



COOPERATIVE EXTENSION

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Matching Drinking Water Quality Problems to Treatment Methods

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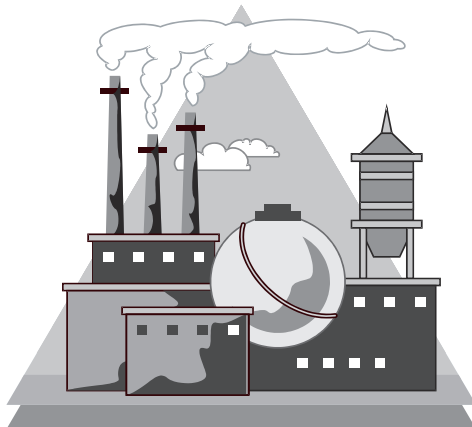
Pivate well owners often seek water treatment devices to solve a number of common problems that can be felt, smelled, tasted, or seen. Some of these symptoms indicate a serious problem, while others do not represent a health risk. If you notice any of the symptoms listed in the following table, first have your water tested by a certified independent laboratory to verify the cause of the problem. Call your local Cooperative Extension

office and ask for "Water Testing for Private Well Owners," SP-00-20 for information on well testing. Testing may also reveal contaminants that have no visible color, odor, or taste, and yet represent health or safety risks.

Once you have determined the source of a well water problem, you can then match appropriate water treatment methods to the problem by consulting the table.

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Hard Water			
	Soap curd and scum in wash basins and bathtub, or white scaly deposits in pipes, water heater or appliances	Calcium and magnesium salts	<input type="checkbox"/> Cation-exchange water softeners
Grittiness			
	Abrasive texture to water when washing, or residues in sink	Very fine sand particles or silt in the water that is able to pass through the well screen	<input type="checkbox"/> Use a sand trap or ultrafiltration
Odors			
	Musty, earthy or woody smell	Usually harmless organic matter	<input type="checkbox"/> Activated carbon filter
	Chlorine smell	Excessive chlorination	<input type="checkbox"/> Activated carbon filter

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Odors			
	Gasoline or oil smell	Possible leak in fuel oil tank or other underground tank leaking into water supply	There is no practical residential treatment system available. It is essential to locate and remove underground source. Activated carbon filters can provide some treatment
	Rotten egg odor	Dissolved hydrogen sulfide gas in water supply	<input type="checkbox"/> Manganese greensand filter will help with levels over 6 mg/L when pH is not lower than 6.7 <input type="checkbox"/> Hydrogen sulfide levels over 6 mg/L require constant chlorination followed by de-chlorinating and filtering
		Presence of sulfate-reducing bacteria in water supply	<input type="checkbox"/> Constant chlorination followed by activated carbon filtration
		Action of magnesium rod in hot water heater in the presence of soft water	<input type="checkbox"/> Remove magnesium rod from heater
	Detergent odor or foaming water	Septic tank leaking into groundwater supply	<input type="checkbox"/> Eliminate source and shock-chlorinate well <input type="checkbox"/> Activated carbon filter will adsorb a limited amount
	Methane gas (caution required; gas is explosive and toxic)	Naturally decaying organic material found in: <ul style="list-style-type: none"> <input type="checkbox"/> Shallow water wells near swamps <input type="checkbox"/> Housing areas built above or near old landfills <input type="checkbox"/> Aquifers overlying oil fields 	<input type="checkbox"/> Residential/commercial aeration system and re-pump
	Phenol (chemical) odor	Industrial waste seeping into groundwater	<input type="checkbox"/> Activated-carbon filter will adsorb for a short time before filter capacity is exceeded



“A chemical odor may be an indication of industrial waste seeping into groundwater”

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Pesticides			
	Sharp chemical odor in water	Leaching of applied pesticides into groundwater	<input type="checkbox"/> Activated carbon filter will help for short time; continue to monitor the treated water
Taste			
	Salty or brackish	High sodium content	<input type="checkbox"/> Deionize drinking water only with disposable mixed-bed (anion-cation) resins <input type="checkbox"/> Reverse osmosis for drinking water only <input type="checkbox"/> Install home distillation system <input type="checkbox"/> There is no economical treatment for residences when sodium levels exceed 1800mg/L
	Soda taste, slippery feel	High total dissolved solids that are alkaline in nature	<input type="checkbox"/> Use reverse osmosis to reduce levels. If the level of alkalinity is greater than 3.080 mg/L there is no economical treatment for the home
	Metallic taste	Very low pH (3 to 5.5)	<input type="checkbox"/> Calcite-type filter (see acid water)
		High iron content (over 3 mg/L)	See heading for iron/reddish under appearance category
Appearance			
Turbidity (cloudiness)	Silt, clay, or suspended particles in water	Silt or sand from well	<input type="checkbox"/> Sand trap and/or new well screen
Acidic water	Green stains on fixtures and/or a blue-green tint to the water	Water high in carbon dioxide content (with a pH below 6.8) that reacts with brass and copper plumbing	<input type="checkbox"/> Calcite filter to neutralize pH if above 5.5 <input type="checkbox"/> Calcite/magnesia-oxide mix at a 5 to 1 ratio to correct very low pH <input type="checkbox"/> Soda ash chemical feed followed by filtration
Black cast to water	Black stains on fixtures and laundry	Interaction of carbon dioxide or organics and manganese in the soil. Above 0.05 mg/L, manganese causes staining, and is usually found combined with iron	<input type="checkbox"/> Chlorination followed by filtration <input type="checkbox"/> Oxidizing filter <input type="checkbox"/> Ozonation <input type="checkbox"/> Water softener <input type="checkbox"/> Oxidation with potassium permanganate

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Appearance			
Reddish or discolored water (from iron)	Red-brown stains on sinks and other porcelain fixtures; water turns reddish brown during cooking or heating; stains on laundry	Indicates more than 0.3 mg/L dissolved iron present. Water appears clear when first drawn from cold water tap	<ul style="list-style-type: none"> <input type="checkbox"/> Water softener and minimum pH of 6.7 (unaerated) will remove 0.5 mg/L of iron for every 17 mg/L of hardness. <input type="checkbox"/> For iron levels over 10 mg/L, chlorination in a retention tank that allows for oxidation, followed by filtration/dechlorination <input type="checkbox"/> In warmer climates, residential aerator and filtration will substantially reduce iron
		Precipitated iron (water is discolored when drawn)	<ul style="list-style-type: none"> <input type="checkbox"/> If pH is higher than 6.7, a manganese greensand filter will remove up to 10 mg/L of iron. <input type="checkbox"/> If pH is higher than 6.8 and oxygen is 15 percent of the total iron content, try manganese treated, nonhydrous aluminum silicate filter <input type="checkbox"/> Downflow water softener with good backwash will remove up to 1 mg/L <input type="checkbox"/> To remove more than that, use a calcite filter followed by downflow water softener
		Iron dissolved from old pipe with pH below 6.8	<ul style="list-style-type: none"> <input type="checkbox"/> Calcite filter to remove precipitated iron
	Brownish cast that does not precipitate and drop out of the water	Organic (bacterial) iron	<ul style="list-style-type: none"> <input type="checkbox"/> Shock chlorinate well, and follow with constant chlorination and filtration. <input type="checkbox"/> Chemical feed of potassium followed by permanganate and then filtration
	Reddish color in water sample after standing 24 hours	Colloidal iron	<ul style="list-style-type: none"> <input type="checkbox"/> Constant chlorination followed by filtration with activated carbon to remove chlorine
Milky water	Water cloudy when drawn	Precipitated sludge that is created when water is heated	<ul style="list-style-type: none"> <input type="checkbox"/> Flush water heater from time to time
		High volume of air in water from poorly functioning pump	<ul style="list-style-type: none"> <input type="checkbox"/> Water will generally clear quickly after standing
		Excessive coagulant-feed being carried through filter	<ul style="list-style-type: none"> <input type="checkbox"/> Reduce coagulant quantity being fed <input type="checkbox"/> Service filters properly

PROBLEM	SYMPTOM	CAUSE	TREATMENT
Appearance			
Yellow water	Yellowish tint to water after softening and/or filtering	Tannins (humic acids) present from water passing through peaty soil or decaying vegetation	<input type="checkbox"/> Anion-exchange <input type="checkbox"/> Chlorination with full retention time followed by filtration to remove chlorine
Contaminants with no visible color, odor or taste			
High chloride content in water	Blackening and pitting of stainless steel sinks and kitchen utensils	Excessive salt content. Note that high temperature drying concentrates chloride, accelerating corrosion	<input type="checkbox"/> Use chloride-resistant metals <input type="checkbox"/> Distillation <input type="checkbox"/> Reverse osmosis
Fluoride	Yellowish or mottled teeth in children.	Fluoride above 2.0 mg/L in groundwater	<input type="checkbox"/> Anion exchange <input type="checkbox"/> Reduce concentration to 0.2 mg/L with activated alumina <input type="checkbox"/> Reverse osmosis <input type="checkbox"/> Distillation
Nitrates	Maximum level set by EPA is 10 mg/L; this level or above is dangerous for infants	Sources include nearby human or animal waste leaching into well, or heavy use of commercial fertilizers with nitrogen entering the groundwater	<input type="checkbox"/> Find sources of wastes and take steps to protect wellhead <input type="checkbox"/> Anion exchange regenerated with NaCl for water with less than 3 mg/L; verify treatment level via water quality analysis <input type="checkbox"/> Reverse osmosis for drinking and cooking water will remove 65 percent of nitrate; try to limit original concentration to 25 mg/l as N <input type="checkbox"/> Home distillation system for drinking/cooking water
Radioactive contaminants	The public health authority will post notices. Radium 226 above 5pCi/L and Strontium-90 above 10pCi/L are considered health risks.	Naturally occurring in deep wells from phosphate rock or radium-bearing rock strata; atmospheric fallout or other human related activities that produce nuclear waste	<input type="checkbox"/> Remove cationic radioactivity with cation-exchange water softener <input type="checkbox"/> Treat with mixed bed deionizer for removal of anionic and cationic nuclides <input type="checkbox"/> Reverse osmosis should remove 70 percent of nuclides
		Radon gas given off by decaying radium dissolved in water	<input type="checkbox"/> Aeration by faucet aerator to dissipate dissolved radon



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PROBLEM	SYMPTOM	CAUSE	TREATMENT
Contaminants with no visible color, odor or taste			
Heavy Metals (lead, zinc, copper and cadmium)	EPA has established maximum contaminant levels (MCLs) for each metal	Industrial waste pollution; corrosion products from plumbing caused by low pH waters	<input type="checkbox"/> Reverse osmosis <input type="checkbox"/> pH adjustment to prevent corrosion of water distribution system <input type="checkbox"/> Water softener will remove cadmium, copper and zinc if operated properly <input type="checkbox"/> Distillation
Arsenic	EPA maximum is 0.01 mg/L; health risks increase above this level	Natural groundwater contaminant in certain regions; industrial waste; herbicides and pesticides	<input type="checkbox"/> Reverse osmosis will remove up to 90 percent <input type="checkbox"/> Activated alumina <input type="checkbox"/> Anion exchange <input type="checkbox"/> Distillation
Barium	EPA maximum is 2 mg/L; health risks increase above this amount	Naturally occurring in certain geographic areas	<input type="checkbox"/> Remove using cation-exchange <input type="checkbox"/> Reverse osmosis <input type="checkbox"/> Distillation
Boron	Inhibits normal plant growth; above 1 mg/L considered undesirable for human use	Naturally occurring in the southwest United States and other areas	<input type="checkbox"/> Selective anion-exchange resin <input type="checkbox"/> Reverse osmosis <input type="checkbox"/> Activated carbon <input type="checkbox"/> Distillation
Cyanide	No visible color, taste or odor; above 0.2 mg/L considered health risk	Industrial waste pollution from electroplating, steel and coking facilities	<input type="checkbox"/> Continuous chlorination and activated-carbon filtration of metals after pH adjustment <input type="checkbox"/> Anion exchange <input type="checkbox"/> Reverse osmosis
Trichloroethylene (TCE)	Notice from Public Health Department	Waste degreasing and dry cleaning solutions entering surface or groundwater supplies	<input type="checkbox"/> Series of activated-carbon filters and constant monitoring between units for breakthrough <input type="checkbox"/> Aeration <input type="checkbox"/> Boiling

This table has been adapted from:

- Driscoll, F. 1986. Groundwater and Wells. Johnson Division, St. Paul, MN
- EPA. 1991. Manual of Individual and Non-Public Water Supply Systems, Appendix E: Identification by Human Senses. EPA 570/9-91-004.
- Wagenet, L, K. Mancl and M. Sailus. 1995. Home Water Treatment. Northeast Regional Agricultural Engineering Service, Cooperative Extension, Ithaca, N. Y. NRAES-48.

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