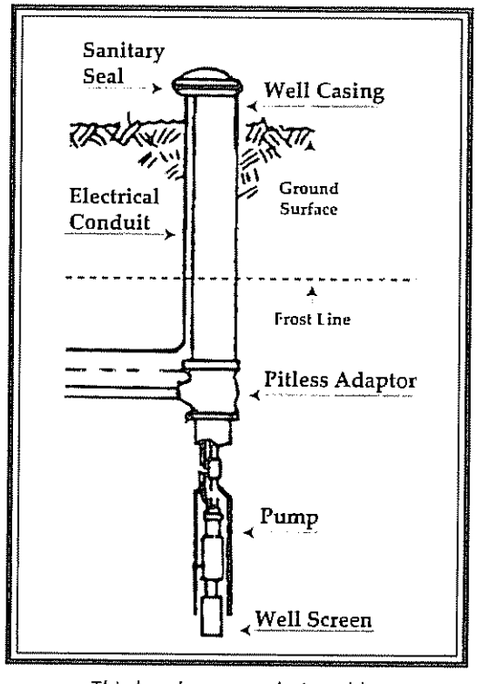
This brochure attempts to answer questions regarding water quality and purification devices. For more specific information you can contact the Summit County Environmental Health Department, P.O. Box 5660, Frisco, CO 80443, 970-668-4070 or the product manufacturer or distributor.

♻ Printed on Recycled Paper.

Summit County
ENVIRONMENTAL HEALTH DEPARTMENT

Colorado State University Cooperative Extension

User's Guide To Private Well Water



This brochure was designed by the Summit County Environmental Health Department and made available by a grant from the Summit County Cooperative Extension Office. Your Cooperative Extension Office is jointly funded by Summit County Government and Colorado State University. Cooperative Extension programs are available to all without discrimination.

GROUNDWATER

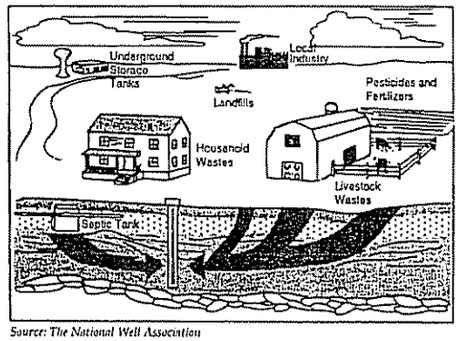
Groundwater occurs practically everywhere in the spaces in sand, rock and gravel formations below the ground surface. A formation containing a usable amount of water is called an aquifer. An aquifer may be sand, gravel, or a mix of sand and gravel, fractured rock or porous rock. It may be a single mass, a layer, or a series of layers. Water may flow between the layers or may be isolated between layers of low permeability such as shale or limestone.

An aquifer that may be recharged with water from the surface directly above is called an unconfined aquifer. Aquifers without hydraulic connection to the surface above are called confined aquifers. This difference is important. Activities near a well in an unconfined aquifer are more apt to cause contamination. Activities near a properly constructed well in a confined aquifer are much less apt to contaminate the well.

GROUNDWATER CONTAMINATION

Groundwater is normally contaminated by natural processes, by waste disposal practices, and by spills or leaks. A contaminant usually enters the ground at or near the surface and percolates down through the soil or finds a more direct route to groundwater through fractured bedrock or poorly constructed wells. Abandoned and poorly constructed wells act as conduits, allowing a contaminant to flow directly into the aquifer without ever having a chance to filter out or decompose contaminants as is usually the case when water moves through soil. Once a contaminant reaches the aquifer, it will generally move with the groundwater at a similar speed, but movement will vary with the type of contaminant. Flowing groundwater naturally undergoes very little mixing, which results in localization of contamination for long periods of time and less dilution than would occur with surface water.

The quality of a contaminated water supply is subject to change at any moment without warning. A contaminated water supply is unsafe to use without treatment even though you may have used the same water for years without getting sick. The most frequent contributor to unsafe water is microbiological contamination which can result in sickness or even death. There are three basic types of disease organisms which are carried in water: bacteria, viruses and cysts. These organisms normally reach the water supply via sewage wastes from infected animals and humans. The only way to identify the presence of these organisms is to have your water tested.



Source: The National Well Association

WELL CONSTRUCTION AND LOCATION

A water well should be constructed so as to prevent contaminated surface water or shallow subsurface seepage from entering the well and getting into your water supply. The well and water system components should not be located in areas subject to flooding; therefore, well pits should be avoided. The ground around the well should slope away from the well and the top of the well casing should extend above the ground surface far enough to prevent surface water infiltration in the event of a flood. The top of every well should also be provided with a watertight cover called a sanitary seal. If your well does not have a sanitary seal you should install one. Water wells need to be located as far as possible from sources of contamination. Setback distances are commonly established in well construction regulations. It is also important to protect the well casing from snowplows and vehicle traffic. This is often accomplished by constructing a barrier around the casing.

COMMON CONTAMINANTS

Bacteria

Bacteria are widely distributed in the environment in soil, on plants, animals and in very large numbers in the feces of warm-blooded animals. The presence of coliform bacteria in a water supply means that the water supply has been exposed to one or more of these sources. Coliform bacteria are not considered pathogens and are for the most part harmless, but if coliform are present, it means that other disease causing microbes may be present. Therefore, the presence of coliform bacteria is cause for concern and corrective action should be taken. This often means disinfecting your well and locating the source of contamination.

Nitrates

Nitrogen is an element essential to living matter. It

occurs naturally in the environment in the soil, air, water and rain. Nitrogen also occurs in other forms including ammonia and nitrate. Nitrates from septic tanks, animal wastes, fertilizers, landfills, decomposing vegetation and geologic deposits are probably the most common sources of contamination. High concentrations of nitrates in drinking water supplies have been linked to nervous system impairment, cancer, birth defects, and methemoglobinemia. Methemoglobinemia, or "blue baby syndrome", is primarily a serious problem with young infants whereby the ability of the baby's blood to carry oxygen decreases. The symptoms can be very serious or even result in death.

The majority of nitrate problems are generally associated with poorly located and constructed wells.

Iron
Soluble iron is easily recognized because the water is clear when first drawn, but soon becomes reddish in color upon standing. The main objection to iron in water is that it causes reddish-brown stains on plumbing fixtures, porcelain, cooking utensils, and laundry. Iron causes a disagreeable metallic taste and can have a sewer type odor.

Hardness
Hardness is probably the most common household water problem. It occurs as water dissolves minerals such as calcium and magnesium from rocks. Water is considered hard if it has over 120 ppm calcium carbonate (highly variable depending on source of literature). Hard water is recognized by the following symptoms:

- Reduced water flow and eventual plugging of plumbing;
- Premature water heater burn out;
- Stained laundered clothing;
- Scale ring at water level in toilets;
- Poor soap lathering;
- Permanent water spots and deposits;
- Poor cooking results;
- Reduced life of laundered goods.

TESTING YOUR WATER

There are three main reasons to test your water:

- to ensure safe drinking water;
- to evaluate the need for treatment, and;
- to select an appropriate treatment device.

Testing is also recommended when there is evidence that the water has changed such as unexplained illnesses, and changes in color, taste or odor. In any case, you should test your water for bacteria and nitrates at least once a year. Contact the Environmental Health Department for information about where you may get your water tested.

DISINFECTION

Whenever bacteria is detected in a water system, disinfection using chlorine is usually the treatment prescribed. The purpose of disinfection is to kill unwanted bacteria and other disease causing organisms. Disinfection should be done before using a new well, following changes or repairs to an existing water system, following a flood, after a positive bacteria test and when water begins to taste or smell poorly.

There are a few things that you should do before you disinfect your well. First, inform anybody who might use the water that the supply may be tainted. Second, make provisions for an alternative water supply. Last, either bypass or disconnect water softeners, reverse osmosis machine or water filtration units if possible because the increase in chlorine could damage these items.

Another method commonly used to disinfect water is called ultraviolet (UV) disinfection. UV disinfection devices house a germicidal UV lamp that destroys bacteria and inactivates viruses without chemicals. Suspended particles in water will affect UV disinfection and will build up dirt on the lamp. Therefore, periodic inspection and maintenance of these systems is required

PROCEDURE FOR DISINFECTION

1. Clean all accessible surfaces with a strong chlorine solution. A solution of 1/2 gallon of chlorine laundry bleach to 5 gallons of water is recommended.

2. Calculate the amount of chlorine that will be necessary to disinfect the well. Sufficient disinfectant shall be used to produce a minimum concentration of one hundred (100) mg/l (milligrams per liter or parts per million) chlorine in the well (see Table 1)

3 Remove the sanitary cap from your well head and pour the calculated amount of chlorine directly into the well casing. Thoroughly mix the chlorine with the water in the well by running a hose from an outside faucet into the well casing and recirculating the water for approximately 15 minutes.

4. Disinfect the distribution system by opening each faucet one at a time until the smell of chlorine develops, then shut off the faucet and move to the next one. Make sure to flush all the toilets several times. When chlorine has reached all of the outlets, let the system set for a minimum of 8 hours.

5. After 8 hours of contact time with the chlorine, the system should be disinfected. Flush the chlorine from the system by opening up faucets and flushing the toilets. Caution: Do not overload your septic system. Most of the chlorine can be flushed from the system by opening an outside faucet.

6. The water should then be tested after 2 weeks to make sure the disinfection procedure eliminated the bacteria from the system. It is not uncommon to have to disinfect the system more than once.

WATER TREATMENT DEVICES

Reverse Osmosis (RO)
Reverse osmosis (RO) systems can easily be installed under your sink or wherever space permits, to remove undesirable contaminants from the water supply. All dissolved or suspended matter, including tastes, odors, sulfates, nitrates and sodium are reduced or eliminated. RO systems may also reduce dissolved metals like arsenic, barium, cadmium and lead, organic contaminants and some pesticides.

Distillation
Distillation is perhaps the oldest and one of the most effective methods of water treatment. Distillation turns water into a vapor leaving minerals and salts behind. The vapor is then condensed back to liquid form. Removal of the minerals and salts make the water very corrosive to plumbing; therefore, distillation is not recommended for whole house treatment, as copper and lead could be leached from the plumbing.

Water Softeners
Water softeners, also called cation exchange, can reduce calcium and magnesium; the cause of hard water. It can also reduce naturally occurring radium, barium and cadmium. The treatment exchanges calcium, magnesium and radium with sodium chloride(table salt). Calcium and magnesium are not harmful to health but sodium may be. If you are on a salt free diet, you should check with your doctor before consuming softened water.

It is recommended that softened water be plumbed into the hot water tank feed line. This arrangement will give you the aesthetic benefits (no spotting of dishes, less scale in hot water heaters and appliances, enhance bathing and cleaning) while not effecting the cold water plumbing.

Activated Carbon Adsorption
The carbon filter, commonly called a charcoal filter, is the most frequently purchased treatment device. The device is normally installed on the cold water line, or for a full house treatment, it may be installed adjacent to the pressure tank. They are most frequently used to remove chlorine and organic compounds which can cause taste and odor problems. As chlorine and other organic compounds are removed from your drinking water, a build-up of organic material and bacteria can occur and the ability of the carbon to remove them decreases. The organic material is, in most cases, an excellent food source for bacteria. If a build-up of bacteria occurs within a filter, it could be passed through with the "treated" water. Therefore, it is necessary to periodically replace the filter or the entire unit.

CONSUMER TIPS WHEN PURCHASING PURIFICATION EQUIPMENT

1. Research the different treatment devices on the market. Learn each product's performance capabilities, maintenance provisions, operational and warranty coverage.

2. Check the seller's reputation and customer references before you sign a sales contract.

3. Be wary of any salesperson who tries to sell you one product to help solve many water quality problems.

4. Understand completely the terms of the treatment device guarantees and warranties, including maintenance and replacement. All devices need maintenance and some require filter replacement. Improper maintenance can result in a poorer quality of water coming out of the device than going into it.

5. Obtain independent test results of your water before agreeing to purchase a treatment device.

WATER QUALITY PROBLEMS AND TYPICAL SOLUTIONS

SYMPTOM: Diseases such as typhoid fever, dysentery, diarrhea, hepatitis and others. CAUSE: Disease producing bacteria, viruses, protozoa, etc. **TEST** : Coliform Bacteria. **SOLUTION:** Repair or reconstruct the complete water system to keep out pollutants, then disinfect and retest. If samples from two or more are unsatisfactory, then either develop a new source or install a continuous disinfection system.

SYMPTOM: Rust or black colored water. Stained clothes and fixtures. Reduced water flow. Unpalatable food and beverages. CAUSE: Iron or Manganese. **TEST** : Coliform Bacteria. **SOLUTION:** Aerate the water in the storage tank, then run the water through a sediment filter. Install a sediment filter and a softener. Continuously chlorinate the water and run it through a sediment and carbon filter.

SYMPTOM: Rust colored slime in toilet tank and pipes. Fuzzy particles in water. Staining. Reduced water flow. CAUSE: Iron Bacteria. **TEST** : Coliform Bacteria.