Water Filters for Home, Marine, and Aviation

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. Rains that soak 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 it's 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.

Hard 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, manganese and magnesium 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) are 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 "soap scum" 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, the hardness minerals are re-crystallized to form hardness scale. This scale can plug your pipes and hot water heater, causing premature failure, necessitating costly replacement. The soap scum remains on your skin even after rinsing, clogging the pores of your skin and coating every hair on your body. This crud 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.

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): call a water conditioning company. 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.

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 with 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 it's ability to react to these forces.

Which Water Conditioning Company should I call?

As in any purchase, talk to your friends and neighbors -- whom do they use? Are they happy with them? Check with the Better Business Bureau for complaints. The BBB can't prevent shady business, but they can and do keep a file of complaints filed by people who have had dealings with them.

Ask at least two to come to your home to look at your plumbing and then give you a quote on their equipment. Have them explain all the features of the unit, as well as the warranty.

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 day's 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.

Whole House 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 carginigns) 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 aeriate the water to release the excess oxygen.

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, their 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 regenerate, 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, and 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 volitle 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 its 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 feed water 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 feed water, 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 feed water. Temperature, pressure also has 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 feed water 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 houseplants. 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 contaminations -- 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 indicates 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 methodgy 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.

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.