AE-1045

Treatment Systems for Household Water Supplies

Identification and Correction of Water Problems

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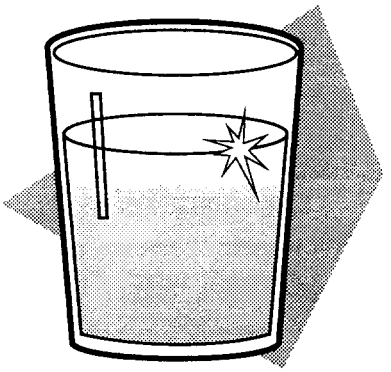
Identification of water problems

Many people determine the quality of the water they consume by how it smells, tastes or looks. Although these are important criteria, they are primarily aesthetic properties of the water. A glass of water may not look, smell or taste good, but it could still be suitable to drink from a health standpoint.

The way water looks, smells and tastes can be used to help determine what type of treatment is necessary to improve the quality of the water. The following guidelines will help you determine if there are any problems with your water and what the most likely cause of those problems might be. All you need is a clear container to take a water sample and then use your senses of sight, smell and taste.



APPEARANCE

Water is clear when first drawn from the raw water tap then becomes yellow or reddish in appearance, but clears upon standing for 24 hours.

Dissolved iron present.

Water is yellow or reddish when first drawn from the raw water tap but clears upon standing for 24 hours.

Undissolved iron present.

Yellow or brownish cast to water even after softening and/or filtering and does not clear up after standing for 24 hours.

Tannin (humic acid) in water. Comes from water passing through coal veins, peaty soils and decaying vegetation.

Black cast to water that clears upon standing for 24 hours.

Dissolved manganese present.

Milky water.

Excessive air in the water caused by the well pump sucking air (excessive drawdown) or a malfunctioning pressure tank. Also, can be caused by high amounts of bicarbonate precipitates resulting from an increase in pH.

Blackening, tarnishing, or pitting of metal sinks, utensils, pipes, etc.

High amounts of salt (chlorides and sulfates) or hydrogen sulfide gas.

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Green stains on sinks and other porcelain bathroom fixtures. Blue green cast to water.

Acidic water (pH below 6.8) reacting with brass and copper pipes and fittings.

Suspended matter in water.

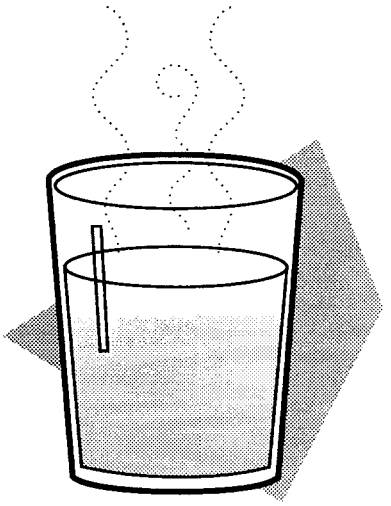
Caused by riled up water in a surface supply or sand pumping from a well.

Soap curds and lime scum in wash basins and bathtubs. Whitish scale deposits in tea kettle and on the ends of plumbing fixtures (faucet, shower head, etc.).

Hard Water caused by calcium and magnesium salts in the raw water supply.

Stained aluminum cookware.

High dissolved mineral content and high alkalinity in the raw water.



SMELL

Chlorine smell.

Normal chlorination of public or private well sources.

Fishy, musty or earthy smell.

Generally harmless organic matter. Commonly associated with surface water supplies.

Rotten egg odor from the raw water tap or directly from the well.

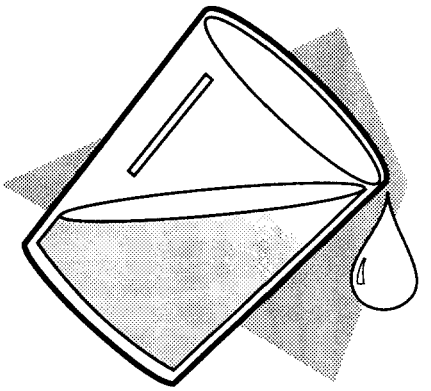
Dissolved hydrogen sulfide gas in the raw water.

Rotten egg odor only from the hot water tap.

Sulfates present in the raw water reacting with the magnesium anode which causes hydrogen sulfide gas. Can be corrected by removing the anode or replacing it with an aluminum anode.

Detergent odor and water foams when drawn. Also septic odor.

Leakage from a sewer system is entering the water supply.



TASTE

Salty flavor to the water that may have a laxative effect in some situations.

High salt content (primarily sodium sulfate and magnesium sulfate).

Metallic taste.

High concentration of manganese, or possibly other metals.

Correction of the water problem

When the cause of a water problem has been identified, then a method of treatment can be used to correct or minimize the problem. Before purchasing a treatment system, first have your water analyzed by a state certified laboratory to determine the quantity of foreign material in your water. The most common water tests are for:

- Coliform Bacteria
- Nitrates
- pH
- Total Dissolved Solids
- Hardness
- Iron and Manganese

After the water is analyzed, you can use the chart on the facing page to determine what treatment methods are needed to correct the problem. You may have identified more than one

problem. If this is the case, you may need more than one type of treatment. Many reputable water treatment companies have equipment that will treat more than one problem.

Common water treatment methods

A brief description of the six most common types of household water treatment is found on the back page. The list explains the main use for the treatment method and also, equally important, the major limitations of the method.

Additional sources of information

NDSU Extension Service Water Treatment Series -

TREATMENT SYSTEMS FOR HOUSEHOLD WATER SUPPLIES:
- Activated Carbon Filtration, AE-1029
- Iron and Manganese Removal, AE-1030
- Distillation, AE-1032
- Softening, AE-1031
- Chlorination, AE-1046
- Reverse Osmosis, AE-1047

Additional NDSU Extension Service Bulletins:
- Interpreting Your Water Test Report, AE-937
- Household Water Treatment, HE-430

Raw Water Problems and Common Treatment Methods

Raw Water Problem	Common Treatment Method
Bacterial contamination	Treat using chlorination or other forms of disinfection (boiling, iodine, etc.) until the source of contamination is found and corrected or removed.
Fine sand, clay or other sediments	Remove using mechanical (fine screen) or sand filtration.
Odor and taste other than ROTTEN EGG SMELL	Corrected with activated carbon filters.
Hydrogen Sulfide Gas (ROTTEN EGG SMELL)	Remove using chlorination followed by sedimentation or use an oxidation filter (sometimes called an aeration filter) followed by an activated carbon filter to remove excess chlorine.
Small amounts of dissolved iron and manganese.	Remove with a common water softener. The water softener manufacturer should have a level of iron removal rating.
Higher amounts of dissolved iron and manganese	Remove using an oxidizing agent such as potassium permanganate or chlorine followed by a mechanical screen or use a green sand filter.
Suspended iron and manganese particles	Remove using mechanical (fine screen) or sand filtration.
Hard water	Treat using a water softener.
Acid water (pH less than 5.0)	Treat with a neutralizing filter (adds calcium carbonate)
Alkaline water (pH greater than 9.0)	Treat by injecting a weak acid (acetic acid or white vinegar)
Tannin (humic acid)	Remove using chlorination with a detention tank or a special anion exchange unit.
Volatile organic[1] compounds, certain pesticides, trihalomethanes and radon	Remove using an activated carbon filter. Other treatment options include reverse osmosis or distillation.
Nitrates, heavy metals[1] (lead, copper, etc.), high total dissolved solids (TDS), sodium, sulfates.	Remove with reverse osmosis or by distillation. Nitrates can be removed with an anion exchange unit.

[1] These problems are not generally noticeable to human senses. Testing for these constituents should be performed by a trained professional familiar with the problems that can cause these forms of contamination.

Common Home Water Treatment Methods

Treatment Method	Main Use	Restrictions
Water Softening	Reduces water hardness minerals (calcium and magnesium) by replacing them with sodium.	Replaces calcium and magnesium with sodium which can present a problem for people on low sodium diets. A kitchen faucet should be left unsoftened for drinking purposes.
	Softened water requires less soap or detergent for washing and cleaning.	Periodic backwashing and regeneration of the resin bed using salt brine is required.
	Reduces scale formation in pipes, water heaters and on faucets. Improves sudsing ability of soaps and detergents.	
Oxidative Iron Filtration	Reduces iron and manganese concentrations to levels where they don't stain clothes or plumbing fixtures.	Periodic backwashing required. Periodic recharging with potassium permanganate is required.
	Prevents odors caused by hydrogen sulfide (rotten egg smell).	Should be installed upstream from a water softener.
Activated Carbon Filtration	Removes general taste and odor problems including chlorine.	Generally does not remove nitrates, sulfates, bacteria or heavy metals.
	Usually installed at the point-of-use for drinking and cooking.	Periodic replacement of activated charcoal (usually in canisters) is required for continuous operation.
Reverse Osmosis	Reduces heavy metals, most pesticides, and fluoride to acceptable levels.	Does not remove all organic chemicals such as chloroform. Does not remove 100% of most chemicals.
	Used primarily for drinking and cooking.	Uses large amounts of water for flushing.
Distillation	Removal of dissolved minerals, trace amounts of heavy metals and many organic chemicals.	Produces bland tasting water.
	Used primarily for drinking and cooking.	Requires significant energy, therefore small capacity units are used.
Chlorination	Disinfection of biologically contaminated water supplies, "shock" treatment of wells and storage tanks.	Not recommended as a continuous practice for the control of bacteria in private water wells. A new, bacteria free source of water should be found.
	Aids in the removal of high levels of iron and manganese.	Additional treatment is required to remove residual chlorine and chlorinated organics.

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