CommonWaterTreatmentProblemsTheirSourcesAndRemedies08252017

What you should know:

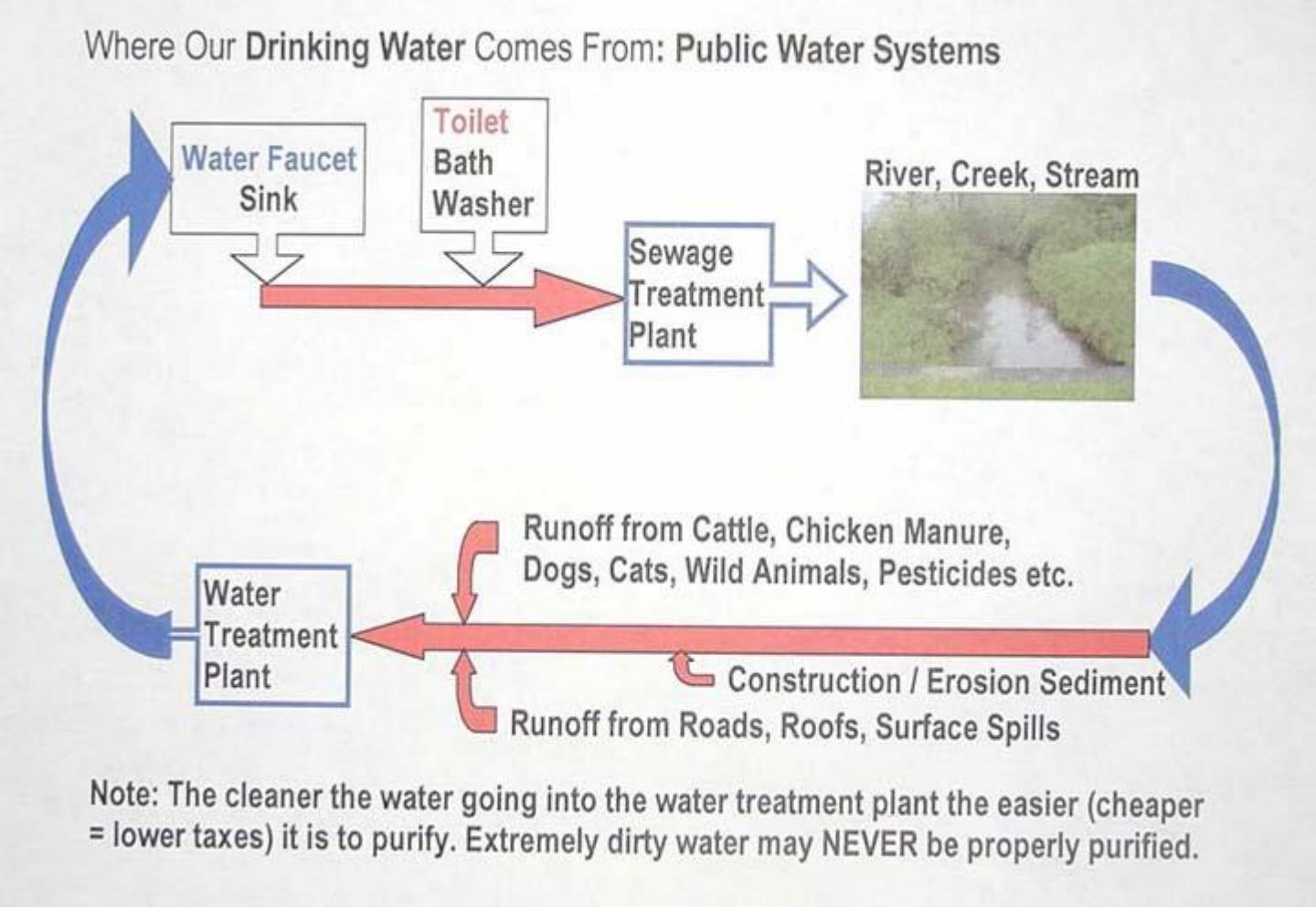
1. If you are on a public water system

2. If you are on a small private system or a well

3. There is no such thing as a free water test

The following applies to public water systems (those serving 15 or more hookups or those that serve 25 or more persons on a year-round basis) but DOES NOT apply to small private systems, which go essentially unregulated, and are most susceptible to bouts of unidentified and unreported contamination. We can help you with these private systems too!!! But...

If you are on a public water supply how can we help you?



Your water treatment plant is ALLOWED to produce water for you to drink, that contains "acceptable" levels of arsenic, lead, mercury, pesticides, herbicides, various mineral contaminants and even most bacteria. The reason being, that it is too expensive to remove ALL of these contaminants completely. The treatment plants would go broke. The tax payers would not stand for it. The results they report in their annual "Water Quality Reports" are average values, which means that some days the values may be far greater than acceptable levels and other days they may be below acceptable levels. If you want to know what is coming to your home (after miles of transport through pipes in the ground), so you can design and install a proper, cost effective, water treatment system that purifies the water of those contaminants found in your tap water, then you should have the same battery of tests done that are recommended for well water in your area.

Once you know what is in the water (a relatively inexpensive -$198) test, you will be able to save money by NOT installing devices you do not need. Also, you will purify and improve the taste of your water to standards that exceed bottled water, and never need to buy another bottle of water. Imagine the savings of that alone. Over $300.00 per year, per average family (according to consumer reports). If you live in North Georgia, chances are YOU DO NOT NEED a water softener or softening system. But you are likely to need some other forms of purification. Don't let anyone do a cheapo "dip stick" test and tell you otherwise. Even if you choose not to use our services (which are the best in this part of the country), use a professional, independent lab, so you know you are not getting scammed out of your hard-earned money.

All public systems are required to disinfect the water. Many use chlorine to disinfect. We have found (by testing in our homes - at the point of use) that the water from our public system contains NO CHLORINE at certain times. This means the water is not being properly disinfected, and E. coli as well as other disease causing organisms could survive in the system. Chlorine does not kill Cryptosporidium cysts, Giardia cysts, certain viruses and is ineffective if large amounts of sediment enter the system during rainstorms. So even when chlorine is at its proper levels, there are still disease causing organisms that can get through the system unaffected. Now, the more modern systems are beginning to use other forms of disinfection including ozonation and ultraviolet treatment to kill the resistant cysts, but relatively few systems are employing that technology at this point. Why do we not hear more about these incidents? Why don't more people get sick? Because most of us are healthy and have strong immune systems, and are neither infants nor elderly. And because many people who do get ill have no idea what caused the illness. Just as with food poisoning, many cases go unreported simply because the affected individuals assume the food and water to be safe, and therefore do not consider it as the possible cause of their "intestinal flu" or "upset stomach" or "24 hour bug" or their diarrhea or mild fever.

However, as the population ages and more individuals are on medications that suppress their immune system, more people will be affected. Some seriously. (Also, some experts believe Cryptosporidium is one of the most likely agents to be weaponized and used in future terrorist attacks)

We can help you determine at the point of use (your home) whether the water quality you receive is as good as what the water treatment plant pumps (or reports in its Water Quality Report). Long distances and ageing of water delivery systems, construction damage, sudden drops in water pressure, and other factors can all contribute to degradation of water quality on the way to your home. There is no better way than a water quality analysis to be sure your water is safe

Not all water systems are alike. Some are very good at purifying water. Some are not as good. Some get their water solely from high quality surface or groundwater while others must rely on contaminated supplies, or intermittently clean supplies.

All public systems are required to test the water they produce. But during peak periods many systems are unable to keep up with demand and water quality is periodically compromised.

During rainstorms and periods of flooding or other high-flow periods water can pass through sewage treatment and water treatment systems without being properly treated (this is especially true systems in rapidly growing areas where the systems are already operating at or near their capacity. This is why we periodically hear about large sewage spills into surface streams and the Chattahoochee River. By the way, the Chattahoochee and some of these creeks are surface water supplies for many municipal water treatment facilities, so these problems are carried downstream from the accident site)

All public systems are required to report and correct violations. Do you know how often your system has been in violation of drinking water quality standards, what its violations are and what if anything was done to correct them? If not, we can find out for you. This is public information which the law requires be available to consumers of the water. (Please keep in mind that it is estimated by some authorities that 88 percent of all violations go unreported)

We can help you find out what your system's Water Quality Report says

We can help you find out how often your system has been in violation.

We can guarantee, if you follow our recommendations, that your water will be completely safe to drink no matter what system is supplying it, and we can also

guarantee that you will have the best possible purification system if you want it. (Many people have had water "filters" installed, which while they are filtering the water provide no protection against biological agents and a variety of toxic chemical agents. These people are operating under the misconception that because their water is being filtered, it is being purified. In fact, some of the filtration units are adding contaminants to the water. Please have your water tested to be sure your water is clear of contaminants both biological and chemical. **Free water tests cannot detect the kinds of contaminants we are referring to here. If you want to be sure your water is safe, contact us toll free at 1-866-626-1716**

If you are on a well or small private system:

There are no laws requiring anyone - the well driller, the home inspectors, the county government, the mortgage companies or others, to determine if your well water is safe to drink. (There are laws requiring testing of all water being used by the public, but private individuals are responsible for their own safety.) It is prudent to test a well at least once before consuming the water on a regular basis. And especially if there is a pregnancy in the home, if young children or infants are drinking the water.

The EPA recommends testing private water supplies once a year. We would add that any water supply in an area where there has been land disturbing activity be tested again because this is a most likely time for introduction of new contaminants.

Whether you get your water from the city, county, local system, bored well or a drilled well, heavy rains produce turbid waters. When turbid water enters your purification system it can "choke" the filters and render them ineffective. This is true of home filtration systems and water treatment plant (public) filtration systems.

When mechanical filters are choked, the flow of water through them is reduced. Slow flow, inadequate or reduced flow volumes or rates indicate that there is a problem which must be corrected.

Unfortunately, when other types of filters (including charcoal) are "choked" there may be a temporary color change in the water or there may be no observable indication whatsoever that the filter is no longer working properly. When this happens chemical pollutants move through the filter as if it were not there, but you may not notice any difference at your tap.

Many people drill or use wells in which the water has not been tested because they do not know that many toxic substances such as arsenic, nitrate, mercury, and lead are tasteless, odorless, colorless, and clear at toxic levels. Yet these compounds are not

uncommon in urban areas with many lawns, near golf courses, agricultural areas, or mining areas, or industrial areas depending on the type of industry.

In some cases the water coming into a home purification (filtration) system is of such good quality that filters may not need to be changed for years. In other cases, one month of use will exhaust the filters. Sometimes a single heavy rainfall will result in exhausted filters. To make wise decisions about how often to replace the cartridges in a filtration system, and to do it in the most cost effective way (save money) yet safe way, it is best to test the water entering and exiting the system at set intervals. If this testing indicates that the cartridges only need to be replaced once every two or three years, you can save considerable money by not replacing the cartridges needlessly. If testing indicates that your cartridges become exhausted every 5 months, you will know to replace them in time to keep your drinking water pure. In either case you have maximized both effectiveness of purification and cost effectiveness by performing just a few water tests at the point of use.

Why guess? Why overspend? Why take unnecessary risks?

P.S. Proper PURIFICATION can protect you against biological and chemical agents that might be added to the water intentionally.

Safe Water for Families

From the EPA:

Terms used and links to Underground Injection Control Program
http://www.epa.gov/safewater/uic/cl5oper/glossary.html

National Primary Drinking Water Information and Regulations
http://www.epa.gov/safewater/mcl.html

Cesspools: http://www.epa.gov/safewater/uic/cl5oper/cesspools.html

There is no such thing as a "free" water test. Companies who offer free tests are trying to sell you something else, which is usually much more expensive. If you want, or need, a water test please choose a laboratory that:

- has nothing to gain or sell based on the results

performs testing according to rigid quality standards and industry or government-established guidelines

performs ALL the tests using appropriate standards and calibrations

has knowledgeable professionals who understand and explain the results to you

can tailor the testing to your specific needs

does not pressure you to make a purchase

has staff that are qualified to make recommendations for correcting problems if they do exist - solutions are part of our business

We Meet or Exceed ALL these criteria.

WATER SOURCES INCLUDE:

Well water, spring water, tap water, wastewater, surface water (pond, streams, and lakes), bottled water, water supply for food/beverage industry, industrial plants, and domestic or farm animals.

AWSA can provide “on site testing” with immediate test results for many parameters.

DOES YOUR WATER HAVE A TASTE, COLOR, OR ODOR?

Many household water filters do not remove toxic organic/inorganic chemicals, minerals, or viruses that can harm your health. Any taste, color, or smell should be investigated.

DO YOU OR YOUR FAMILY MEMBERS HAVE A WELL?

High mineral content or corrosives in water significantly reduce the life expectancy of appliances that use water; including, hot water heaters, dishwashers, filtration units, plumbing, and irrigation systems.

DOES YOUR COMMUNITY NEED ITS OWN SEWAGE OR WATER TREATMENT FACILITY?

AWSA can help you establish, operate, and maintain such a facility.

DOES YOUR SPRING, CREEK, POND, OR LAKE CONTAIN HIGH NUMBERS OF BACTERIA OR COLIFORMS?

We can screen for such bacteria. AWSA has access to all environmental tests currently available in the USA, and we can help solve pollution problems if they exist.

What you don't know CAN hurt you: http://www.epa.gov/safewater/dwinfo.htm

Neither the federal nor the state governments require any testing of well water serving less than approximately 25 people. They do however recommend you test your well at least once a year, and at times when you suspect a problem. Aquifers are subject to contamination in a variety of ways including introduction of toxins into nearby (or even distant) abandoned wells.

We wish to provide a service that will help you be certain that the water you, your children, domestic animals, and pets are drinking is free of contaminants, and safe to drink. This region of the US still has the best water to be found anywhere in the country, and in most cases bottled water and filtration are not necessary. The cost of a single preliminary screen can be recovered in a short time, and will give you peace of mind.

It is prudent to test the well and surface water we are drinking, as recommended by the EPA, at least once a year.

SOME COMMON WATER TREATMENT PROBLEMS AND THEIR SOLUTIONS

pH

Sources: dissolved acid and alkaline materials

Symptoms: pitting of pipes and fixtures, bitter or metallic taste (low pH); slippery feel, soda taste, scaly deposits (high pH).

A pH of 7 is considered neutral. pH values above seven (7.1 -14) are considered basic, pH values below seven (0 – 6.9) are considered acidic. The higher or lower the number the more basic or more acidic the substance is. One of the most common causes of corrosion in private water systems is from low pH waters (acidic - less than 7.0 pH). Low pH can result in leaching of iron, manganese, copper, lead, and zinc from the aquifer, plumbing fixtures, and piping. It can also cause increased leaching of other harmful substances from the ground surrounding the well. Signs of acid water are corrosion of fixtures, blue staining (from copper pipes) or rust staining (from iron pipes). Corrosion of plastic pipes and soldering can produce vinyl chloride, a carcinogen, which is released into the water in PVC (polyvinyl chloride) distribution systems. High pH water, with a pH > 8.5 could indicate that the water is hard. Hard water does not pose a health risk, but can cause aesthetic problems

Often, water is of high quality, but is low in buffering calcium minerals, and high in dissolved carbon-dioxide gas, which can cause the low pH or acidity.

Treatment:

Treatment is accomplished by neutralizing the water with the use of an automatic neutralizer. Water tanks are filled with a blend of calcium and magnesium carbonates made from naturally occurring minerals, which dissolve into the water, making it less corrosive. Periodically, (once or twice a year for a typical residential application) more mineral is added to the filter tank.

In some cases, instead of dissolved carbon dioxide causing the low pH or acidity, the acidity is caused by mineral acids, either natural or from mining or other industrial wastes. With mineral acids the pH is usually very low, less than 5.0. Treating this type of water requires injection of soda ash or sodium hydroxide with a metering pump, and generally, the neutralizing type mineral filters described above will not work well on this type of water.

VISUAL AND MICROSCOPIC EXAM:

These examinations are very powerful tools in making determinations about water quality, but are not performed by the health department, the extension services or other laboratories because they do not have the personnel who are trained or experienced at making microscopic observations and it costs a great deal of money to hire a trained and experienced microbiologist. This type of examination is therefore deemed “cost prohibitive” and not performed by any other service except at very high prices (100’s to 1000’s of dollars). There is no substitute for directly

observing the presence of microorganisms. One of the drawbacks of coliform testing is that it can return negative results even when dangerous microorganisms are present, but if organisms are seen under a microscope there is no doubt that they are present. And they can be observed even if they do not give positive results using the "field" tests that are normally used to test for their presence.

At a magnification of 30x it is unlikely that bacteria or viruses will be observable, since most are too small. However, the microscopic predators of bacteria (Protozoans, amoebas etc), as well as fungi, nematodes (worms), insects, crustaceans, arthropods, their remains, or cysts of various eukaryotic protozoa and other microorganisms are observable and can be identified. Their presence indicates the presence of smaller microorganisms upon which they feed. Examination at higher magnifications will reveal the presence of bacteria. Thus, if they are observed and coliform and E. coli tests are negative other microbial contamination is very likely present, and further testing is recommended. Coliforms indicate that there may have been fecal contamination of the water supply, but the presence of other, larger organisms, can give information about the source or nature of that contamination, or that other types of microorganisms which may pose a health risk may be present.

When other results come back negative, a positive microscopic observation can indicate the need for further action and prevent serious health problems.

ARSENIC

Cause: Dissolved **arsenic** from natural deposits in soil or from agricultural activity or from wood that has been treated with arsenic containing preservatives to prevent rotting or other forms of damage, or from industrial processes. Arsenic is used in alloys with lead, in storage batteries, and in ammunition. It is widely thought that naturally occurring arsenic dissolves out of certain rock formations when ground water levels drop significantly. It may contaminate commercial phosphates in fertilizers and laundry detergents; be found in pesticide residues; or be a byproduct of smelting, glass making and coal mining operations. Surface arsenic-related pollutants enter the ground water system by gradually moving with the flow of ground water from rains, melting of snow, etc. Either way, ongoing testing for arsenic is an important strategy by the private water system owner to safeguard the health and well being of their family.

Like many chemical contaminants in drinking water, the element is potentially hazardous at levels or concentrations that do not impart a noticeable taste, odor, or appearance to the water.

The average abundance of arsenic (As) in the earth's crust is 1.8 ppm; in soils it is 5.5 to 13 ppm; in streams it is less than 2 mg/L, and in groundwater it is generally less than 100 mg/L. It occurs naturally in sulfide minerals such as pyrite (fools gold).

Severe poisoning can arise from the ingestion of as little as 100 mg arsenic trioxide; chronic effects may result from the accumulation of arsenic compounds in the body at low intake levels over longer periods of time. Arsenic compounds are thought to cause skin and lung cancer; as well as liver and kidney damage even at very low doses if they are consumed regularly over a period of time. It is for this reason that it is especially important to test the water you are drinking when you use it in one place for a long time. There is no such thing as a safe level of arsenic in the water. The lower the level of arsenic, the lower your risk of toxic effects, but the only way to be sure of avoiding adverse effects is to remove all arsenic from your drinking water. As with other chemical contaminants, arsenic is especially dangerous to developing fetuses.

Treatment:

The following water treatment technologies are effective in reducing arsenic from drinking water:

1. Activated alumina filters
2. Anion exchange
3. Distillation
4. Reverse Osmosis
5. Nanofiltration

Pretreatment may be needed in some cases to ensure acceptable treatment by the primary unit. Also, as a safeguard against organic arsenic, granular activated carbon filtration should be added. Some of the treatment technologies may not be amenable to point-of-entry, whole house treatments. In these cases, point-of-use units may be the best option. Periodic testing should be maintained after the treatment system is in place to ensure objectives are being met.

NITRATE:

POTENTIAL HEALTH EFFECTS

"The primary health hazard from drinking water with nitrate-nitrogen occurs when nitrate is transformed to nitrite in the digestive system. This leads to the condition known as methemoglobinemia (sometimes referred to as "blue baby syndrome"), in which blood lacks the ability to carry sufficient oxygen to the individual body cells causing the veins and skin to appear blue.

A potential cancer risk from nitrate (and nitrite) in water and food has been reported. As with arsenic, mercury, and other compounds, there are no safe levels of nitrate in drinking water. A possibility exists that nitrate can react with amines or amides in the body to form nitrosamine which is known to cause cancer. Nitrate must be converted to nitrite before nitrosamine can be formed. The magnitude of the cancer risk from nitrate in drinking water is not known.

Bacteriological contamination in water may contribute to an individual's susceptibility to the presence of nitrate. All drinking water sources also should be tested for bacteriological contamination, particularly if the nitrate-nitrogen level exceeds the 10 mg/L standard. The presence of both nitrate and bacteriological contamination may indicate poor well location or construction, and possible contamination from surface drainage, feedlots, sewage systems, or some other source."

Since nitrate is very water soluble, and moves through the ground fairly easily, we have chosen this parameter together with coliform testing to provide us with warning that further testing or inspection of the well or water distribution system and its location may be in order.

Treatment Solutions:

Nitrate can be removed from the drinking water using Nitrate specific filtration (usually very expensive) distillation or reverse osmosis.

BACTERIA

There are many types of bacteria that can potentially be present in water, and now more than ever, it is important to make sure that any water system is safeguarded against contamination.

The health department and other government entities will typically do a test for coliform bacteria (coliforms), as these have proven to be good indicators of certain problems in the past. But they do not test for fecal coliforms, which are far better indicators of the likelihood of the presence of disease causing organisms (nor do they perform microscopic examinations). It is a good idea to test 3 or 4 times per year, as water conditions can change seasonally. Our test includes tests for coliforms and tests for E. coli, which is a fecal coliform. If E. coli is present it is extremely likely that your water has been contaminated by a warm-blooded animal's fecal material.

Treatment:

There are two main ways of treating bacteria in water.

Chlorine is the standard form of treatment used in municipal systems. Chlorine is a toxic substance and must be used under strict controls with any water treatment system.

Ultraviolet (UV) lights have become the main treatment method for rural residential and commercial systems because of their ease and reliability. When using UV lights, it is important to understand that there are pre-requisites, as outlined by the manufacturers.

- Water flow rates must be recognized to determine the correct size of UV light.
- Sediment must be filtered down to at least 5 microns.
- Levels of Hardness, Iron and Manganese must also be minimal to avoid staining on the lamp's internal sleeve. Any staining can shield bacteria from the UV rays, letting it pass without any direct UV penetration.
- The maximum levels recommended are Hardness <7 grains per gallon, Iron < 0.3 parts per million, and Manganese <0.05ppm. Humic and Fumic acid, and Tannins are more uncommon factors that can absorb the effectiveness of UV rays.

If turbidity is high, neither of these methods of treatment is very effective. Also, if there is a substantial amount of organic matter present in the water, these treatments can be rendered ineffective and other treatment methods should be chosen.

It is therefore crucial to have your water tested by a water treatment specialist before installing a UV system.

Most importantly, it is critical to identify the source and correct the problem that is causing positive coliform and E. coli tests. This is most important, because all other measures are only temporary solutions, and if they fail will put you at serious risk of illness.

TOTAL AND FREE CHLORINE

For municipal water treatment, chlorine tends to be the most widely used bacteria control method. At times this can be very undesirable, especially in a residential setting. Chlorine is a disinfectant added by man that should be analyzed immediately (on site) because it does not remain stable and can evaporate from solution to give false low readings. Testing for chlorine should be done along with coliform and other bacterial testing to determine whether or not bacterial growth may have been inhibited by the presence of this disinfectant. Some private well owners have needed to install chlorination units into their water supply to assure that it is safe to drink.

Large amounts of organic matter, turbidity, sediment, or bacteria will bind the available "free" chlorine and reduce the ability of chlorine to disinfect the water. In fact, if there is enough organic matter in the water it can render chlorine completely ineffective. This is why water parks have on occasion had outbreaks of e coli or other problems despite the fact that they chlorinate the water. Also, it is for this reason that both total chlorine and the amount that is left "free" in the water are important to determine. Excess "free" chlorine can react with organic substances (if they are present) to produce trihalomethanes such as chloroform and other halogenated hydrocarbons, which can be very toxic. These "byproducts" of chlorine disinfection are a necessary risk associated with chlorine disinfection, but can be kept to a minimum if the amount of chlorine that is added to the water does not exceed the amount needed for disinfecting the water, and if the amount of organic matter in the water is reduced as much as possible.

Problems associated with chlorine in excess of 250 mg/L (milligrams/liter) in your drinking water, can include high blood pressure, salty taste, corroded pipes, fixtures and appliances, blackening and pitting of stainless steel. However, the EPA does not consider chlorine to be a primary health concern. The common chlorinating compounds are unstable. As a result the water, which arrives at the your faucet, rarely has any chlorine in it, but often has some level of trihalomethanes (THMs). THMs include chloroform, chlorodibromomethane, bromodichloromethane and bromoform. These are considered to be carcinogens when they occur in sufficiently high quantities. The EPA recommends the total THMs (TTHMs) not exceed 0.01 mg/L or parts per million (ppm). Some studies show a slight increase in the incidence of bladder, colon and rectal cancer amongst those whose primary water source is chlorinated water.

Carbon filtration is the method of removing chlorine.

COLOR, ODOR, TASTE, TURBIDITY

Color:

Sources: iron, copper, or manganese; organic chemicals; organic matter

Symptoms: visible tint

Milky: precipitation of carbonates, excess air bubbling through the solution, suspended solids or particulates

Reddish: presence of precipitated or dissolved iron or iron reducing bacteria

Yellow: presence of humic of fluvic compounds, iron, or iron reducing bacteria

Blackish tint: reactions with manganese and possibly iron; iron reducing or slime producing bacteria

Odor:

Sources: dissolved gases, minerals, chemicals; leaking underground storage tanks; landfill or septic run-off; organic matter

Symptoms: "rotten-egg," septic, musty or chemical smell. 3 Threshold Odor Number (TON)

1. Rotten egg odor: hydrogen sulfide gas, sulfate-reducing bacteria; soft water reactions in electrical water heaters
2. Musty, grassy, fishy, vegetable and cucumber odors: products produced by algae
3. Oily smell: gasoline or oil contamination, possibly bacteria
4. Methane gas: organic matter decomposing or presence of gas in the aquifer
5. Phenolic: industrial or gasoline contamination
6. Chemical: organic chemicals or industrial products

Taste:

Sources vary but closely parallel the substances that cause odors, and in addition include substances such as salty taste due to various mineral salts, bitterness from organic substances such as alkaloids or acids (such as tannic acid), and metallic from iron, manganese, copper or zinc.

Turbidity (also see Sediment):

Is the measure of light absorbed by water because of its content of suspended matter. In most cases some type of backwashing mechanical or ceramic filtration will remove most of the suspended solids from the water. If the particles are extremely fine, then a coagulation-filtration process is recommended. Increases in turbidity can also indicate the presence of bacteria or other disease causing organisms, high mineral content, or high content of other suspended solids. Concurrent tests for bacteria and TDS can help rule out some of these possibilities.

Sediment

Sediment can enter a water supply through cracks or breaks in the system, from the well itself, or from material flowing into the well on the surface or farther down where the shaft passes through layers that do not allow surface water to penetrate deeper into the soil. Rarely, the pump or water feed line need to be relocated.

It is important to remove sediment before the water enters an Ultraviolet Light (UV) purification system, distillation system, chemical disinfection (ex., chlorination) system and most water softeners and filters. It can reduce the life and reliability of the media bed, but more important, it can render disinfection and purification ineffective thus allowing disease-causing organisms to survive the disinfection process.

In fact, sediment often contains nutrients that encourage the growth of microorganisms in the system or filters where the sediment and organic material are trapped. If the amount of sediment is minimal, inexpensive replaceable cartridge filters are used. These filters come in a variety of micron sizes, typically from 50 microns down to 1 micron. Filters of less than 2 microns will protect against cysts of eukaryotic parasites and many bacteria, but may become obstructed (“clogged”) very quickly and do NOT protect against water-borne viruses.

NOTE: this “sediment filter” is usually the ONLY kind of filtration that is installed in a homeowner’s system. When homeowners are told they have a “water filter” or “filtration system” this is the kind of filter that is being referred to. Occasionally builders will also refer to water softening units as “filters”, but like sediment filters, these do not provide any protection against disease causing organisms or toxic chemicals. These filters do NOT remove toxic chemicals or disease causing viruses. They only remove bacteria and parasites if the pore size is 2 microns or less, and most filters that are installed in these systems DO NOT have such a small pore size, so they allow virtually everything except large mineral particles to get through to your kitchen tap. Usually, all these home filtration systems remove is mineral sediment and large soil particles which helps prevent water lines from becoming clogged.

Treatment:

If there is a major sediment problem, ceramic backwashing filters are the solution otherwise a woven fabric or similar mechanical filter will do very well. Keep in mind that sediment will almost surely contain organic matter along with minerals, bacteria and other substances. It therefore makes an ideal medium to support growth of possibly dangerous bacteria, algae, and fungi. So it is important to change these kinds of filters regularly, even when relatively little material has been trapped.

TEMPERATURE

There is no limit to drinking water temperature. However, the temperature of water in the ground and distribution system leading to the water faucet determines how much and what kind of substances can be dissolved in the water. Lower temperatures generally mean higher concentrations of gasses such as oxygen, carbon dioxide, nitrogen, hydrogen sulfide, and others can be dissolved in the water. Also, as temperature increases higher concentrations of minerals can dissolve in that water. So, as water temperatures in your water heater, appliances or distribution system drops, minerals will be more likely to precipitate (deposit) on the insides of those appliances. During winter, the water coming from a well will be warmer than the distribution system leading to the house, and some minerals may deposit in those lines.

Freezing temperatures can cause a great deal of temperature related damage.

Treatment:

Protect system against freezing by winterizing wherever possible. Bury distribution systems deeply enough to avoid hard freezes. Provide an enclosure for wells, pumps, pump housings, and plumbing leading into and out of the well, insulate exposed areas and plumbing, and provide enough heat to prevent freezing.

Inspect system seasonally for freeze-thaw damage, and test water regularly to reveal hidden problems (breaks, cracks, slow leaks, surface water intrusion, etc.) that are not visible to visual inspection, but may potentially affect drinking water safety.

TOTAL DISSOLVED SOLIDS (TDS)

Description: TDS is a measurement of all dissolved mineral and metal content in a water supply, expressed in parts per million (ppm.). The dissolved minerals and metals are both dissolved in water in the form of positively charged (cations) and negatively charged (anions). This includes the cations Phosphorus, Potassium, Calcium, Magnesium, Manganese, Iron, Aluminum, Boron, Copper, Zinc, Sodium, Cadmium, Nitrogen, Chromium, Molybdenum, Mercury, Arsenic, and the anions Chloride, Fluoride, Phosphate, and Sulfate as well as others. Ideally, we recommend that TDS measurements be performed frequently with an annual test for these specific ions at the same time as the TDS to provide a baseline for understanding the TDS reading.

Symptoms: Water that leaves deposits on fixtures after evaporation, has a salty or brackish taste, or has a known content of mineral in excess of accepted drinking water standards. Of particular concern are nitrates, arsenic, heavy metals, and several others. The US EPA secondary drinking water regulations / standards call for less than 500 ppm TDS and places limits on most of the other minerals that the TDS measurement detects.

Treatment Solutions: Reverse osmosis (RO) systems and distillation systems will reduce TDS. Water softeners will usually NOT reduce TDS but they will change the concentrations of specific minerals in the water by increasing the sodium content in exchange for reducing the content of calcium and magnesium.

Commercial reverse osmosis systems will reduce TDS for POE (point of entry) applications.

Reverse Osmosis systems cannot be used on water that is microbiologically unsafe or of unknown quality without adequate disinfection before or after the system.

POE systems should be considered when working water is unusable for washing, bathing, etc. These systems require adequate storage, usually to an atmospheric storage tank (followed by pressurization to restore line pressure. RO water can be aggressive to plumbing and fixtures. Passing the water through a bed of calcite will minimize the aggressive tendencies and protect plumbing and fixtures; however, it will add hardness to the water.

Reverse Osmosis systems require soft (less than17 ppm hardness) iron free (less than 0.3 ppm) water with a minimum pressure of 35 pounds per square inch. These conditions can be met by pretreatment procedures if the water does not naturally meet these requirements. .

CALCIUM, MAGNESIUM, HARDNESS

The U.S. Department of Interior and the Water Quality Association classify water hardness as follows:

Classification	mg/l or ppm	grains/gal
Soft	0 - 17.1	0 - 1
Slightly hard	17.1 - 60	1 - 3.5
Moderately hard	60 - 120	3.5 - 7.0
Hard	120 - 180	7.0 - 10.5
Very Hard	180 & over	10.5 & over

Source:

Pure groundwater dissolves any water-soluble substance it comes in contact with and carries it to your well. Of all the substances that are found in groundwater calcium and magnesium are the primary contributors to water hardness. As calcium and magnesium levels increase water hardness increases. If groundwater becomes slightly acidic, it is a more effective "dissolver" of minerals and is more likely to contain high amounts of calcium or magnesium. While these constituents do not particularly cause health concerns for most people, they can cause a variety of other problems.

Symptoms:

High levels of calcium and magnesium reduce the ability of soap and water to clean. Soap curds form and deposits on skin and hair. All soaps and detergent become less effective and clothing does not become clean during washing, is left appearing dinghy and feeling scratchy and harsh to the skin. Hair will appear dull and lifeless. A film forms on dishes, glasses, shower doors, shower walls, tile, bathtubs, toilets, sinks, fixtures, inside your plumbing, on heating elements (such as the hot water heater). Pipes can become clogged, reducing water pressure. Scale

forming on heating elements causes them to overheat and prematurely "burn out". It shortens the life of water heaters, coffee makers, and all other appliances using water and has been known to clog plumbing so severely that entire distribution systems had to be replaced.

Treatment / Solutions: Water Softeners

a) Borax or washing-soda based softeners form an insoluble precipitate that tends to make the water cloudy, cause deposits on materials exposed to the water and increase alkalinity which can cause damage to materials and skin.

b) Complex phosphates can bind and thereby remove magnesium and calcium. This is a method that is labor intensive and generally only used in industrial applications, and it does not remove calcium or magnesium, but simply prevents their deposition on substances that come in contact with the water.

c) Typical household water softening units use a resin with negatively charged particles on its surface. Addition of salt (sodium chloride) to the water in the system fills the negatively charged sites on the resin with positively charged sodium ions. As incoming well water passes over the resin the positively charged magnesium and calcium ions replace the positively charged sodium atoms that were used to "charge" the system. Sodium atoms are released from the resin into the water, thus increasing the sodium content of your household water but reducing the levels of magnesium and calcium. Your water is softened, but the system must be recharged with more sodium, has a limited life, and sodium content of water for heart and blood pressure patients may be an issue. This is called an "ion exchange" water softening system.

CORROSIVITY:

Description: Corrosion is the deterioration of plumbing, concrete, and / or fixtures associated with specific water characteristics

Symptoms: Leaks, pinholes, encrustations on metallic plumbing and fixtures. Pitted or leaking pipes; metallic taste; staining due to lead, copper, iron or zinc dissolved from plumbing. Water

heater, water tank or element failure. Blue-green staining on fixtures. Rusty water not originating from the groundwater .

Sources: Acid pH (< 6.7), CO_2 (carbon dioxide gas), dissolved oxygen, electrolysis, old galvanized pipes or pressure tanks. Source depends on temperature, acidity, hardness, and oxygen content of water.

Treatment based on source:

Source	Solution
Acid pH	Upflow neutralizer or PF backwashing filter with calcite for pH between 5.5 and 6.7. Lower pH will require addition of Corosex or sodium carbonate feed pump
CO2 (carbon dioxide)	Aeration followed by neutralizer or sodium carbonate feed pump
High Dissolved Oxygen	Polyphosphate feed, chemical pump or cartridge type
Electrolysis	Eliminate dissimilar metal contacts (dielectric unions). Assure proper grounding
Galvanized plumbing	Eliminate galvanized plumbing and holding tanks

Additional:

Water softeners do not make water more corrosive. However, installing a softener can uncover corrosive tendencies in a given water supply by removing the hard scale inside of plumbing and fixtures. Make sure softener installations do not interrupt grounding, and use similar plumbing materials.

Use caution when applying any water processing equipment to galvanized steel plumbing. Disrupting this type of plumbing can shake loose built up corrosion inside and taint the product water. Water can be improved, but old plumbing cannot be.

Saturation Index and Recommended Action		
Saturation Index Value	Description	Recommendations

-5 to –2	Moderate to Severe Corrosion	Treatment is Recommended
-0.5 to –1.9	Mild Corrosion	Treatment should be considered
0.0	Balanced	Treatment not needed
0.5-1.9	Mild Scale Forming	Treatment should be considered
2-5	Moderate to Severe Scale Formation	Treatment is Recommended

IRON OR MANGANESE

Symptoms: Black staining on fixtures

Sources: Dissolved **iron** or **manganese**

In deep wells, where oxygen content is low, the iron/manganese-bearing water is clear and colorless (the iron and manganese are dissolved). Water from the tap may be clear, but when exposed to air, iron and manganese are oxidized and change from colorless, dissolved forms to colored, solid forms.

Oxidation of dissolved iron particles in water changes the iron to white, then yellow and finally to red-brown solid particles that settle out of the water. Iron that does not form particles large enough to settle out and that remains suspended (colloidal iron) leaves the water with a red tint. Manganese usually is dissolved in water, although some shallow wells contain colloidal manganese (black tint). These sediments are responsible for the staining properties of water containing high concentrations of iron and manganese. These precipitates or sediments may be severe enough to plug water pipes.

Iron and manganese can affect the flavor and color of food and water. They may react with tannins in coffee, tea and some alcoholic beverages to produce a black sludge, which affects both taste and appearance. Manganese is objectionable in water even when present in smaller concentrations than iron.

Iron will cause reddish-brown staining of laundry, porcelain, dishes, utensils and even glassware. Manganese acts in a similar way but causes a brownish-black stain. Soaps and detergents do not remove these stains, and use of chlorine bleach and alkaline builders (such as sodium and carbonate) may intensify the stains.

Iron and manganese deposits will build up in pipelines, pressure tanks, water heaters and water softeners. This reduces the available quantity and pressure of the water supply. Iron and manganese accumulations become an economic problem when water supply or water softening equipment must be replaced. There also are associated increases in energy costs from pumping water through constricted pipes or heating water with heating rods coated with iron or manganese mineral deposits.

A problem that frequently results from iron or manganese in water is *iron or manganese bacteria*. These nonpathogenic (not health threatening) bacteria occur in soil, shallow aquifers and some surface waters. The bacteria feed on iron and manganese in water. These bacteria form red-brown (iron) or black-brown (manganese) slime in toilet tanks and can clog water systems.

The method used to test water for iron and manganese depends on the form of the element. If water is clear when first drawn but red or black particles appear after the water sits in a glass, dissolved (ferrous) iron/manganese is present. If the water has a red tint with particles so small they cannot be detected nor do they settle out after a time, colloidal (ferric) iron is the problem.

Typically, laboratory tests are needed only to quantify the extent of iron and manganese contamination, but testing of additional water parameters such as pH, silica content, oxygen content, hardness and sulfur may be necessary to determine the most appropriate water treatment system.

Treatment:

1. Phosphate compounds (*less than 3 mg/l iron*)
2. Water softener (*<5 mg/l combined concentrations of iron and manganese*)
3. Oxidizing filter (manganese greensand or zeolite) (*<15 mg/l combined concentrations of iron and manganese*)
4. Aeration (pressure) (*<25mg/l combined concentrations of iron and manganese*)

5. Chemical oxidation with potassium permanganate or chlorine; followed with filtration (*>10 mg/l combined concentrations of iron and manganese*)

Chloride

Sources:

Natural minerals, seawater, road salt, fertilizers, industrial waste, sewage

Secondary standard maximum concentration limit is 250 mg/L

Symptoms:

Salty taste, corroded pipes, fixtures and appliances, blackening and pitting of stainless steel. Nuisance Chemical: Cosmetic or Aesthetic (Taste, Odor, Color, Rash). The recommended maximum contaminant level is 250 mg/L, since the chloride ion imparts a salty taste to the water. If ions of Calcium and Magnesium are present, the chloride ion may not impart a salty taste until over 1000 mg/L

Treatment:

Prevent salt-water and surface water intrusion into the underground water supply.

Distillation and reverse osmosis and ion exchangers are the preferred methods of removal.

TOTAL PHOSPHORUS

Source and Symptoms:

Phosphorus in the form of phosphates occurs naturally in rocks, mineral deposits, in living and decaying plant and animal matter, chemically bonded to sediments, partially treated and untreated sewage, agricultural sites (fertilizers and animal waste), lawn fertilizers in urban areas, treated boiler waters and in laundering and commercial cleaning agents. Phosphates are present in such small amounts in nature that they are usually one of the nutrients, which by its absence, limits the growth of photosynthetic organisms such as plants and algae. Then why test for it in well or surface waters? Because its presence is a good indication that the water has become contaminated by surface water, sewage, animal waste, or other human activities. Also, because if it is present in more than very small amounts it will lead to “algal blooms, the overproduction of

algae, bacteria, and their toxins in streams, ponds, lakes, or translucent water reservoirs, and can result in fish kills and other very serious water quality problems. There is no limit given by the EPA for phosphate consumption. Digestive problems can occur at very high levels, but it is an "unregulated" contaminant in drinking water. Together with coliform testing, and nitrate testing it can be extremely important in revealing potential contamination by organisms that can cause disease.

We have observed significant algal growth in clear plastic sediment filters used in household plumbing. (Many algae produce chemical compounds which have disagreeable, odors and tastes, and some produce toxins that are released into the water where they grow. All produce nutrients that help bacteria and other organisms to grow.)

Treatment:

The following water treatment technologies are effective in removing phosphate from drinking water:

1. Anion exchange, 2.Distillation, 3.Reverse Osmosis, and 4.Nanofiltration

The following information is an excerpt from the Remco Engineering Web site but will be very helpful to homeowners who would like to know more about household water treatment …and get that information from reliable sources.

The following links will take you to sites that review the basic treatment technologies. Each source (your water) should be analyzed and specific treatments tested before you invest in a system.

HOUSEHOLD WATER TREATMENT LITERATURE ON THE WEB

Click on the highlighted web address to go to the web page listed. Hit back on your browser (right click mouse) to get back here if you want more.

Site visits are not always necessary! Forward samples direct to us. Call us for full details.