Frequently Asked Questions

The Water FAQ List

INFORMATION

Water Basics

Water is generally classified into two groups: Surface Water and Ground Water. Surface water is just what the name implies; it is water found in a river, lake or other surface impoundment. This water is usually not very high in mineral content, and many times is called "soft water" even though it usually is not. Surface water is exposed to many different contaminants, such as animal wastes, pesticides, insecticides, industrial wastes, algae and many other organic materials. Even surface water found in a pristine mountain stream possibly contains Giardia or Coliform Bacteria from the feces of wild animals, and should be boiled or disinfected by some means prior to drinking.

Ground Water is that which is trapped beneath the ground. Rain that soaks into the ground, rivers that disappear beneath the earth, melting snow are but a few of the sources that recharge the supply of underground water. Because of the many sources of recharge, ground water may contain any or all of the contaminants found in surface water as well as the dissolved minerals it picks up during its long stay underground. Waters that contains dissolved minerals, such as calcium and magnesium above certain levels are considered "hard water" Because water is considered a "solvent", i.e., over time it can break down the ionic bonds that hold most substances together, it tends to dissolve and 'gather up' small amounts of whatever it comes in contact with. For instance, in areas of the world where rock such as limestone, gypsum, fluorspar, magnetite, pyrite and magnesite are common, well water is usually very high in calcium content, and therefore considered "hard".

Due to the different characteristics of these two types of water, it is important that you know the source of your water -- Surface or Ground. Of the 326 million cubic miles of water on earth, only about 3% of it is fresh water; and 3/4 of that is frozen. Only 1/2 of 1% of all water is underground; about 1/50th of 1% of all water is found in lakes and streams. The average human is about 70% water. You can only survive 5 or less days without water.

What is hard water?

Hard water is the most common problem found in the average home. Hard water is water that contains dissolved hardness minerals above 1 GPG.

What are hardness minerals?

Calcium, Magnesium, and Lime are the most common.

How do you Measure Hardness?

Parts per million or grains per gallon are the most common. One part per million (PPM) is just what it says: out of one million units, one unit. Grains, or grains per gallon (GPG) is a weight measurement taken from the Egyptians; one dry grain of wheat, or about 1/7000 of a pound. It takes 17.1 PPM to equal 1 GPG.

Why Should Hard Water Concern Me?

For many uses, it would not matter. For instance, to put out fires, water your lawn, wash the mud off the streets or float your boat, water would have to be pretty hard to cause a problem. But for bathing, washing dishes and clothes, shaving, washing your car and many other uses of water, hard water is not as efficient or convenient as "soft water." For instance:

- you use only 1/2 as much soap cleaning with soft water.
- because hard water and soap combine to form calcium soap, an insoluble curd that can't be rinsed off, forming a bathtub ring on all surfaces and dries leaving unsightly spots on your dishes.
- when hard water is heated, some of the hardness minerals are re-crystallized to form hardness scale. This scale can plug your hot water pipes and water heater, causing premature failure, necessitating costly replacement.
- the calcium soap remains on your skin even after rinsing, clogging the pores of your skin and coating every hair on your body. This curd can serve as a home for bacteria, causing diaper rash, minor skin irritation and skin that continually itches.

- for many industrial uses, the hardness minerals interfere with the process, causing inferior product production.

Who Will Test My Water for Hardness?

If you are connected to a municipal supply, call the water Superintendent, or City Hall. They can either provide the answer, or direct you to the proper individual. Remember the conversion factor: it takes 17.1 PPM to equal 1 GPG. In other words, if your water has 171 PPM calcium in it, divide 171 by 17.1 to get the answer in grains. This example would be 10 grains, or GPG.

If you are on a private supply, you could contact your county extension agent: collect a sample in an approved container and send to the city or state health department for testing: find a testing lab (try the yellow pages)

By the way, if you are on a private well, YOU, AND YOU ALONE are responsible for the safety of the water you and your family drink. You should test your supply for bacteria at least once per year and other contaminants at least every three years -- more under certain conditions. To be on the safe side we recommend UV sterilization for all well water. It is up to you to make sure your family is protected from disease causing bacteria if you have a private well.

My Water is Hard; Now What?

If your water tests over 3 GPG hard, you should mechanically soften it. Softening water that is less than 3 GPG, while it makes your shaving and bathing more comfortable, is considered a luxury due to the fact that the cost is more than your savings. Over 3 GPG, you will save enough to pay for the cost and maintenance of a water conditioner.

As of this writing, the most economical way for you to soften your household water is not an ion exchange water softener. This unit uses sodium chloride (salt) to recharge man made plastic like beads that exchange hardness minerals for sodium. As the hard water passes through and around the plastic like beads, the hardness minerals (ions)

attach themselves to the bead, dislodging the sodium ions. This process is called "ion exchange". When the plastic bead, called Resin, has no sodium ions left, it is exhausted, and can soften no more water. The resin is recharged by flushing with salt water. The sodium ions force the hardness ions off the resin beads; then the excess sodium is rinsed away, and the resin is ready to start the process all over again. This cycle can be repeated many, many time before the resin loses its ability to react to these forces.

What Should I look for in a Water Conditioner?

Make sure the unit has enough resin to treat all the water you and your family will use. As of this writing, the average usage per day, per person (including children), for inside the house is 87 gallons. You should also be shown two or three ways to initiate recharging the unit.

The oldest way is by a time clock, i.e., your water usage is calculated and the frequency of recharging programmed into the timer. On the appointed day, at the appointed hour, the unit recharges. If all went as calculated, ok. If you were gone -- too bad -- you just wasted salt and water. If you had extra company -- too bad -- you ran out of soft water. You must pick a unit that will treat one days supply of water and still have about 40% of the resin in the recharged state. This will provide you with the most efficiency for salt and regeneration water.

A second way to initiate recharge is by electronic sensing. By electronically checking the resin, these units can determine when the resin needs to be recharged -- this is a great help when your water hardness changes, when you have extra company or when you are gone for a few days. These 'sensor' units can save you up to 42% of your salt and recharge water as well as keep you in soft water when you have extra guests.

A third way to initiate recharge is by using a meter. These units have a meter installed in the water line and simply measure how many gallons of water you actually used. The unit is set according to your water hardness, and will recharge when the gallons used approach exhaustion of the resin bed, saving you a high percentage of your recharge salt and water.

Many variations of these methods are on the market. Some use computers to calculate in advance, when to recharge the unit; some have two resin beds (tanks), and switch back and forth between the two, keeping you in soft water all the time, at the highest efficiency. These systems are most effective in high-hardness waters, i.e., over 10-12 GPG, and over 4 people in the family. Low hardness water and smaller families do not require the extra expense of these options.

I Have a Water Conditioner, Now my Water Feels "Slimy"

When the hardness minerals are removed, soap no longer forms a soap curd, or "bathtub ring" on your skin, plugging your pores, clinging to every strand of hair. You are now truly clean. That slick, slimy feeling you feel is your natural body oils -- without the soap scum. The old saying that you get "squeaky clean" is a myth; that feeling was caused by the soap scum on your skin. By the way, that soap scum provided an excellent place for bacteria to hide and grow, causing numerous minor skin ailments.

My Water Stinks! What can I Do?

First, you must learn a little about your nose: Once you smell some things, your sense of smell is dulled for a short while, and you can't make accurate judgments of smell. For instance, if I blindfold you, let you smell gasoline, hand you a piece of onion to eat and tell you it is an apple, you can't tell it's not because your nose isn't working properly!! (Your sense of taste isn't working either -- smell and taste are closely related and affect each other!)

So, to correctly analyze your problem, you need to become a detective. The best time to locate the smell is after you have been away from home for a few hours -- this allows your nose to become sensitive to "that smell" again. With your 'sensitized' nose, go to an outside spigot -- one that the raw, untreated water flows from. Turn it on, let it run a few minutes, then smell it. If it smells -- we found it. If not, we must look further. (Many, many smells are not in the raw water at all, they are introduced into the water inside the house.) Go to a cold, treated water spigot inside the house, turn it on and let it run a minute; then smell. If this water smells,

and the outside, untreated water didn't -- you must have a device (cartridge filter, water softener, etc.) in the water line that needs to be cleaned and sanitized.

If it is a cartridge, or 'string' filter, replace the element and sanitize the housing. If you have a water conditioner call the Company where you bought the unit for advise on how to sanitize the unit. If you rent the unit, just call! You can sanitize the unit by pouring Hydrogen Peroxide or Chlorine Bleach in the brine well of the salt tank, and placing the unit into regeneration. Check with the seller, or, if they are no longer in business, any Professional Water Conditioning Dealer for how much to put in your particular unit.

If the cold, treated water inside didn't smell, turn on the hot water and let it run a few minutes -- does it smell? If it does, chances are you have a sacrificial anode inside your hot water heater that is "coming apart at the seams" and throwing off a "rotten egg" odor. This obnoxious smell will drive you right out of your shower! The only solution is to remove the anode from the heater, voiding your warranty, or replace it with a new one made with aluminum alloy. This anode is placed in a (glass lined) hot water heater to seal up any cracks in the glass lining and prevent corrosion of the heater tank. You will find the anode on the top of the heater; remove the tin cover and insulation -- look for what looks like a pipe plug -- about 3/4 inch in size with a 1 1/16"fitting. Turn off the heat source and the water; have someone hold the tank to prevent it from turning, and unscrew the "plug". You will find that the 'plug' has a 30 - 40 " long pipe (or what's left of one) attached to it. Hopefully, most of the rod is still attached -- just corroded. If so, replace the plug with a real pipe plug and throw the anode away. If part of the rod has corroded off, and fallen into the heater, you may have to try to fish it out. Either way, before you plug the hole, pour about 2 pints of chlorine bleach into the heater first. This will kill the smell left in the heater. If, after a week or so, the smell returns, you must fish out the rod that is in the bottom of the tank. Good Luck!

OK, It's my Raw Water That Smells -- Now What?

First, you must determine what is causing the smell, and how strong it is.

Minor, musty smell

If it is a minor, or low-level smell, you MIGHT be able to solve it with a small, point-of-use carbon filter. You can place these types of filters on the water line going to the cold water where you draw you drinking water. Or, you might solve it with a whole-house filter on your incoming water line to filter all of the water inside your home.

Because carbon removes smells by ADsorbtion, i.e., the smell "sticks" or "adheres" to the carbon particles, you must be careful not to exceed the manufactures recommended flow -- some filters even have a flow restriction built in them. If you run water through them too fast, you will not remove the smells. Whenever you place a carbon filter in your water line, you must be sure to replace the element and sanitize the housing on a regular basis. Carbon filters remove organics from water, and the bacteria found in water like to eat organics -- the carbon filter is a nice, dark place, just full of food for them to grow and reproduce in. Regular and routine replacement will help prevent any buildup of bacteria in the cartridge.

Strong, rotten-egg smell

Strong, rotten-egg odors in the raw water is usually the result of the decomposition of decaying underground organic deposits. As water is drawn to the surface, hydrogen sulfide gas can be released to the atmosphere. In strong concentrations, this gas is flammable and poisonous. It rapidly tarnishes silver, turning it black. It is toxic to aquarium fish in sufficient quantities. As little as 0.5 ppm hydrogen sulfide can be tasted in your drinking water.

Strong, musty smell

If you are unlucky enough to have this problem, you should look for a company that has local experience in dealing with this problem. There are three basic ways to solve this problem for homeowners.

Filters

Installation of a whole house filter loaded with a media that is specific for hydrogen sulfide removal is successful many times. These types of filters must be recharged with chlorine or potassium permanganate. The removal capacities of these types of filters are usually fairly low, and must be sized to contain enough media to prevent premature exhaustion, and subsequent passage of the smell to service. It is also typical that the amount of hydrogen sulfide can fluctuate rapidly, causing great difficulty in sizing the unit. In addition, potassium permanganate is extremely "messy", and will leave stains that are very difficult to remove.

Feeders

Feeder systems consist of a small pump that injects small amounts of chlorine (usually) into the incoming water. The water must then be held for a short period of time to allow the hydrogen sulfide to precipitate out of the water. This tank should be designed in such a manner that the water that enters it will mix thoroughly with the water in the tank, to assure complete reaction. The water then should pass through a filter to remove both the precipitated matter and the chlorine remaining in the water. You should be aware, however, that whenever you mix chlorine with organic materials (remember where hydrogen sulfide come from!), the chances are very high that trihalomethanes (possible cancer causing carcinogens) will be formed. Also, feeder maintenance is high, you should be prepared to "play" with the unit frequently.

Aeration

Aeration consists of breaking the incoming water into small droplets (spray) into the air, drawing fresh air through that spray, collecting the water into a storage tank, repressurize the water, passing it through a particulate filter to catch any particles that might be carried out of the storage tank. The air drawn though the spray must be vented outside the house -- remember, it is toxic and explosive. Although this system necessitates another pump to repressurize your supply, you are not adding any chemicals to your water, which makes it attractive. This system is low maintenance and no chemicals to purchase. Initial cost may be higher, however, and space requirements may be greater.

Water that stains

I have Red Stains in my Sinks and Other Fixtures -- Help!

Red stains are normally caused by iron in the water. You must test to determine the amount and the type of iron you have. Some types are: oxidized, soluble, colloidal, bacteria or organic-bound. All are a problem! It only takes 0.3 ppm to stain clothes, fixtures, etc.

Oxidized

This type of iron is usually found in a surface water supply. This is water that contains red particles when first drawn from the tap. The easiest way to remove this type of iron is by a fine mechanical filter. A cartridge type filter is usually not a good solution, due to the rapid plugging of the element. Another method or removal is by feeding a chemical into the water to cause the little particles of iron to clump together, and then fall to the bottom of a holding tank, where they can be flushed away.

Soluble

Soluble iron is called "clear water" iron. After being drawn form the well and contacting the air, the iron oxidizes, or "rusts", forming reddish brown particles in the water. Depending on the amount of iron in the water, you may solve this problem with a water conditioner, or a combination of softener and filter. You may use an iron filter that recharges with chlorine or potassium permanganate, or feed chemicals to oxidize the iron and then filter it with a mechanical filter. You can sometimes hide the effects of soluble iron by adding chemicals that, in effect, coat the iron in the water and prevent it from reaching oxygen and oxidizing.

Colloidal

Colloidal iron is very small particles of oxidized iron suspended in the water. They are usually bound together with other substances. They resist agglomeration, i.e., the combining together of like substances forming larger, heavier, more filterable ones, due to the static electrical

charge they carry. This iron looks more like a color than particles when held up in a clear glass, as they are so small. Treatment is usually one of two: Feed chlorine to oxidize the organic away from the iron, thus allowing agglomeration to occur, or, feeding polymers that attract the static charge on the particles, forming larger clumps of matter that is filterable.

Bacterial

Iron bacteria are living organisms that feed on the iron found in the water, pipes, fittings, etc. They build slime all along the water flow path. Occasionally, the slimy growths break free, causing extremely discolored water. If a large slug breaks loose, it can pass through to the point of use, plugging fixtures. These types of bacteria are becoming more common throughout the United States. If you suspect bacteria iron, look for a reddish or green slime buildup in your toilet flush tank. To confirm your suspicions, gather a sample of this slime and take it to your local health department, or water department for observation under the microscope. This type of iron problem is very hard to eliminate. You must kill the bacteria, usually by chlorination. You must use high amounts of chlorine throughout your plumbing system to kill all organisms. You may find it necessary to feed chlorine continuously to prevent regrowth. A filter alone will not solve this problem.

Organic bound

When iron combines with tannins and other organics, complexes are formed that cannot be removed by ion exchange or oxidizing filters. This iron may be mistaken for colloidal iron. Test for tannins; if they are present, it is most likely combined with the iron. Low level amounts of this pest can be removed by use of a carbon filter, which absorbs the complex. You must replace the carbon bed when it becomes saturated. Higher amounts require feeding chlorine to oxidize the organics to break apart from the iron and cause both to precipitate into a filterable particle.

I Have Blue or Green Stains on my Fixtures -- Help!

You either have copper in your water supply, or you have copper pipes and corrosive water. Test for copper in your water. Test the pH, total dissolved solids content and the oxygen content of your water.

Copper

Copper can be removed by ion exchange, i.e., a water softener. The removal rate is about the same as it is for iron.

Copper pipes and corrosive water

If your pH is from 5 to 7, you may raise it by passing the water through a sacrificial media. By sacrificing calcium carbonate into the water, the corrosively will be reduced. If the pH is below 5, you will need to feed chemicals into the water.

If the corrosively is caused by excess oxygen, the hot water will be much more corrosive than the cold. Treatment is by feeding polyphosphate or silicates to coat and protect the plumbing, or to aerate the water to release the excess oxygen.

Water and health disease

Improving your drinking water

Filters; what can they do?

There are many types of filters available in the market place today. I will try to group them by the method they use to filter water. Almost everyone has seen the ads for the filter that fits on the end of your kitchen sink or bathroom spigot. These filters usually use two basic types of filtration: a filter 'pad' catches the large (usually over 25 micron in size) particles or 'chunks' , and a small amount of carbon to adsorb organics and/or chlorine. The main problem here is the flow rates at which they are expected to work at. The consumer expects to turn the tap on as normal and draw "filtered" water. To remove free chlorine, for instance, standard engineering practices set the maximum flow rate at 10 gallons per minute per square foot (144 square inches) of surface area of the carbon, *if* you

are using a standard 30" bed depth. To remove chloramines or organics, the maximum flow rate is set at 5 gallons per minute per square foot of surface area. If your spigot will provide a flow of 1.5 gallons per minute, what size filter do you need hanging on the end of that spigot to insure that the chlorine and organics will not be swept past through the filter, into your glass? If you purchase this type of filter, make sure it has a way of limiting the rate at which water passes through it.

Next comes the cartridge type filter. Most common are the 10 1/2 or 20 inch long filters. This type filter will usually have a removable housing, into which different types of "elements" can be placed. A sediment filter cartridge element can be manufactured to remove certain size particles and larger. Most elements for home use will indicate 30 or 50 micron and larger removal. More expensive elements, usually for industrial use, may indicate a particle size (in microns) and add the words "Absolute" after it. No, it isn't Vodka, it simply means that if it says 5 micron absolute, it means it! Very few particles larger than 5 microns will pass through the filter. The regular filter may say 25 microns, meaning that *most* of the particles 25 microns and larger will be caught by the filter. Remember, there filters actually get better, or more effective, as they are used. The 'junk' in the water collects on the surface of the filter and becomes a part of the filter as well. As it builds up, progressively smaller and smaller particles are trapped, and the flow rate through the filter slowly diminishes. This slowing of the flow rate can be a source of problems to water using appliances in your home. If you use such a filter, regular changing of the filter element is very important. Elements for these filters can also be carbon (block or granular, or powdered), can be manufactured for use in hot water, can be ceramic, pleated as well as many other configurations. Some manufacturers are mixing a small amount of silver into the carbon to help prevent any bacteria growth in them. This has yet to be a proven methodology. In fact, make sure that such a filter doesn't give off more silver than is allowed, if not rinsed thoroughly prior to use, especially after a prolonged period of non-use. Remember, all filters, carbon especially, trap organics that bacteria feed on, and as the water sits without moving, they can multiply rapidly. Always change the elements on a regular, frequent basis.

Selective Resins

A relative newcomer to the market, some small filters now contain resins that only remove specific things from the water, such as Nitrates, Fluoride or Lead. Technology is rapidly changing in this area; If you have a need for such a device, you should ask for supporting test results from an independent testing lab to verify that the unit will perform as advertised. Many states now have legislation that requires such data be provided to you prior to purchase.

Deionization

Used mainly in labs, manufacturing processes, or for serious aquarium owners, DI filters are actually more complex than a filter. True filters, unlike the selective resin and DI units, work on a mechanical basis: they just 'catch' the particles that are too large to fit through the spaces between the filter media. (Well, I fibbed a little; but who wants to know about the Van Der Waals or Coulomb forces?) DI works by ion exchange, just like a water softener. Just as a water softener exchanges sodium for hardness minerals, a DI unit will have two types of resin in it: Cation and Anion. Basically, the Cation resin (like in a water softener) removes the ions with a positive charge, while the Anion resin removes those ions with a negative charge. Instead of using salt as a regenerant, acid and caustic are used. Some small DI cartridges are sold as "throw-aways", others can be returned for regeneration and reuse. These small units can treat only small amounts of raw, city water. Usually, it is much more economical to pretreat the water feeding a DI system with reverse osmosis water.

Distillation

One of the oldest methods for cleaning water is distillation. Simply put, you boil water, catch the steam, and condense it back into water. Theory is, the minerals stay behind in the boiling chamber, and only *pure* water ends up in your container. In the real world, most of those things do happen; but if you do not perform preventative maintenance on your still, you can get very poor results. Distillation will kill bacteria, viruses, cysts as well as remove heavy metals, organics, radionuclides, inorganics and

particulates if properly maintained. One thing you must watch out for is VOC's (volatile organic chemicals). These chemicals have a lower boiling point than water (like benzene), and can vaporize and mix with the steam, carrying over into the product water. Some stills today have a volatile gas vent -- a small hole at the top of the condensing coil that allows the venting of such substances. Many distillers have a carbon filter to "polish" the product water before use and to remove any VOC's that may carry over. The energy used to treat a gallon of water is usually about 3,000 watts, or about 25 cents per gallon (average) in the US. This treatment method requires that you 'plan ahead' and make and store water for use, which makes it somewhat less appealing. The more elaborate units will make and store water automatically, but raise the initial investment and maintenance of the equipment.

Reverse Osmosis

This is a process that is often described as filtration, but it is far more complex than that. We sometimes explain it as a filter because it is much easier to visualize using those terms. We should remember that osmosis is how we feed each cell in our bodies: As our blood is carried into the smallest of capillaries in our bodies, nutrients actually pass through the cell wall to sustain it's life. Reverse osmosis is just the opposite: We take water with "nutrients" (in this case, junk) in it, and apply pressure to it against a certain type of membrane, and, presto -- out comes "clean" water. Lets review the basics: If you take a jar of water and place a semi-permeable membrane (like a cell wall? or a piece of skin?) in it, dividing the jar into two sections, then place water in both sides to an equal level, nothing happens. But, if you place salt (or other such substance) into one side of the jar, you will notice that, after awhile, the water level in the salty side begins to rise higher as the unsalted side lowers. This is osmotic pressure at work: The two solutions will continue to try to reach the same level of salt in each side by the unsalted water passing through the membrane to dilute the salty water. This will continue until the "head" pressure of the salt water overcomes the osmotic pressure created by the differences in the two solutions. On the other hand, researchers have discovered that if we take that membrane and feed water with sufficient pressure to overcome the osmotic pressure of the two waters, we can

'manufacture' clean water on the side of the membrane that has no pressure. We sometimes say we "filter" the water through the membrane. Depending on the membrane design, and the material it made from, the amount of TDS (total dissolved solids) reduction will range from 80 to over 95 per cent. Different minerals have different rejection rates, for instance, the removal rate for the membrane I am looking at now is 99.5% for Barium and Radium 226/228; but only 85.9% for Fluoride and 94.0% for Mercury. Removal rates are very dependant on feedwater pressures, and some membranes are not tolerant to high or low pH. For home use, it is important to make sure you get an RO *System*; i.e., a sediment prefilter, a carbon prefilter, membrane, storage tank and post carbon filter. Some of these filters may be combined into one, i.e., the prefilter may be a particulate and carbon both. A lot of comments have been made concerning the *wasting* of water by an RO. True, the old style units with the early type membranes were more prone to becoming plugged, or fouled by the "junk" they removed from the water. To help keep this from happening, a small amount of water was allowed to run across the membrane to help carry away those impurities to drain. Early designs only recovered 1 gallon of good water for every 4-8 gallons used to keep the membrane clean. Even worse, when your storage tank was full, water still ran to the drain because the early membranes were made of a material that the little bugs in your water supply (no, not pathogens, or dangerous to you in small numbers) loved to eat! So to prevent that, we just let the water run so they couldn't have time to stop and eat. :>) Now membranes are made to not only recover a much higher percentage of the feedwater, but the bugs don't eat them! Newer systems not only recover more, they can have a shut off device that stops all water flow when the storage tank is full. Actual recovery rate is dependant on several factors, including the TDS, and just what the TDS is composed of, in your feedwater. Temperature, pressure also have a big effect on the amount of product water you can make in a given period. Remember, all RO units are normally rated using a feedwater temperature of 77 degrees F -- is your feed water temperature that high?

What is the best water for Coffee?

Well, that a good question! After visiting with many coffee people, I have

gathered the following as a basis for recommending the "perfect water" for coffee.

1. All oxidants removed. (Chlorine or other such sanitizers".)

2. All organics removed. (You know, dead fish, tadpoles, THM's, insecticides, pesticides, etc)

3. TDS (total dissolved solids) from 60 to 100 ppm (parts per million)

4. Hardness of about 3-4 grains per gallon. (51.3 to 68.4 ppm)

5. Low sodium water, i.e., less than 10 mg/L.

6. pH depends on the Bean you are using, plus the method of extraction.

7. Iron, Manganese and copper gone, or less than 0.02 ppm.

What is the best way to get this type of water?

There is no single answer for this question, however, if we assume you are getting your water from a municipal supply, we *assume* the Iron and Manganese problems are taken care of by the city plant. (Some towns may not solve these problems -- you be the judge!) Copper *may* come from the supply itself, or, if the water is aggressive enough, it may actually be picked off the copper plumbing in your house as it sits overnight in the pipes. (Lead can also be leached out of the older "sweat" joints that may have used solder that contained lead.) It is best to "clear the pipes" the first thing in the morning before using any water for ingestion. Simply run enough water to clear your pipes of the 'overnight' standing water that *may* have picked up the harmful metals from your pipes -- use it to water your house plants. If we use a good, properly sized carbon filter, we will substantially reduce the organics and oxidants in the water, as well as remove most of the particulates. However, we still have TDS and Hardness to worry about. If we soften the water, we do not reduce the TDS, we simply *exchange* the hardness minerals for Sodium -- which we don't want for coffee! The best answer (usually) is the reverse osmosis system. This *system* usually has a particulate and carbon filter (organics, oxidants and particulates are reduced); and a membrane

(reduces the TDS by about 90% -- including hardness, sodium and others as well); all linked together in one flow path.

We can greatly improve the coffee by using any one of the above mentioned methods, but if we combine them, we get, for all practical purposes, the *best* water for your coffee! Rule of thumb: With an RO System, whatever impurities were in the water are typically reduced by 90% or more, leaving only water behind, which is what we really wanted, anyway!

How much sodium does Ion-Exchange add to my water?

For every grain of hardness in your water, 7.5 mg of Sodium will be *added* to each quart of water by the ion-exchange method. If you have water that is 10 grains per gallon hard; you will add 75.0 mg of Sodium per quart of water softened by ion-exchange. To put that in perspective, one 8-oz glass of milk contains 120 mg of Sodium, one slice of white bread contains 114 mg of Sodium. You must also remember that there is *probably* Sodium in the raw water, too. If your city supply treats your water by a "hardness reduction" treatment plant, you can be sure that the Sodium level in your water has increased as a result -- how much? Call your plant operator and ask -- it is information free to the public.

Water Testing Information

When Should I test?

Several factors will influence when and how often you test your water. Where do get your water from? Has that source changed? Have you done any plumbing changes lately? Is there reason to believe that your water is contaminated? Is there a sickness or illness in your family affecting more than one person and over a longer than normal time period?

If you receive your water from a "Public Supply", i.e., a municipal supply, or a supply that provides water to more than 25 persons for 60 days per year (some states are different -- check with YOUR local water department), you can be fairly certain that the water supply is checked on

a regular basis. The frequency of the testing is based on the number of people served, and may vary from more than once per week to once per month, or even less. Under these conditions, test when you move into a new residence to acquire a "base line" of contaminant level, if any. Retest every three years, unless you have reason to believe that something has changed that could affect the quality of your water.

If you have a private well, you are the only person who is responsible for the water your family drinks and bathes in. I recommend testing by your local Health Department every six months for Bacteria and Nitrate. These two tests serve as indicators for other types of contamination -- that is not to say forget the other tests; just that if you get a "bad" test from them, you should also retest for the other types of contaminants as well. Private wells should be tested on a regular basis for Pesticides, Herbicides, Metals, Organic and Inorganic chemicals and volatiles. Currently, no laws govern the frequency of such testing -- that is why I say YOU are the only person responsible for your family's water. I recommend an initial test (for a base line), and then at least once per year. Remember, one day after testing and finding "no contaminants", your source could become contaminated.

What Could I Test For?

Coliform bacteria are a group of microorganisms that are normally found in the intestinal tract of humans and other warm blooded animals, and in surface water. The presence of these organisms in drinking water suggest contamination from a surface or shallow subsurface source such as cesspool leakage, barnyard runoff or other source. The presence of these bacteria indicate that disease-causing (pathogenic) organisms may enter the drinking water supply in the same manner if preventive action is not taken. Drinking water should be free of coliforms.

Cysts and viruses are microbiological contaminants, usually found in surface water supplies. Giardia Lamblia cysts can cause giardiasis, a gastrointestinal disease. Another "bug" getting a lot of attention lately, is Cryptosporidium, single-cell parasite measuring about 2 - 5 microns in diameter. Many surface water supplies contain this pest, which also comes from the intestine of warm blooded animals.

Nitrate in drinking water supplies may reduce the oxygen carrying capacity of the blood (cyanosis) if ingested in sufficient amounts by infants under 6 months of age. This could cause a disease called "methemoglobinemia", or "blue baby" syndrome. The EPA has established a maximum contaminant level (MCL) for nitrate at 10 mg/l (ppm) measured as N. Unlike coliform or other types of bacteria, boiling the water will actually INCREASE the amount of nitrate remaining in the water, increasing the danger to infants. If you have high nitrate water, either treat it with an approved treatment methodology or find another source: Boiling will only make it worse!

Lead is now known to leach from older sweat joints in copper pipe. As the water sits in the pipes, small amounts of lead 'dissolve' into the water, contaminating it. Lead is particularly harmful to small children as they more rapidly absorb the toxic substance into their systems. The EPA has estimated that more than 40 million U.S. residents use water that contains more than the recommended levels.

An Easy Way to Test

National Testing Laboratories, Inc. in Ypsilanti has a five bottle testing kit, which is supplied by many water quality professionals across the nation. You simply follow the directions in the kit and return the sample to the lab. They test your sample and then report to you. Your test results will be a two page report showing contaminant level, a cover letter explaining the test results and what you should do.

ANODE RODS IN A WATER HEATER

Publication date: 01/12/2002

Warm up to your water heater and make sure it's in working condition

By Glenn Haege / Special to The Detroit News

When was the last time you did any maintenance on your water heater? Do you even drain a quart of water from the bottom of the hot water tank every three months to remove sediment? When was the last time you checked the anode rod to see if it needs to be replaced? Come to think of it, do you even know what the anode rod is or where it is located?

Hot water is an integral part of our lives. We love to take nice hot showers on cold crispy mornings, and nothing sooths like a nice hot bath. Hot water typically accounts for about 14 percent of our utility bills, according to government statistics.

Despite its importance, most of us forget our hot water tank the day after it is installed. Then, when problems start, we gripe that the darned thing only lasted seven to ten years.

Some of the complaints about hot water tanks on my radio show include: *"We're not getting enough hot water." "The water is starting to smell like rotten eggs." "I'm starting to get this popping sound."*

There are good reasons for all of these complaints. Hot water heaters do tend to become less effective over the years. This is especially true if the water heater is not maintained properly.

According to the people at A. O. Smith, (800) 433-2545, one of the largest manufacturers of water heaters, the most common cause of smelly water is non-toxic sulfate-reducing bacteria. The rotten egg smell is a by-product of the bacteria that convert sulfate in the water to hydrogen sulfide as part of the bacteria's life process. The bacteria get into the water through construction, a break in ground piping, or a well system.

Factors that increase the likelihood of having the bacteria in your water supply, include having a well, using a water softener or not using the water system for a prolonged period of time.

Most hot water heaters have aluminum anode rods. If your hot water is giving off a rotten egg smell, the easiest solution is to replace the aluminum anode rod with a non-aluminum anode rod, such as the A. O. Smith KA90 or State Industries Replacement Kit, No. 9000029.

Should changing the anode rod not correct the problem, the water tank and hot water lines may need a chlorine bleach bath. This procedure kills the bacteria with a ten-to-one water and bleach solution. After the bath, the tank and lines have to be continuously flushed. Something this involved should be done by a plumbing professional.

The anode rod is a tube that extends from the top 39 to 54 inches down into the tank. The rod keeps metal parts and connections in the tank from corroding through a chemical process called cathodic protection.

Most anode rods are made from aluminum. They are also made from magnesium and a combination of magnesium and zinc. The anode rod creates an electrical charge that prevents metallic ions from going into the solution and corroding. The rod is self-sacrificial and wears away over time. When the rod is not replaced in time, metal parts and connections start to corrode, causing premature replacement of the water heater.

Water tanks can also start making sounds, including everything from water hammering to popping and crackling. Water hammering can be severely destructive. It is caused by water sent through pipes under pressure being stopped abruptly. The jolt sends a shock wave back through the water line. The shock wave rocks back and forth between the water heater and the point of stoppage until the destructive power subsides.

Single lever faucets or the automatic solenoid valves in dishwashers and washing machines often cause the water hammer effect. The faster the valve closes, the greater the intensity of the shock. At its worst, the water

hammer effect can expand the water tank shell by increasing water pressure in the tank beyond its capacity or collapse the flue tube at the top of the water heater.

The best remedy for this problem is to install water hammer arrestors, like those made by Precision Plumbing Products, (503) 256-4010, as close to the source of the closure as possible. The arrestors prevent damage by absorbing the shock wave in an air cushion.

A much smaller problem is the rumbling, crackling or popping sound associated with mineral buildup in the water tank. The popping sound is caused by water trapped under lime deposits escaping or being boiled away when trapped above the heating element.

A product called Mag-Erad by Tri Brothers Chemical Corporation dissolves the mineral buildup so that it can be flushed from the tank. The project takes about two hours, according to the water-heating specialists at Hartford and Ratliff, (800) 466-3110.

Mag-Erad costs about $18 a container. Two containers are needed for a 30- or 40-gallon water heater and three containers for a 40- or 60-gallon water heater. If you have an older water heater, the folks at Tri Brothers say you may need more Mag-Erad to do the job.

Give your water heater the attention it deserves, and it will last for many years. Forget about it, and you will soon be getting that *"cold shoulder"* treatment in the shower.

WATER

Water is important to your body. Approximately 70% of your body is water; 85% of the gray matter of the brain is water. Water is important in equalizing the temperature throughout the body. Water serves as a lubricant for moving surfaces such as joints, the heart and intestines. Water dissolves or holds in suspension other materials in your protoplasm. The sense organs of equilibrium depend upon the presence of water. Sound is conducted through the inner ear. The transparency of the media of the eye to light is maintained by water. Water (cerebrospinal fluid) serves as a cushion for the brain and spinal cord. Water moistens the surface of the lungs for gas diffusion. Water is the medium for digestion, absorption, metabolism, secretion and excretion. (These processes can only take place in the presence of water.) Doctors recommend drinking 8 glasses of water daily for good health. Chemicals and other impurities in our drinking water can attack and damage our vital organs. With all these important functions of water in your body… Doesn't it make good sense to put only high quality conditioned water into your body?

The Benefits of Chlorine:

Chlorine kills bacteria, fungus, algae and mold in municipal water delivery systems. Chlorine kills and inhibits algae and bacteria growth in swimming pools. It is most commonly known as bleach. Chlorine makes your drinking water appear to be pure and refreshing.

The Disadvantages of Chlorine:

It does not remove harmful metal contaminates present today in most water systems. Chlorinated water affects the taste of everything it's mixed with. Examples: Coffee, Tea, Juices, Soups & all concentrated or powdered food products. But worst of all… There is overwhelming evidence that prolonged and continued ingestion of chlorine and harmful metals (such as lead) causes serious health problems and increases the risks of cancer.

Why You Shouldn't Drink Chlorinated Water

Chlorine added to water acts as a disinfectant to kill disease-causing microorganisms that can infect humans. Fifteen years ago it was discovered that chlorine reacts with naturally occurring organic material and synthetic organics to produce by-products called trihalomethanes (THM's). The THM's have been found to be highly mutagenic and carcinogenic (cancercausing). The National Cancer Institute recently published a study showing that trace amounts of THM's increase our risk for bladder cancer which inflicts over 40,000 people a year. They found that long-term exposure, 40 to 60 years, to chlorinated drinking water could increase your risk for bladder cancer by 40 to 80 percent. This is pretty serious considering that according to the EPA about 75% of the U. S. population drinks chlorinated water.

How Can the Problems be Solved?

By Point of Entry and Use Filtration.

This type of filter lets the chlorine stay in the delivery system to do the good for which it is intended. The chlorine is removed immediately on demand at the time of point of entry or use. Harmful metals and other contaminates can also be removed at the same time, if the filter is designed to do so.

We recommend THREE GRADES of water for our homes. 1) Utility Grade for outside use, lawns, fighting fires, etc. 2) Conditioned Grade for washing clothes, dishes, cars, showers, etc. 3) Food Grade for cooking and drinking.

If your water has over 2 grains of hardness, you need conditioned water.

Each year we waste $1.8 billion on cleaning supplies, $2.7 billion on plumbing damages, $1 billion replacing washables and linens and $800 million on fuel bills because of hard water. With conditioned water you can save up to 80% on laundry soap and clothes stay brighter, fluffy and last longer. Reduce the need for expensive hair conditioners, conditioned water leaves no soap curd that results in dry, flaky scalp. Hard water

impurities and soap scum will clog the pores of your skin. Your skin will become dry, flaky, itchy, wrinkled and begin to show premature age. Conditioned water will help unclog your pores and aid in keeping your skin healthy. Conditioned water is a natural moisturizer, it leaves skin soft and healthy without the aid of expensive creams and lotions. Conditioned water will also give you a clean, smooth shave and your razor blades will last longer. Save time; an Ohio State university Study showed that conditioned water will save 10 eight-hour days of housework per year. Hard water creates build up in plumbing that requires 22% more electricity to heat water and eventually requires replacement.

IMPROVE THE QUALITY AND TASTE OF YOUR WATER

The LaPure Non Invasive Fluid Management Systems for Simple and Safe Solutions

Agricultural • Commercial • Industrial • Residential

These actual photographs are before and after pictures of a riser from an industrial **ScaleBlaster™** installation showing the scale reduction over a

120 day period.

One needs to understand the cause and effect of water related problems – Although water is basically H2O (a simple combination of hydrogen and oxygen), by its very nature it is highly receptive to many other substances that complicate and contaminate this simple mixture.

THERE ARE THREE BASIC CAUSES OF WATER OR FLUID RELATED PROBLEMS

Scale;

Problems: Loss of heat transfer efficiency - Flow restriction in pipes and frozen valves - Back pressure

increases energy needed to pump - Reduced reaction vessel capacity - Localized corrosion - Visible surface scale

Adverse Water Chemistry;

Problem: General corrosion

Biofilm;

Problems; General corrosion - Biocorrosion (both general and local) – Sludge - Disease and odors - Bacteria – Algae – Fungus - etc.

The End Results of Water Problems:

Wasted water - Ruined equipment - High energy costs - Productivity losses - Product contamination or quality problems - Disease –

and - Odor in the environment

MATERIALS THAT DEPOSIT ON EQUIPMENT AND CAUSE OF WATER or FLUID PROBLEMS:

Materials may be animal – vegetable - mineral or corrosive water chemistry - The sources of the materials include - pollution - wind borne dirt – algae - chemical additives - viruses and bacteria that occur abundantly in the natural environment and process components themselves. Some of the materials can grow, such as bacteria – algae – fungus etc. A growing list of man-made poisons includes pesticides – herbicides - chemical fertilizers - auto emissions - industrial waste, etc.

TREATMENT OPTIONS;

The Problems - Scale, Adverse Water Chemistry and Biofilm will cost you money!

- Untreated fluid used in boilers - hot water systems - cooling towers and other fluid related equipment contains dissolved salts - gases and traces of many minerals and metals. These elements are the direct cause of scale buildup in pipes and equipment. If left untreated, scale buildup will increase fuel costs - repair and ongoing cleaning costs - downtime and will eventually result in significant equipment replacement.

The bottom line is that if the problem-causing materials are controlled then 85% to 90% of the problems are eliminated.

Treatment options include removal and control.

- Removal involves physical or chemical cleaning – filtration - ion exchange – softening – demineralization - reverse osmosis.

- Control involves adding chemicals or ozone - or electronically conditioning the water.

What do I have to know?

Selecting a system that meets your needs is an important step. However, it is not as simple as reading a few ads for various filters and other treatment systems, or looking at a few samples, and/or industry catalogs.

The more effective fluid treatment systems utilize a variety of both removal and control methods depending upon the specific nature of the system/water being treated and its intended use. These combinations of techniques can be deployed to effectively solve your specific problems and can be designed to function together in a way that will enhance the effectiveness of each component in achieving the desired results.

Selecting a System for your needs.

A comprehensive approach to selecting a fluid treatment system includes;

Testing your water or fluid to determine the specific problems in it and your area

Selecting the system and/or components of a system that will solve these problems

Installing and monitoring your system

Periodically re-testing to insure that your old problems are being treated and controlled, and that new problems have not developed.

Installing and Monitoring your system

A qualified engineer, plumber (and sometimes an electrician) is often required to install the system you select. It is recommended that you carefully study the owners manual and other literature accompanying your various components, and develop a thorough understanding of what you have. This little bit of extra effort is well worth your time and attention. Then prepare a service schedule (put it on your calendar) to insure that you are replacing filters, UV lamps, or other components as

recommended by the manufacturer.

Testing.

Although the testing approach may seem bothersome, it is like a good routine physical by a health care specialist. Avoiding this step is to assume that ‘what you don’t know won’t hurt you’. Sorry, but it will! Avoiding the truth may result in health problems and costly repairs to your plumbing system and other equipment.

Periodically re-test and evaluate performance.

Simply owning a water treatment system does not guarantee that your water will be safe for ever... In addition to monitoring your system and providing for replacement of parts, you also need to periodically test and re - evaluate the quality of the water coming into your system to determine if changes or upgrades are needed. The ultimate responsibility is yours.

THE LaPure CHEMICAL FREE FLUID MANAGEMENT SOLUTION.

We provide all the methods and components necessary for a comprehensive approach to water and fluid treatment. We recommend that you apply components from the filtration, deposit control, purification and disinfection categories (as needed) to obtain the highest levels of results. At the core of the product line is our electronic scale control technology, around which you should deploy products from the rest of the treatment methods.

The LaPure System represents a significant break through in electro - magnetic technology. We have made possible the use of electromagnetic technology in applications of all sizes, from residential to large commercial and industrial applications. As an advanced system for controlling scale and bio - fouling, it is applicable with once-through and recirculating HVAC, heating and process cooling systems as well as agricultural, industrial processing, wastewater, and other fluid - based systems.

This State *of the Art electronic scale controller provides continual scale and bio - film control in fluid systems resulting in reduced maintenance and more efficient operation. The LaPure ‘’ScaleBlaster’’ scale control system utilizes unique and proprietary treatment and design processes*

The ‘’ScaleBlaster’’ Technology;

The ‘’ScaleBlaster’’ System represents an advanced method for controlling scale and bio - fouling. The electronic scale control technology uses a signal coil that is wrapped around a pipe in the plumbing system being treated. The signal coil produces an extremely small time - varying magnetic field inside the pipe. The resulting induced, oscillating electric field provides the necessary molecular agitation for chemical free scale prevention and removal.

Polarity changes from positive to negative many thousands of times per second.

Frequency varies from 2,000 cycles per second to 7,000 cycles per second. That range of frequency is wide enough to affect the water and the materials in the water.

Amplitude varies from 25 milliamps to 350 milliamps. This means that the water molecules and the materials in the water are being subjected to a wide range of field forces.

The entire Signal is repeated many times each second. When the current reaches the solenoid, a constantly changing electro - magnetic field is formed. That field introduces a constantly changing voltage in the fluid. This process ensures proper fluid treatment results and increased operational efficiency.

In effect, a clean, corrosion-free delivery system is restored and maintained in an environmentally safe and chemical free manner. The result is clean pipes and tubing with no biofilm and reduced bacterial contamination.

Benefits of the ‘’ScaleBlaster’’ System.

Prevents scale build up

Scale particles in the water receive an enhanced surface charge that causes them to repel each other and from the walls of the equipment

Eliminates Toxic Chemical/Salts

No recurring chemical expense

No handling and storage of hazardous chemicals on site

No hazardous salt contamination

Reduces Corrosion

Reduces bio - corrosion by preventing the formation of bio - growth on vessel surfaces where bacteria can attack the metal

With higher concentration ratios and TDS the pH will be higher and there will be much less tendency for corrosion.

Prolongs life cycle of equipment

Increases operating efficiency of equipment

Reduces or eliminates waste water trough regeneration or blow downs

Controls Algae and Bacteria

Bacteria and algae must attach to something before they can feed and reproduce. The ‘’ScaleBlaster’’ System keeps the bacteria, algae, and their food dispersed in the water, off of surfaces and away from their biofilm breeding ground.

Without biofilm to house and protect it, biological growth

cannot feed or reproduce, resulting in greatly reduced biological activity.

Within hours the biofilm will die, too.

Short Payback Period

The combined reduction of water and chemical cost is enough to pay for the "ScaleBlaster'' System in a few months.

With the ''ScaleBlaster'' Treatment, systems can run at higher concentration ratios, meaning the amount of water removed as blowdown and the corresponding sewer charges are greatly reduced.

With no chemicals being added, the requirements for pretreatment of blowdown are eliminated.

Labor costs for maintaining the chemical systems will be reduced.

Labor costs to clean the vessel surfaces will be reduced.

Costs to replace corroded parts will be reduced.

The ''ScaleBlaster'' System requires no maintenance.

There is little electrical current flow in an electromagnetic system

Reduces energy costs.

<u>Results of using the ''ScaleBlaster'' System</u>

The constant battle of monitoring and cleaning cooling and heating systems becomes a thing of the past.

Reduced Maintenance

Balancing the water chemistry of a daily or weekly basis may no longer

be necessary

Cleaning of the vessels if much easier, involving a pressure wash one or two times a year rather than the extensive manual brushing and acid washing traditionally required.

Reduced Energy Requirements –Cost Savings that can amount to 3% to 30%

Water systems are kept free of deposits, allowing heat transfer at its most efficient and eliminating the insulation caused by the presence of scale and biofilm

The roughness and reduced flow caused by the presence of scale is eliminated, reducing the energy needed to drive the pumps.

Reduced Sewer, Municipal, Pre-Treatment, and Water Fees

Municipal penalties and treatment fees for chemical content in blowdown of cooling systems are reduced or eliminated, since there are no longer chemicals present. If pretreatment has been in place, it is no longer necessary

Blowdown itself and its water costs are also reduced because higher TDS ratios are acceptable.

REDUCED REPAIR AND REPLACEMENT COSTS

Recent studies by manufacturers of cooling systems report that equipment that should last up to 20 years is only lasting an average of 8 years. The cycle of equipment rendered clean and efficient by the ‘’ScaleBlaster’’ system is significantly extended by the reduction or elimination of biofilm, biocorrosion, scale and overwork.

The often negative side-effects suffered by equipment from chemicals and sodium used for treatment no longer exist, since the chemicals and sodium are no longer necessary.

SAFETY AND HANDLING ISSUES ELIMINATED - ENVIRONMENTAL ISSUES SUCCESSFULLY ADDRESSED.

The workplace and workers are safer because personnel are not handling harsh and/or toxic chemicals.

OSHA issues related to chemical fluid treatment no longer apply, since chemicals are no longer used.

Legislative and regulatory directives regarding commercial and industrial effluent output are more easily met.

Corporate citizenship and environmental support goals are more easily met.

THE ‘’SCALEBLASTER" SYSTEM GIVES OWNERS ALL OF THE BENEFITS OF SOFT WATER WITHOUT THE HARMFUL SALTS.

The ‘’ScaleBlaster’’ Scale Control system is a revolutionary breakthrough in the treatment of hard water and its effect on water-based applications. The system is non - invasive and non - chemical by design, and is suitable for practically all applications requiring water/fluid treatment.

Sources of Water

Water primarily comes from two sources, the bodies of water on the earth’s surface and the subterranean wells which gather groundwater after it is filtered through the top layers of the earth’s strata. After the groundwater passes through the uppermost layers of the earth’s surface, it contains carbon-dioxide (CO_2), a carbonic acid. In the lower strata of the earth, the carbonic acid enriched water dissolves lime ($CaCO_3$) from the subterranean rock and converts it to calcium - hydrogen carbonate. The calcium-hydrogen carbonate is the source of lime deposits and encrustations (scale) which form in water systems

Hardness in Water

Regardless of the source of water, water typically contains carbon-dioxide (CO_2) and the earth's alkalines, such as calcium and magnesium. The total hardness of water is determined by the sum calcium - hydro carbonate, magnesium - hydrogen carbonate and the non-carbonate starches which include calcium and magnesium component solutions. Consequently, the water 'hardness' is dependent on the amount of lime in the water.

The ''ScaleBlaster'' technology prevents the formation of lime deposits using an electronic deposit controller which generates an electronically modulated frequency, and an amplified, square wave waveform. The wave is then oscillated to change the separation characteristics of calcium and carbonates before they enter the water system, immediately neutralizing the hardness, and functionally 'softening' the water. The process is purely physical as it uses no chemical additives.

THE ''SCALEBLASTER" SCALE CONTROL SYSTEM WILL;

Give the benefits of soft water without adding harmful salt or removing health giving minerals.

Prevent any further hard scale build-up in and on water-fed equipment and fixtures.

Remove the existing scale that is inside the water system over a period of time.,

Soften the existing hard scale around taps, basins, and toilets. Etc

Reduce soap scum and improve the lather of soap.

Make the water feel silkier.

Reduce the harsh effects of hard water on skin and clothes.

Reduce but not eliminate water spotting on fixtures and

surfaces in contact with the water.

Provides a much more environmentally friendly solution to hard water – no salts or chemicals.

The water will taste better, as pipes will e cleared of both mineral and biological deposits.

Plants that receive the treated water will grow better.

The key to the systems success and its unique approach is that different particles respond to different frequencies and amplitudes of the signal. The microprocessor rapidly varies the frequency and amplitude of the signal to deliver the various combinations to treat nearly 100% of the particles in the water.

Bacteria and scale forming colloids in the water receive a strong boost in their natural surface charge. The particles free from one another and remain in stable suspension, rather than uniting to form scale or colonizing to form biofilm or other system fouling. The ‘’ScaleBlaster’’ Scale Control System treats all incoming water as it passes the coil and alters the characteristics of the calcium so that it does not stick and form hard scale. It is important to remember that the calcium is still in the water and will be visible in appliances that are not subject to free flowing water.

USE WITH A SALT WATER SOFTENER?.

If a salt softener is currently being used, it should be disconnected, and the plumbing bypass valves should be opened/closed, to experience the sole effect of the *‘’ScaleBlaster’’ System*. If the softener is not bypassed, the ‘’ScaleBlaster’’ should be installed downstream of the softener, or else the calcium held in the ion exchange bed will quickly redissolve, causing a flood of extra-hard water. It is recommended that salt softening be eliminated for the best possible economic and ecological results.

EXTERNAL SCALE

It is a good idea to use external scale as a tracking reference to

determine whether or not the system is working properly. Areas to identify for this are;

Scale around taps, sinks, etc, will begin to soften, provided that the newly treated water is in regular contact with the area. Once softened these deposits can be removed using a stiff scouring pad, or other appropriate device.

Surfaces in contact or splashed with water become easier to clean,.

Scale on showerheads softens and can be removed. During descaling, some deposits may collect inside the nozzle. These can easily be rinsed away.

Water spotting on fixtures and surfaces will begin to diminish but not be eliminated.

INTERNAL SCALE

As the hot water heating coil is descaled, water heating will become progressively more efficient. The descaled heater coil will heat the water faster. Therefore it is possible to saved considerable energy by reducing thermostat settings.

If the water system was severely scaled, an improvement in water flow also will occur.

IMPORTANT NOTES;

For some time after installation, the unit will be descaling pre - existing scale in the water system. This often results in the water appearing to be harder, and calcium deposits increase in places like showerheads. Once descaled inside, the water system will be scale - free and calcium marks outside the system should easily wipe away. The ‘’ScaleBlaster’’ System use Molecular Surface Energy Realignments to neutralize the

dissolved calcium carbonates that causes hardness. ‘’ScaleBlaster’’ uses the resonant energy forces that are developed on charged particles, the dissolved ions, moving in electromagnetic fields to alter the molecular surface energy states.

Surface energy states determine how physical crystals form during precipitation. In this case, ionic calcium carbonate is treated so that electrically neutral aragonite is formed rather than calcite, or lime stone. Bone calcite and aragonite ($CaCO_3$) are chemically identical. These two crystals simply have different physical structures and therefore behave differently. One causes hard water and the other does not. Now, soaps will really lather, soap scum is greatly reduced, and the water feels silkier, not oily or slimy as salt softened water commonly does.

Water softeners - Water softeners often leave deposits inside a water system; therefore if a softener is in use, allow the ‘’ScaleBlaster’’ to remove the deposits before the softener is switched off. In that case, leave the softener and the ‘’ScaleBlaster’’ System on together for about one or two months. Remember, install the ‘’ScaleBlaster’’ control unit down stream of the water softener, if planning to run them together.

Typical User Experiences … Silky water feeling;

The treated water is immediately altered and will start dissolving scale build - up in the pipes. The scale dissolves one particle at a time, therefore there are few problems with clogging filters or screens in the plumbing system. If a water softener was never used before the water user will experience a dramatic difference in the ‘feel’ of the waster. The water will have a silky feeling, and hair will be ‘squeaky clean’ after a shampoo.

Soap, Scum and Skin effects

As the hard water effects of the calcium diminish, you will usually notice;

A reduction of around 30% in soap and detergents needed.

Less water spotting on fixtures and surfaces in contact with water.

Less scum formed on the bathtub, and improved soap lather.

A great improvement in skin condition for anyone suffering from dry skin. Even those with normal skin can expect improvements and reduction in the use of hand creams, etc.

Chlorine

It may be smelled as it dissipates in the air, (if the water has been chlorinated) because the ‘’ScaleBlaster’’ Scale Control System reduces the surface tension of the treated water. The chlorine controls organisms inside the plumbing, however, it is not good for people, their hair, skin or internal organs. Therefore, it is ideal to have the chlorine perform its function in the water, and then have it dissipate before drinking or bathing.

Water Taste

Users of the ‘’ScaleBlaster’’ Scale Control System will notice improvement in the taste of their water, due to cleaner pipes and the softening effect. Water used in coffee, drinks, ice cubes and for cooking will taste better.

Replacing a Salt - Based Water Softener

If a salt softener is replaced, the user may notice the water becoming harder as the scale begins dissolving. Do not worry, this is consequence of descaling, and the condition will improve daily as the scale is removed. The plumbing took years to get full of scale; however it only takes a short time to clean it u with the ‘’ScaleBlaster’’. This period may e brief for a newer facility, or several months for older facilities with low water usage. It is recommended that water heaters be drained regularly to shorten the

descaling process. The shorter the descaling period, the more money will be saved.

First Ninety Days*

Descaling should be mostly complete and you will be left with:

- Softer feeling water from every tap/system.
- Clean pipes.
- A savings in energy and detergent expenses.
- Cleaner, fresher water for drinking, cooking and processing,.
- Less water spotting

*Depending on preexisting conditions.

Typical questions?:

What does a softener do that an electronic deposit control system does not?

- The water softener removes calcium from the water by replacing the calcium with sodium (salt).
- The softener gives a feeling that one cannot get rid of soap from ones body.
- The water softener makes skin dry
- The water softener requires that salt be purchased and replaced regularly and will waste 100’s of gallons per month regenerating.
- Water softeners contribute to negative environmental conditions and are banned in many communities.

Water softeners require on - gong maintenance.

What does the ‘’ScaleBlaster’’ Scale Control System do that a water softener does not?

The ‘’ScaleBlaster’’ gives all of the benefits of softened water without the sale.

It removes calcium build-up in hot water heaters (saves energy Costs and extends the life of the heater).

Saves Money (no salt purchase or wasted water).

Provides salt - free water, a concern for many health conscious people.

Provides clean water, while eliminating the discharge of salt - laden water into the water table as a result of the normal regeneration cycle of conventional water softeners – its environmentally friendly.

Reduces the consumption of detergents and shampoos, a big benefit for the environment.

Removes both mineral and biological deposits, but leaves the benefits of the minerals, so water used is cleaner and healthier.

Reduces water spotting on fixtures and surfaces.

Does not require on-going maintenance.

If there is a water softener already installed, how should the ‘’ScaleBlaster’’ be installed?

Is it possible to use both a water softener and the ‘’ScaleBlaster’’?

It is possible to use both a water softener and the ‘’ScaleBlaster’’. The ‘’ScaleBlaster’’ Scale Control System should be installed ‘downstream’ of the water softener, because it will cause the calcium ions attached to the ion exchange resin to be released back into the water. Because existing scale build-up in the plumbing will be dissolved into the water, the use of a water softener may help to diminish the effects of this increase in hardness. After approximately 2or 3 months put the softener by ‘by-pass’.

What Carbon Can Reduce or Remove

Diethyl phthalate	Alpha Naphthol
4-Dimethylaminoazobenzene	beta-Naphthol
N-Dimethylaminoazobenzene	Alpha-Naphthylamine
2, 4-Dimethylphenol	Beta-Naphthylamine
Dimethyl (phenethyl) carbinol	P-Nitroaniline
Dimethyl phthalate	Nitrobenzene
4.6 Dinitro-o-cresol	4-Nitrobiphenyl
2.4 Dinitrotoluene	2-Nitrohenol
2.6 Dinitrotoluene	4-Nitrophenol
Diphenylamine	N-Nitrosodiphenylamine
1.1 Diphenylhydrazine	N-Nitrosodi-n-propylamine
1.2 Diphenylhydrazine	p-Nonylphenol
Endrin	PCB 1221
Ethylbenzene	PCB 1232
Ethylenediaminetetraacetic acid (EDTA)	Pentachlorophenol
Bis (2-ethylhexyl) phthalate	Phenanthrene
Fluoranthene	Phenol
Fluorene	Phenylmercuric acetate
5-Fluorouracil	Styrene
Guanine	1,1,2,2-Tetrachloroethane

Heptachlor	Tetrachloroethane (tetrachloroethylene)
Heptachlor epoxide	1,2,3,4-Tetrahydronaphthalene
Hexachlorobenzene	Thymine
Hexachloro-1, 3-butadiene	Toluene
Hexachlorcyclopentadiene	1,2,4-Trichlorobenzene
Hexachloroethane	1,1,1-Trichloroethane
Hydroquinone	1,1,2-Trichloroethane
o-Inisdine	Trichloroethane (trichloroethylene)
Isooophorone	Trichiorofluormethane
Methylene chloride	2,4,6-Trichlorophenol
4.4 Methylenebis (2-Chloroaniline)	Uracil
Naphthalene	p-Xylene

What Contaminants Do Activated Carbon Filters Remove From Water?

Activated carbon (AC) filtration is most effective in removing organic contaminants from water. Organic substances are composed of two basic elements, carbon and hydrogen. Because organic chemicals are often responsible for taste, odor, and color problems, AC filtration can generally be used to improve aesthetically objectional water. AC filtration will also remove chlorine. AC filtration is recognized by the Water Quality Association as an acceptable method to maintain certain drinking water contaminants within the limits of the EPA National Drinking Water Standards (Table 1).

Table 1. Water contaminants that can be reduced to acceptable standards by activated carbon filtration.
(Water Quality Association, 1989)

Primary Drinking Water Standards

Contaminant	*MCL, mg/L
Inorganic Contaminants	
Organic Arsenic Complexes	0.050
Organic Chromium Complexes	0.050
Mercury (Hg+2) Inorganic 0.05	0.050
Organic Mercury Complexes	0.002
Organic Contaminants	
Benzene	0.005
Endrin	0.002
Lindane	0.004
Methoxychlor	0.100
1,2-dichloroethane	0.005
1,1-dichloroethylene	0.007
1,1,1-trichloroethane	0.200
Total Trihalomethanes (TTHMs)	0.100
Toxaphene	0.005
Trichloroethylene	0.005
2,4-D	0.100
2,4,5-TP (Silvex)	0.100

Para-dichlorobenzene	0.075

Secondary Drinking Water Standards

Contaminant	**SMCL
Color	15 color units
Foaming Agents (MBAS)	0.5 mg/l
Odor	3 threshold odor number

---

*Maximum Contaminant Level
**Secondary Maximum Contaminant Level

AC filtration does remove some organic chemicals that can be harmful if present in quantities above the EPA Health Advisory Level (HAL). Included in this category are trihalomethanes (THM), pesticides, industrial solvents (halogenated hydrocarbons), polychlorinated biphenyls (PCBs), and polycyclic aromatic hydrocarbons (PAHs).

THMs are a byproduct of the chlorination process that most public drinking water systems use for disinfection. Chloroform is the primary THM of concern. EPA does not allow public systems to have more than 100 parts per billion (ppb) of THMs in their treated water. Some municipal systems have had difficulty in meeting this standard.

The Safe Drinking Water Act mandates EPA to strictly regulate contaminants in community drinking water systems. As a result, organic chemical contamination of municipal drinking water is not likely to be a health problem. Contamination is more likely to go undetected and untreated in unregulated private water

systems. AC filtration is a viable alternative to protect private drinking water systems from organic chemical contamination.

Radon gas can also be removed from water by AC filtration, but actual removal rates of radon for different types of AC filtration equipment have not been established.

Water Contaminants Not Removed by AC Filtration

Similar to other types of water treatment, AC filtration is effective for some contaminants and not effective for others. AC filtration **does not** remove microbes, sodium, nitrates, fluoride, and hardness. Lead and other heavy metals are removed only by a very specific type of AC filter. Unless the manufacturer states that its product will remove heavy metals, the consumer should assume that the AC filter is not effective in removing them. Refer to the other circulars in the Treatment Systems for Household Water Supplies series for information on systems that do remove the contaminants listed above.

Water Testing

Regular water testing is recommended to reduce the risk of consuming contaminated water. Many contaminants are not detected by the senses. Even if contamination can be detected by color, smell, or taste, only a laboratory test can tell you the quantity of contaminant actually present. Testing should always be done by a reputable or certified laboratory. Prior to sending in your water sample, determine what you want your water tested for. Contact the laboratory to find out how to take a proper water sample. Remember, there are thousands of substances that can contaminate your water, and they all have slightly different chemical behavior. Proper sampling and handling for one type of contaminant may cause erroneous

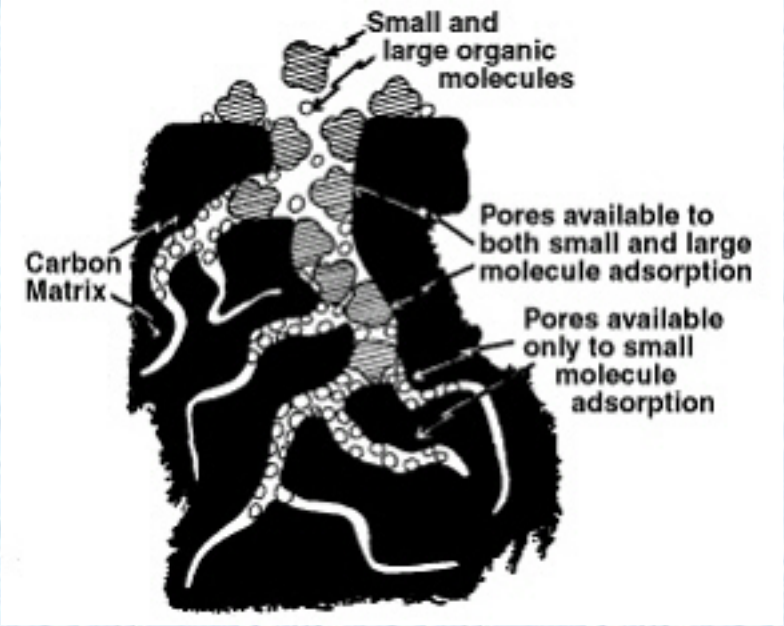
results for other types of contaminants.

Once you have the laboratory results in hand, make sure you understand the numbers. If you don't fully understand the results, don't assume anything. The testing laboratory will be able to answer any questions you may have regarding your test results. Understanding the laboratory results will help you select the best and most economical water treatment system. Sometimes just a single piece of equipment, such as an AC filter, is all that is necessary to treat the problem. Other times you may need completely different equipment or possibly a combination of equipment. It all depends on the type and amount of contaminants present in your water.

The Activated Carbon Filtration Process

AC works by attracting and holding certain chemicals as water passes through it. AC is a highly porous material; therefore, it has an extremely high surface area for contaminant adsorption. The equivalent surface area of 1 pound of AC ranges from 60 to 150 acres.

AC is made of tiny clusters of carbon atoms stacked upon one another. The carbon source is a variety of materials, such as peanut shells or coal. The raw carbon source is slowly heated in the absence of air to produce a high carbon material. The carbon is activated by passing oxidizing gases through the material at extremely high temperatures. The activation process produces the pores that result in such high adsorptive properties.



The adsorption process depends on the following factors: 1) physical properties of the AC, such as pore size distribution and surface area; 2) the chemical nature of the carbon source, or the amount of oxygen and hydrogen associated with it; 3) chemical composition
and concentration of the contaminant; 4) the temperature and pH of the water; and 5) the flow rate or time exposure of water to AC.

Physical Properties

Forces of physical attraction or adsorption of contaminants to the pore walls is the most important AC filtration process. The amount and distribution of pores play key roles in determining how well contaminants are filtered. The best filtration occurs when pores are barely large enough to admit the contaminant molecule (Figure 1). Because contaminants come in all different sizes, they are attracted differently depending on pore size of the filter. In general AC filters are most effective in removing contaminants that have relatively large molecules (most organic chemicals). Type of raw carbon material and its method of activation will affect types of contaminants that are adsorbed. This is largely due to the influence that raw material and activation have on pore size and distribution.

Figure 1. Molecular screening in the micropores of an activated carbon filter. (after G. L. Culp and R. L. Culp)

Chemical Properties

Processes other than physical attraction also affect AC filtration. The filter surface may actually interact chemically with organic molecules. Also electrical forces between the AC surface and some contaminants may result in adsorption or ion exchange. Adsorption, then, is also affected by the chemical nature of the adsorbing surface. The chemical properties of the adsorbing surface are determined to a large extent by the activation process. AC materials formed from different activation processes will have chemical properties that make them more or less attractive to various contaminants. For example chloroform is adsorbed best by AC that has the least amount of oxygen associated with the pore surfaces. The consumer can't possibly determine the chemical nature of an AC filter. However, this does point out the fact that different types of AC filters will have varying levels of effectiveness in treating different chemicals. The manufacturer should be consulted to determine if their filter will adequately treat the consumer's specific water problem.

Contaminant Properties

Large organic molecules are most effectively adsorbed by AC. A general rule of thumb is that similar materials tend to associate. Organic molecules and activated carbon are similar materials; therefore there is a stronger tendency for most organic chemicals to associate with the activated carbon in the filter rather than staying dissolved in a dissimilar material like water. Generally, the least soluble organic molecules are most strongly adsorbed. Often the smaller organic molecules are held the tightest, because they fit into the smaller pores.

Concentration of organic contaminants can affect the adsorption process. A given AC filter may be more effective than another type of AC filter at low contaminant concentrations, but may be less effective than the other filter at high concentrations. This type of behavior has been observed with chloroform removal. The filter manufacturer should be

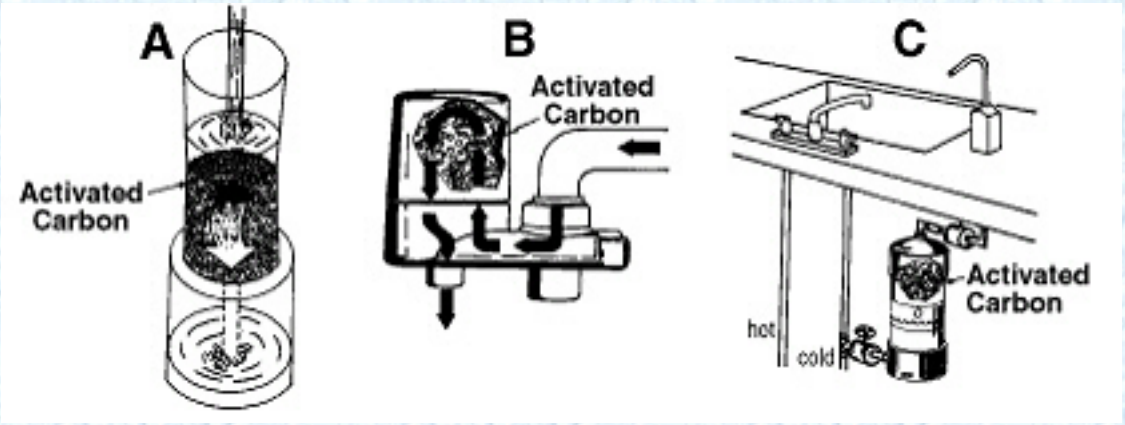
consulted to determine how the filter will perform for specific chemicals at different levels of contamination.

Water Temperature and pH

Adsorption usually increases as pH and temperature decrease. Chemical reactions and forms of chemicals are closely related to pH and temperature. When pH and temperature are lowered many organic chemicals are in a more adsorbable form.

Exposure Time

The process of adsorption is also influenced by the length of time that the AC is in contact with the contaminant in the water. Increasing contact time allows greater amounts of contaminant to be removed from the water. Contact is improved by increasing the amount of AC in the filter and reducing the flow rate of water through the filter.



Activated Carbon Filtration Equipment

AC filters can be placed in the three following categories: 1) **pour-through**; 2) **faucet-mounted**; and 3) **high-volume** (Figure 2).

Figure 2. The three types of activated carbon filtration units are: A) pour-through; B) faucet-mounted; and C) high-volume.

Pour-through AC filters are the simplest. They work like a drip coffee maker. Water is poured in the top and filters by gravity through the filter to the bottom. They are quite slow and handle only small volumes of water.

Faucet-mounted AC filters are small units attached on the end of a standard kitchen faucet. They are convenient to use, but because of their size require frequent change. Some units have bypass valves, so that just water for cooking and drinking is filtered.

High-volume AC filters contain much more AC than either the pour-through or faucet-mounted models. High-volume units are designed to be installed in-line, generally under the sink. They are installed on the cold water line, and some units are installed with a bypass to separate cooking and drinking water from other uses. Under exceptional circumstances all water may need to be treated by AC filtration. A high-volume unit may be installed at the point of entry to the house if all water needs to be treated.

Results of Activated Carbon Filter Testing

In recent years several independent laboratories have tested AC filtration equipment for effectiveness in contaminant removal. Organizations involved in AC testing are the Gulf South Research Institute, National Sanitation Foundation, Canadian Bureau of Health, Consumer Reports and Rodale Press Product Testing Department.

Based on the testing results of these organizations, general recommendations can be made regarding AC filtration. High-volume AC units should be used if removal of health threatening contaminants is your concern. Pour-through and faucet-mounted units do not provide the contact time for significant removal of contaminants. If you are only concerned with taste, odor, or color, pour-through and faucet-mounted

units will probably do the job. However, they will still require changing much more often than high-volume AC filters.

Efficiency of contaminant removal and equipment operation vary even among the high volume AC units (Table 2). The most efficient unit is not always the most expensive one.

Table 2. A comparison of activated carbon filtration units. (Consumer Reports, 1990)

Brand and Model	Cartridge Price $	Cost $	Chloroform Removal %
High-Volume Filters			
Ametek CCF-201	158	20(2)	100
Ecowater Water Master	250	33(2)	100
Amway E-9230	276	69	90
Hurley II	375	-	100
Filtrate CF 10	85	8	90
Cuno AquaPure AP-CRF	155	15	90
Kinetico MAC	275	32	90
Culligan SuperGard THM	349	37	90
Teledyne Instapure IF-10	50	12	80
Omni UC-2	99	20(2)	80
NSA Bacteriostatic	158	158	158
(The following two models were downrated because they clogged after filtering only 300 gallons.)			
Bionaire H20 BT850	199	100	100
Everpure H200	298	90	100
Faucet-Mount Filters			
Cuno Purity PPO1105	30	6	60
Teledyne Instapure F-2C	24	5	54
Pollenex WP90K	22	5	30
Pour-Through Filters			
Brita	30	8	50

Innova	7	5	45
Glacier Pure	13	5	40

Eventually the AC filter loses its ability to remove contaminants, because it becomes clogged with material. In the case of taste and odor, the time to change the filter is easy to detect. However, in the case of other contaminants, it is more difficult to determine when the filter is no longer performing at an adequate level. Most manufacturers recommend a filter change after a certain volume of water has passed through the filter. Some AC units actually meter the water and automatically shut down after a specific quantity of water has passed through the filter. General recommendations are somewhat useful quidelines, but there is no guarantee that they apply to any specific situation. Remember, the only certain way of knowing whether contaminant levels are acceptable or not is by having your water tested.

A sediment filter installed ahead of any AC filter will prolong the life of the AC unit. Sediment can easily clog the pores of an AC filter within a short period of time. A good sediment filter can be purchased for only a fraction of the price of most high volume AC filters.

The Bacteria Issue

AC filters can be a breeding ground for microorganisms. The organic chemicals that are adsorbed to the AC are a source of food for various types of bacteria. Pathogenic bacteria are those that cause human diseases such as typhoid, cholera, and dysentery. Public water systems must treat for disease causing bacteria; therefore, the likelihood of disease causing bacteria being introduced to an AC filter from public drinking water is remote. AC filtration should only be used on water that has been tested and found to be bacteria free or effectively treated for pathogenic bacteria.

Other types of non-pathogenic bacteria that do not cause diseases have been regularly found in AC filters. There are times when high amounts of bacteria (non-pathogenic) are found in water filtered through an AC unit. Research by R. L. Caldron and E. W. Mood (1987) shows little risk to healthy people that consume high amounts of non-pathogenic bacteria. We regularly take in millions of bacteria every day from other sources. However, there is some concern for certain segments of the population, such as the very young or old and people weakened by illness. Some types of non-pathogenic bacteria can cause illness in those whose natural defenses are weak. Flushing out bacteria that have built up in the filter can be accomplished by running water through an AC filter for about 30 seconds prior to use. Water filtered after the initial flushing will have much lower levels of bacteria and ingestion of a high concentration of bacteria will have been avoided. The flushing procedure is most important in the morning or any other time of the day when the filter has not been used for several hours.

Last Modified 02/18/2006