Recognized Treatment Techniques for Meeting the National Secondary Drinking Water Regulations with the Application of Point-Of-Use Systems

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are non-enforceable guidelines for contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effect (such as taste, odor or color) in drinking water. EPA recommends secondary standards to water systems but does not require systems to comply. However, states may choose to adopt them as enforceable standards.

Note: This document addresses the United States Environmental Protection Agency National Primary Drinking Water Regulations in effect at its time of publication. These regulations are continually being reviewed and updated at the federal level. Accordingly, this list of recognized treatment technologies will be reviewed and amended periodically.

CONTAMINANT	SMCL,MG/L+	TREATMENT METHODS		
Alkalinity (measured as calcium carbonate, $CaCo_3$)	No federal limit Low alkalinity - <30mg/L High alkalinity - >300 mg/L	Raise alkalinity by feeding 1.5 mg/L of soda ash for each on mg/L of alkalinity needed or calcite filtration; Lower alkalinity by feeding white vinegar (acetic acid), citric acid or any acid; add carbon dioxide; ion exchange dealkalization; reverse osmosis; distillation or electrodialysis		
Aluminum (Al^{+3}) on case-by-case	0.05 to 0.2 depending circumstances	Cation Exchange	Distillation	Ultrafiltration
		Reverse Osmosis	Electrodialysis	Deionization
Chloride ($C1^{-1}$)	250	Reverse Osmosis	Distillation	Deionization
		Anion Exchange	Electrodialysis	
Color	15 color units	Anion Exchange	Reverse Osmosis	Filtration
		Activated Carbon	Distillation	Chlorination
		Ozonation		
Note: Color units are based on the APHA recommended standard of 1 color unit being equal to 1 mg/L of platinum or chloroplatinate ion.				
Copper (Cu^{+2})	1.0	Reverse Osmosis	Corrosion Control	Distillation
		Cation Exchange (20-90%)		
Corrosivity	Non-corrosive	Calcite or Calcite/Magnesium Oxide (Magnesia)		
		(5 to 1) Filter to raise pH		
		Soda Ash Chemical Feed		
		Polyphosphate Feed		
		Sodium Silicate Feed		
		Remove all hydrogen peroxide		
		Reduce TDS via Reverse Osmosis (partial, split stream treatment)		
		Coatings		
		Insulating Unions with Ground straps around all insulating breaks in metal pipe		
Fluoride (Fl^{-1})	2.0	Activated Alumina	Electrodialysis	Distillation
		Reverse Osmosis		
Foaming agents (MBAS)	0.5	Chlorination	Reverse Osmosis	Ozonation
		Activated Carbon	Distillation	
Hard Water (measured as calcium carbonate $CaCO_3$)	No federal limit Soft - <17.1 Slightly hard -17.1 to 60 Moderate -60 to 120 Hard - 120 to 180 Very Hard - >180	Remove all calcium and magnesium ions with a cation exchange water softener (general limit is 1710 mg/L total hardness. Above 70 grains per gallon, install two softeners in a series.		

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Iron	0.3 (total iron)	Raise alkalinity by feeding 1.5 mg/L of soda ash for each on mg/L of alkalinity needed or calcite filtration; Lower alkalinity by feeding white vinegar (acetic acid), citric acid or any acid; add carbon dioxide; ion exchange dealkalization; reverse osmosis; distillation or electrodialysis			
Ferrous Iron (Fe^{+2})	0.05 to 0.2 depending circumstances	Filtration (oxidizing filters)	Distillation	Reverse Osmosis*	
		Pressure Aeration/Filtration	Cation Exchange	Electrodialysis	
		Oxidation/Precipitation/Filtration			
Ferric Iron (Fe^{+3})	0.3 (total iron)	Filtration	Sand	Cartridges	
		Calcite (also raise pH to 7.2)	Greensand		
Sequestered iron Iron Bacteria		Strong oxidation and/or fine (10 micron or <) filtration Disinfection and Retention followed by activated carbon filtration for dechlorination			
Colloidal Iron		Coagulation/Filtration	Submicron Filtration		
*Ferrous Iron (clean water iron) is readily converted to ferric iron (red water iron) in the presence of any air or oxidizing material; precipitating ferric iron must be prevented to avoid fouling and interference with effective reverse osmosis membrane rejection.					
Manganese (Mn+2)	0.05	Filtration (Oxidizing Filters)	Cation Exchange	Reverse Osmosis	
		Oxidation/Precipitation/Filtration	Distillation	Electrodialysis	
		Pressure Aeration/Filtration			
Manganese (Mn^{+4})	Non-corrosive	Filtration	Sand	Cartidges	
		Calcite (raise pH to 7.2)	Greensand		
Sequestered Manganese		Strong Oxidation and/or fine filtration			
Colloidal Manganese		Coagulation/Filtration	Submicron Filtration		
*Manganese must be maintained in the soluble manganous (Mn+2) state to avoid fouling and interference with effective reverse osmosis membrane rejection.					
Methyl Tertiary Butyl Ether (MTBE)	No federal limit	Activated Carbon (similar to chloroform and TTHMs, except the treatment life of the activated carbon may be one-half or less of that for chloroform when MTBE will begin to break through).			
		For MBTE concentrations greater than 0.1 mg/L, pre-treat with high air-to-water ratio air stripping prior to activated carbon filtration.			
Odor	3 threshold odor number	Activated Carbon	Air Stripping		
		Oxidation followed by retention and filtration			
		Disinfection for sulfate-reducing bacteria			
		If H2S is in the hot water only, remove the hot water anode rod or replace it with an aluminum anode rod.			
Note: Chlorine and hydrogen sulfide are examples of odors that may be reduced by the treatment methods suggested.					
pH	6.5 – 8.5	Neutralizing filter (calcite or calcite plus magnesia oxide). pH may be increased by alkalies and may be decreased by acids. Chemical feed of soda ash to raise pH or white vinegar to lower pH.			
Silver (Ag+1)	0.1	Ion Exchange (Anion or Cation depending on complexed Ion Species)			
		Distillation	Ozonation	Coagulation/Filtration	
		Reverse Osmosis		Submicron Filtration/Activated Carbon	
Sulfate (SO4-2)	250	Reverse Osmosis	Anion Exchange	Distillation	Electrodialysis
Total dissolved solids (TDS)	500	Reverse Osmosis	Distillation	Electrodialysis	
		Deionization by Ion Exchange (Cation/Anion in two bed or mixed bed)			
Zinc (Zn+2)	5	Reverse Osmosis	Cation Exchange	Distillation	Electrodialysis

(P)* = Proposed Standard
SMCL (mg/L+) = Secondary Maximum Contaminant Level expressed in milligrams per liter (unless otherwise specified).