VIQUA™
simply safe water

Home Water Treatment from A to Z

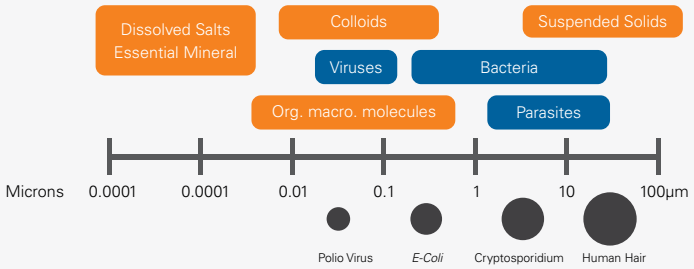
So, you got the results of your water quality test, and there are some issues you need to solve. Surely, there must be a "one-size-fits-all" solution, right? In reality, it's not very likely. Water, as they say, is the universal solvent. As it travels through the ground and to our taps, it picks up different types of contaminants that can cause a problem. As a result, water quality varies dramatically around the world, and each problem may require its own solution. Understanding water treatment basics can help you make an informed decision with your water treatment professional.

Adsorption: Simply put adsorption involves the adhesion of contaminants to an adsorbent material. Activated carbon is very often the material used. It is effective against some organic chemicals, hydrogen sulfide which is famous for giving water a "rotten egg" smell, and, of course, residual chlorine. So, one of the most common applications is in pitcher-style kitchen filters. Unfortunately, activated carbon can make a great home for bacteria, so this type of filter should only be used on bacteriologically-safe water.

Disinfection: The goal of disinfection is to destroy or inactivate disease-causing microbes like *E.coli*, Cryptosporidium, and Giardia. Disinfection techniques are either physical, like exposure to ultraviolet (UV) light, or chemical, like chlorine, ozone, or hydrogen peroxide.

Distillation: Distillation is one of oldest and simplest water purification methods. It depends on the principle that water as a liquid carries all sorts of contaminants but water as a gas carries none. So just by applying heat to convert water to steam, the contaminants are left behind. Then the vapors are passed over cooling coils, condensing the water back to a liquid form. The resulting fluid is nearly pure water. Distillation is very effective but very energy inefficient and upfront costs can be prohibitive.

Filtration: Filtration is the process of passing water through a porous material to remove suspended particles. The pore size of the filter will determine what gets rejected and what's allowed to pass through. Very often, a sediment filter will be used as the first stage of water treatment, to remove the larger particles in the water, and may be followed by more refined filters. Pore size is typically measured in microns (µ).



Filter pore sizes in microns represented by marks on the line. Round shapes shows the relative sizes of impurities. Not to scale, only to give idea of size of filter pores and impurities.

Ion exchange: Ion exchange is like the "swap meet" of water treatment. Water is passed over a resin bed that holds certain ions – particles that hold a charge. But that

Disinfection	Pros	Cons
Ultraviolet (UV)	Adds no chemicals No change to taste/odour of water* Low energy usage Environmentally-friendly Limited maintenance	Requires pre-filtration for best results Does not provide residual
Chlorine	Can also oxidize (see Oxidation) Can provide a residual	Adds an unpleasant taste and odour to the water Need to handle chemicals Requires holding time/tank Cryptosporidium and Giardia are highly resistant
Ozone/Hydrogen Peroxide	Can also oxidize (see Oxidation)	Need to handle chemicals Provides limited residual

* In rare circumstances, low levels of sulphur in source water may become detectable due to the UV system.

resin would prefer to swap for ions found in water. The classic example is a water softener, which is a cation (positive charge) exchanger. The softener resin bed is saturated with sodium ions but prefers the calcium ions that make water "hard". So hardness ions are exchanged for sodium ions that stay in solution. Because iron in water is also positively charged, a water softener can be used for iron removal. This usually only applies to low levels of iron contamination. Check the manufacturer's recommendations.

An anion exchanger can likewise be used to remove negatively charged molecules like nitrates and tannins.

Oxidation: Oxidation is really about transferring electrons from the unwanted molecule to the oxidizing agent. A common example in water treatment is the oxidation of iron changing ferrous iron (Fe^{2+}) which is soluble in water to ferric iron (Fe^{3+}) which is not. The ferric ions can then form compounds that precipitate and can be filtered out. In water treatment common oxidizing agents are chlorine, ozone, hydrogen peroxide, and oxygen itself.

Reverse Osmosis (RO): In reverse osmosis, water is forced through a porous membrane (much finer than filtration) which traps larger molecules and dissolved ions. Reverse osmosis can remove dissolved ions, metals like arsenic, lead and nitrates, organic compounds like trihalomethanes (disinfection by-products), and pesticides. However, the effectiveness of the RO system will depend on the type of membrane and overall operating conditions. Very often, additional stages of filtration are needed for best results. Because RO produces a high proportion of reject water, it is more practical (but still wasteful) for point-of-use applications rather than whole home treatment – RO typically produces 2-4 gallons of reject water for every gallon of treated water.

Putting It Together

The following chart outlines many common well water contaminants and possible treatment options. Again, it is fairly unlikely that your water will contain only one of these troubling substances. It will be important to test your water to understand not just *WHAT* is in the water but *HOW MUCH*. Be sure to explore the pros and cons with your water treatment professional and always be mindful of the manufacturer's specifications.

	Adsorption	Disinfection	Filtration	Ion Exchange	Oxidation
Arsenic	Activated aluminum filter		Reverse Osmosis	Anion exchange system	
Bacteria & Parasites		UV disinfection Chlorinator** Distiller			
Hardness Minerals (Ca^{2+}, Mg^{2+})				Water softener	
Hydrogen Sulfide	GAC filter*				Chlorinator*** Carbon/Air filter
Iron/Manganese				Sanitizer (high levels) Water softener* (low levels)	Chlorinator*** Birm/Air filter
Nitrates			Reverse Osmosis	Anion exchange system	
Pesticides	GAC filter		Reverse Osmosis*		
Radon	GAC filter*				

*Check manufacturer's specifications
**Giardia can be highly resistant to chlorination
***Chlorination must usually be followed by filtration

About VIQUA

VIQUA is proud to be the world's largest supplier of residential UV water disinfection systems, providing safe water without the use of chemicals. Whether you choose a point-of-entry or a point-of-use system, your VIQUA UV system will disinfect your drinking water, keeping you and your family safe from microbiological contaminants. Our promise to you is clear: simply safe water. For more information, visit www.viqua.com.

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