

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

National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public drinking water systems. Primary standards protect drinking water quality by limiting the levels of specific contaminants that can adversely affect public health and are known or anticipated to occur in drinking water. The following tables divide these contaminants into Microorganisms, Radio Nuclides, Inorganic Chemicals, Organic Chemical and Disinfectant/ Disinfectant By-products.

For simplicity, WQA uses the term Point-Of-Use (POU) when referring to both treatment at the tap and for whole house treatment.

Except for instances of contamination through inhalation or dermal adsorption, the WQA notes that in-home treatment of drinking and cooking water only is often the most economical and preferred method of choice for consumer protection from these drinking water health contaminants. Of course, the particular contaminant found in the water will determine the appropriate treatment technique.

The recognized treatment methods listed here reflect the fact that point-of-use systems on the market today may differ widely in their effectiveness to treat any specific contaminant. Also, many of these can appear in a variety of forms (ionic and/or organic). Examples include arsenic, lead, chromium and mercury which may require different or

multiple treatment techniques. Anyone contemplating use of such point-of-use equipment for a specific application or purpose should make their selection only after careful investigation and substantiation of the performance capabilities. As part of the installation procedure, the performance of the system should be verified through an appropriate water analysis. In addition, the product water should be monitored and appropriately serviced to ensure continued satisfactory performance.

It is the general consensus of the manufacturers and sellers of the point-of-use systems employing the listed technologies that, if these systems are defect-free, properly applied and installed and maintained strictly according to the manufacturers' installation and maintenance instructions, they may be considered for use in meeting the requirements of the National Primary Drinking Water Regulations (NPDWR).

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.

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EPA Primary (Health-Related) Microbial & Turbidity Contaminants					
CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS		
Turbidity		0.5 to 1 NTU in 95% of samples; maximum of 5 NTU under certain circumstances	Coagulation/Filtration	Submicron Filtration	Reverse Osmosis
			Sediment Reduction	Ultrafiltration	Distillation
			Cartridge Filtration matched to turbidity particle size		
Coliform bacteria	zero	zero in 95% of samples	Turbidity or sediment reduction to 1 NTU, then:		
			Disinfection	Chlorination	Ozone
			Ultraviolet Radiation	Iodine (Polyiodide Resins)	Ultraviolet Radiation
			Distillation	Submicron (absolute) Filtration (<0.45 micron)	
Viruses	zero	99.99% reduction	Turbidity reduction to 1 NTU, disinfection:		Distillation
			Chemical Oxidation/Disinfection		Ultraviolet Radiation
			Chlorination	Ozone	Iodine
Giardia lamblia and Cryptosporidium cysts	zero	99.9% reduction or inactivation	Turbidity or sediment reduction to 1 NTU, then:		Disinfection
			Ultraviolet Light	Distillation	Ozone
			Absolute Filtration of less than 3 micron-sized particles		
Legionella	zero	TT	Sediment reduction to one NTU turbidity, then:		Disinfection
			Ultraviolet Light	Chlorination	Ozone
Heterotrophic	zero	TT	Sediment reduction to one NTU turbidity, then:		Disinfection
			Ultraviolet Light	Chlorination	Ozone

Primary (Health-Related) Radionuclide Contaminants

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS		
Beta particle and photon activity (formerly manmade radionuclides)	none	4 mrem/year	Ion Exchange (mixed bed)		Distillation
			Reverse Osmosis		Electrodialysis
Gross alpha particle activity	none	15 pCi/L*	Treatment method depends on the specific radionuclide-e.g., radium, radon or uranium. See below.		
Radium 226 and Radium 228	none	5 pCi/L	Cation Exchange		Reverse Osmosis
			Electrodialysis		Distillation
Radon	zero (P)*	300 pCi/L (P)*	Activated Carbon		Air Stripping
Uranium	zero (P)*	0.03 mg/L (P)*	Coagulation/Filtration	Submicron Filtration	Anion Exchange
			Activated Alumina	Reverse Osmosis	Distillation
			Electrodialysis		

(P)* = Proposed Standard

MCLG+=Maximum Contaminant Level Goal established at the level at which no known or anticipated adverse effects on the health of persons occur and which allows an adequate margin of safety; expressed in milligrams per liter unless otherwise specified.

MCL+=Maximum Contaminant Level established as close to the MCLG as feasible taking into consideration costs and treatment techniques applicable at public water systems; expressed in milligrams per liter unless otherwise specified.

* = 1 pCi = 2.2 atom disintegrations per minute

TT = Treatment Technique

Primary (Health -Related) Inorganic Contaminants

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS		
Antimony	0.006	0.006	Coagulation/Filtration	Submicron Filtration	Reverse Osmosis
			Ultrafiltration	Distillation	
Arsenic (total)	zero (P)*	0.01			
Arsenic (+3)			Chemical oxidation to convert to Arsenic +5, then use Arsenic +5 treatment methods		
Arsenic (+5)			Coagulation/Filtration	Submicron Filtration	Anion Exchange
			Activated Alumina	Reverse Osmosis	Distillation
			Iron Oxide Media	Electrodialysis	Iron/Alumina Media
Arsenic (organic complexes)			Activated Carbon		
Asbestos	7 MFL	7 million fibers per liter (MFL) (longer than microns)	Coagulation/Filtration	Submicron Filtration	Reverse Osmosis
			Distillation	Ultrafiltration	
Barium	2.0	2.0	Cation Exchange	Reverse Osmosis	Distillation
			Electrodialysis		
Beryllium	0.004	0.004	Coagulation/Filtration	Ultrafiltration	Activated Alumina
			Cation Exchange	Reverse Osmosis	Distillation
			Electrodialysis	Submicron Filtration/Activated Carbon	
Cadmium	0.005	0.005	Coagulation/Filtration	Ultrafiltration	Submicron Filtration
			Cation Exchange	Reverse Osmosis	Distillation
			Electrodialysis		
Chromium(total)	0.1	0.1	Coagulation/Filtration	Cation Exchange	Reverse Osmosis
Chromium-3			Distillation	Electrodialysis	
Chromium-6			Anion Exchange	Reverse Osmosis	Distillation
			Electrodialysis		

Primary (Health -Related) Inorganic Contaminants

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS		
Chromium (organic complexes)			Activated Carbon		
Copper	1.3	1.3 (action level)	Corrosion Control	Reverse Osmosis	pH Adjustment
			Distillation	Polyphosphate	Silicate Feed
			Electrodialysis	Cation Exchange (20% - 90%)	
Cyanide	0.2	0.2	Chemical Oxidation	Anion Exchange	Reverse Osmosis
			Distillation	Electrodialysis	
Fluoride	4.0	4.0	Activated Alumina	Bone Char	Reverse Osmosis
			Distillation	Electrodialysis	
Lead	zero	0.015 (action level)	Cation Exchange (20% - 90%)		Electrodialysis
			Coagulation/Filtration		Distillation
			Submicron Filtration/Activated Carbon		Reverse Osmosis
Mercury (total)	0.002	0.002			
Mercury (+2)	0.002	0.002 (total mercury)	Submicron Filtration/Activated Carbon		Reverse Osmosis
			Cation Exchange (20% - 90%)		Distillation
			Electrodialysis		
Mercury (HgCl 3 -1)			Anion Exchange	Reverse Osmosis	Distillation
			Electrodialysis		
Mercury (organic complexes)			Activated Carbon		
Nickel	0.1	0.1	Cation Exchange	Reverse Osmosis	Distillation
			Electrodialysis		
Nitrate plus nitrate (as nitrogen)	10	10	Anion Exchange	Electrodialysis	Distillation
			Reverse Osmosis (sensitive to pressure)		
Nitrite (as nitrogen)	1	1	Chemical Oxidation/Disinfection	Anion Exchange	
			Reverse Osmosis	Distillation	Electrodialysis
Selenium (total)	0.05	0.05			
Selenium (+4)	0.05 (total selenium)	0.05	Coagulation/Filtration	Electrodialysis	Distillation
			Anion Exchange	Activated Alumina	Reverse Osmosis
			Submicron Filtration/Activated Carbon		Ultrafiltration
Selenium (+6)			Anion Exchange	Activated Alumina	Reverse Osmosis
			Distillation	Electrodialysis	
Sulfate	500 (P)*	500 (P)*	Anion Exchange	Reverse Osmosis	Distillation
			Electrodialysis		
Thallium	0.0005	0.002	Cation Exchange	Activated Alumina	Distillation

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Primary (Health-Related) Organic Contaminants

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS
Acrylamide	zero (action level)	0.0005	Control of water treatment chemicals and surfaces in contact with water
Alachlor	zero	0.002	Activated Carbon
Atrazine	0.003	0.003	Activated Carbon
Benz(a)anthracene	zero (P)*	0.0001 (P)*	Activated Carbon
Benzene	zero	0.005	Activated Carbon Air Stripping
Benzo(a)pyrene	zero	0.0002	Activated Carbon
Carbofuran	0.04	0.04	Activated Carbon
Carbon tetrachloride	zero	0.005	Activated Carbon Air Stripping
Chlordane	zero	0.002	Activated Carbon
Chlorobenzene	0.1	0.1	Activated Carbon Air Stripping
2, 4-D	0.07	0.07	Activated Carbon
Dalapon	0.2	0.2	Activated Carbon
1,2-Dibromo 3-chloropropane(D-BCP)	zero	0.0002	Activated Carbon Air Stripping
o-Dichlorobenzene	0.6	0.6	Activated Carbon Air Stripping
p-Dichlorobenzene	0.075	0.075	Activated Carbon Air Stripping
1,2-Dichloroethane)	zero	0.005	Activated Carbon Air Stripping
1,1-Dichloroethylene	0.007	0.007	Activated Carbon Air Stripping
Dichloromethane	zero	0.005	Air Stripping
cis-1,2-Dichloroethylene	0.07	0.07	Activated Carbon Air Stripping
trans-1,2-Dichloroethylene	0.1	0.1	Activated Carbon Air Stripping
1,2-Dichloropropane	zero	0.005	Activated Carbon Air Stripping
Di(2-ethylhexyl)adipate	0.4	0.4	Activated Carbon Air Stripping
Di(2ethylhexyl)phthalate	zero	0.006	Activated Carbon
Dinoseb	0.007	0.007	Activated Carbon
Dioxin(2,3,7,8-TCDD)	zero	0.00000003	Activated Carbon
Diquat	0.02	0.02	Activated Carbon
Endothall	0.1	0.1	Activated Carbon
Endrin	0.002	0.002	Activated Carbon
Epichlorohydrin	zero (action level)	0.002	Control of water treatment chemicals and surfaces in contact with water
Ethylbenzene	0.7	0.7	Activated Carbon Air Stripping
Ethylene Dibromide	zero	0.00005	Activated Carbon Air Stripping
Glyphosate	0.7	0.7	Activated Carbon Oxidation
Heptachlor	zero	0.0004	Activated Carbon
Heptachlor Epoxide	zero	0.0002	Activated Carbon
Hexachlorobenzene	zero	0.001	Activated Carbon
Hexachlorocyclopentadiene	0.05	0.05	Activated Carbon Air Stripping
Lindane	0.0002	0.0002	Activated Carbon
Methoxychlor	0.04	0.04	Activated Carbon
Oxamyl (Vydate)	0.2	0.2	Activated Carbon

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS
Pentachlorophenol	zero	0.001	Activated Carbon
Picloram	0.5	0.5	Activated Carbon
Polychlorinated byphenyls (PCBs)	zero	0.0005	Activated Carbon
Simarazine	0.004	0.004	Activated Carbon
Styrene	0.1	0.1	Activated Carbon Air Stripping
Tetrachloroethylene	zero	0.005	Activated Carbon Air Stripping
Toluene	1	1	Activated Carbon Air Stripping
Toxaphene	zero	0.003	Activated Carbon
2,4,5-TP (silvex)	0.05	0.05	Activated Carbon
1,2,4-Trichlorobenzene	0.07	0.07	Activated Carbon Air Stripping
1,1,1-Trichloroethane	0.2	0.2	Activated Carbon Air Stripping
1,1,2-Trichloroethane	0.003	0.005	Activated Carbon Air Stripping
Trichloroethylene	zero	0.005	Activated Carbon Air Stripping
Vinyl chloride	zero	0.002	Air Stripping
Xylenes (total)	10	10	Activated Carbon Air Stripping

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Primary (Health-Related) Disinfectants/Disinfectant By-Products

CONTAMINANTS	MCLG+	MCL+	TREATMENT METHODS
Bromate	zero	0.010	Activated Carbon Air Stripping
Bromodichloromethane	zero	see TTHMs	Activated Carbon Air Stripping
Bromoform	zero	see TTHMs	Activated Carbon Air Stripping
Chloramines	4 (total chlorine)	4 (total chlorine)	Activated Carbon
Chlorine	4 (as free chlorine)	4 (as free chlorine)	Activated Carbon
Chlorine Dioxide	0.3 (as ClO ₂)	0.8 (as ClO ₂)	Activated Carbon
Chorite	0.8	1.0	Activated Carbon
Chloroform	zero	see TTHMs	Activated Carbon Air Stripping
Dibromochloromethane	0.06	see TTHMs	Activated Carbon Air Stripping
Dichloroacetic Acid	zero	see HAA5	Activated Carbon
Haloacetic Acids (HAA5)	zero (0.050) (P)*	0.06	Activated Carbon
Trichloroacetic Acid	0.3	see HAA5	Activated Carbon
Total Trihalomethanes (TTHMs) Bromodichloromethane Bromoform Chloroform Dichlorobromomethane	zero	0.080 0.040 (P)*	Activated Carbon Reverse Osmosis (20-90%) Ultrapurification for precursor removal prior to chlorination Air Stripping Distillation (20-90%)

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Microorganisms

Contaminant	MCLG1 (mg/L) ²	MCL or TT1 (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
Cryptosporidium	zero	TT3	Gastrointestinal illness (such as diarrhea, vomiting, and cramps)	Human and animal fecal waste
Giardia lamblia	zero	TT3	Gastrointestinal illness (such as diarrhea, vomiting, and cramps)	Human and animal fecal waste
Heterotrophic plate count (HPC)	n/a	TT3	HPC has no health effects; it is an analytic method used to measure the variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	HPC measures a range of bacteria that are naturally present in the environment
Legionella	zero	TT3	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and E. Coli) Quick reference guide	zero	5.0% ⁴	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present ⁵	Coliforms are naturally present in the environment; as well as feces; fecal coliforms and E. coli only come from human and animal fecal waste.
Turbidity	n/a	TT3	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (such as whether disease-causing organisms are present). Higher turbidity levels are often associated with higher levels of disease-causing microorganisms such as viruses, parasites and some bacteria. These organisms can cause symptoms such as nausea, cramps, diarrhea, and associated headaches.	Soil runoff
Viruses (enteric)	zero	TT3	Gastrointestinal illness (such as diarrhea, vomiting, and cramps)	Human and animal fecal waste