

National Primary Drinking Water Regulations

National Primary Drinking Water Regulations (NPDWRs or primary standards) are legally enforceable standards that apply to public water systems. Primary standards protect public health by limiting levels of contaminants in drinking water.

National Secondary Drinking Water Regulations

National Secondary Drinking Water Regulations (NSDWRs or secondary standards) are non-enforceable guidelines regulating contaminants that may cause cosmetic effects (such as skin or tooth discoloration) or aesthetic effects (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.

Definitions

Maximum Contaminant Level Goal (MCLG) --The level of a contaminant in drinking water below which there is no known or expected risk to health. MCLGs allow for a margin of safety and are non-enforceable public health goals.

Maximum Contaminant Level (MCL) -- The highest level of a contaminant that is allowed in drinking water. MCLs are set as close to MCLGs as feasible using the best available treatment technology and taking cost into consideration. MCLs are enforceable standards.

Maximum Residual Disinfectant Level Goal (MRDLG) -- The level of drinking water disinfectant below which there is no known or expected risk to health. MRDLGs do not reflect the benefits of the use of disinfectants to control microbial contaminants.

Maximum Residual Disinfectant Level (MRDL) -- The highest level of a disinfectant allowed in drinking water. There is convincing evidence that addition of a disinfectant is necessary for control of microbial contaminants.

Treatment Technique (TT) -- A required process intended to reduce the level of a contaminant in drinking water.

***Note:** *This document addresses the United States Environmental Protection Agency Drinking Water Regulations in effect at its time of publication. These regulations are continually being reviewed and updated at the federal level. If there is any question as to validity of the current data, simply contact a state EPA office in your area.*

EPA National Primary Drinking Water Standards MICROORGANISMS

Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
<i>Cryptosporidium</i>	Note: 1-1	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Absolute 1 micron filtration, Ultraviolet disinfection, Ozone, Chlorine disinfection
<i>Giardia lamblia</i>	99% Removal/inactivation	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Absolute 1 micron filtration, Ultraviolet disinfection, Ozone, Chlorine disinfection
Heterotrophic plate count (HPC)	No more than 500 bacterial colonies per milliliter	No health effects; it is an analytic method used to measure a variety of bacteria that are common in water. The lower the concentration of bacteria in drinking water, the better maintained the water system is.	Ultraviolet disinfection, ozone, hydrogen peroxide or chlorine disinfection
<i>Legionella</i>	Note: 1-2	Legionnaire's Disease, a type of pneumonia	same as above
Total Coliforms (including fecal coliform and <i>E. coli</i>)	Note: 1-3	Not a health threat in itself; it is used to indicate whether other potentially harmful bacteria may be present	Ultraviolet disinfection, ozone, hydrogen peroxide or chlorine disinfection
Turbidity	Note: 1-4	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality and filtration effectiveness (e.g., whether disease-causing organisms are present). These organisms can cause symptoms such as nausea, cramps, diarrhea, and headaches.	Coagulation/Filtration, Submicron Filtration, Ultrafiltration, Reverse Osmosis, Cartridge Filtration matched to Turbidity Particle size, or Distillation
Viruses (enteric)	99% Removal inactivation	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Ultraviolet disinfection, ozone, hydrogen peroxide or chlorine disinfection

Notes:

- 1-1. *Cryptosporidium* (as of 1/1/02 for systems serving more than 10,000 and 1/14/05 for systems serving less than 10,000) 99% removal.
- 1-2. *Legionella*: No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, *Legionella* will also be controlled.
- 1-3. Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal wastes. Disease-causing microbes (pathogens) in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. These pathogens may pose a special health risk for infants, young children, and people with severely compromised immune systems. No more than 5.0% total coliform-positive in a month. Every sample that has total coliform must be analyzed for either fecal coliforms or *E. coli* if two consecutive TC-positive samples, and one is also positive for *E. coli* fecal coliforms, system has an acute MCL violation.
- 1-4. Turbidity: At no time can turbidity (cloudiness of water) go above 5 nephelometric turbidity units (NTU); systems that filter must ensure that the turbidity go no higher than 1 NTU (0.5) for conventional or direct filtration in at least 95% of the daily samples in any month. As of January 1, 2002, for systems servicing more than 10,000, and January 14, 2005, for systems servicing less than 10,000, turbidity may never exceed 1 NTU, and must not exceed 0.3 NTU in 95% of daily samples in any month.

RADIONUCLIDES

Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Alpha particles	15 picocuries per Liter (pCi/L)	Increased Risk of Cancer	Ion Exchange, Reverse Osmosis, Distillation, & Electrodialysis
Beta particles & photon emitters	4 millirems per year	Increased Risk of Cancer	Ion Exchange, Reverse Osmosis, Distillation, & Electrodialysis
Radium 226 & Radium 228 (combined)	5 pCi/L	Increased Risk of Cancer	Cation exchange, Reverse Osmosis, Distillation, & Electrodialysis
Uranium	30 ug/L as of 12/08/03	Increased Risk of Cancer, kidney toxicity	Coagulation/Filtration, Submicron Filtration, Anion Exchange, Activated Alumina, Reverse Osmosis, Distillation, and Electrodialysis

Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Antimony	0.006	Increase in blood cholesterol; decrease in blood sugar	Coagulation/Filtration, Submicron Filtration, Reverse Osmosis, Ultrafiltration, and Distillation
Arsenic	0.010 as of 1/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Coagulation/Filtration, Submicron Filtration, Anion Exchange, Activated Alumina, Reverse Osmosis, Distillation, Electro-dialysis, and granular ferric oxide media fil.
Asbestos (Fibers > 10 micrometers)	7 million fibers per Liter (MFL)	Increased Risk of developing benign intestinal polyps	Coagulation/Filtration, Submicron Filtration, Reverse Osmosis, Ultrafiltration, and Distillation
Barium	2	Increase in blood pressure	Cation Exchange, Reverse Osmosis Distillation, and Electrodialysis
Beryllium	0.004	Intestinal lesions	Coagulation/Filtration, Submicron Filtration/Activated Carbon, Activated Alumina, Cation Exchange, Reverse Osmosis, Distillation, and Electrodialysis
Cadmium	0.005	Kidney Damage	Coagulation/Filtration, Submicron Filtration, Cation Exchange, Reverse Osmosis, Distillation, and Electrodialysis
Chromium (total)	0.1	Allergic dermatitis	Coagulation/Filtration, Cation Exchange, Reverse Osmosis, Distillation, Anion Exchange, and Electrodialysis
Copper	Note: 2-1 1.3 action level	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage.	Cation Exchange (20%-90%), Reverse Osmosis, Distillation, and Electrodialysis
Cyanide (as free cyanide)	0.2	Nerve damage or thyroid problems	Chemical Oxidation/Disinfection at pH > 10, Anion Exchange, Reverse Osmosis, Distillation, and Electrodialysis
Flouride	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Activated Alumina, Activated Carbon, Reverse Osmosis, Distillation, and Electrodialysis
Lead	Note: 2-1 0.015 action level	Infants and Children: Delays in physical or mental development; children could show slight deficits in attention span and learning abilities; Adults: Kidney problems, high blood pressure	Cation Exchange (20%-90%), Coagulation/Filtration, Submicron Filtration/Activated Carbon, Reverse Osmosis, Distillation, and Electrodialysis
Mercury (inorganic)	0.002	Kidney damage	Submicron Filtration/Activated Carbon, Cation Exchange (20%-90%), Reverse Osmosis, Distillation, Anion Exchange, and Electrodialysis
Nitrate (measured as Nitrogen)	10	Infants below the age of six months who drink water containing nitrate or nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Anion Exchange, Reverse Osmosis, Distillation, and Electroradialysis
Nitrite (measured as Nitrogen)	1		Chemical Oxidation/Disinfection, Anion Exchange, Reverse Osmosis, Distillation, and Electrodialysis
Selenium	0.05	Hair or fingernail loss; numbness of fingers or toes; circulatory problems	Coagulation/Filtration, Submicron Filtration/Activated Carbon, Activated Alumina, Anion Exchange, Reverse Osmosis, Distillation, and Electrodialysis
Thallium	0.002	Hair loss; changes in blood; kidney, intestine or liver problems	Cation Exchange, Activated Alumina, and Distillation

Note:

2-1. Lead and Copper are regulated by a treatment technique that requires systems to control the corrosiveness of their water. If more than 10% of tap water samples exceed action level, water systems must take additional steps.

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Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Acrylamide	Note: 3-1	Nervous systems or blood problems	Control of water treatment chemicals and surfaces in contact with water
Alachlor	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Activated Carbon, Aeration
Atrazine	0.003	Cardiovascular system or reproductive problems	Activated Carbon
Benzene	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Activated Carbon, Aeration
Benzo(a)pyrene (PAHs)	0.0002	Reproductive difficulties; increased risk of cancer	Activated Carbon
Carbofuran	0.04	Problems with blood, nervous system, or reproductive system	Activated Carbon
Carbon tetrachloride	0.005	Liver problems; increased risk of cancer	Activated Carbon, Aeration
Chlordane	0.002	Liver or nervous system problems; increased risk of cancer	Activated Carbon
Chlorobenzene	0.1	Liver or kidney problems	Activated Carbon
2,4-D	0.07	Kidney, liver, or adrenal gland problems	Activated Carbon
Dalapon	0.2	Minor kidney changes	Activated Carbon
1,2-Dibromo-3-chloropropane (DBCP)	0.0002	Reproductive difficulties; increased risk of cancer	Activated Carbon
o-Dichlorobenzene	0.6	Liver, kidney, or circulatory system problems	Activated Carbon, Aeration
p-Dichlorobenzene	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Activated Carbon, Aeration
1,2-Dichloroethane	0.005	Increased risk of cancer	Activated Carbon, Aeration
1,1-Dichloroethylene	0.007	Liver problems	Activated Carbon, Aeration
cis-1,2-Dichloroethylene	0.07	Liver problems	Activated Carbon, Aeration
trans-1,2-Dichloroethylene	0.1	Liver problems	Activated Carbon, Aeration
Dichloromethane	0.005	Liver problems; increased risk of cancer	Aeration
1,2-Dichloropropane	0.005	Increased risk of cancer	Activated Carbon, Aeration
Di(2-ethylhexyl) adipate	0.4	Weight loss, liver problems, or possible reproductive difficulties	Activated Carbon, Aeration
Di(2-ethylhexyl) phthalate	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Activated Carbon
Dinoseb	0.007	Reproductive difficulties	Activated Carbon
Dioxin (2,3,7,8-TCDD)	0.0000003	Reproductive difficulties; increased risk of cancer	Activated Carbon
Diquat	0.02	Cataracts	Activated Carbon
Endothall	0.1	Stomach and intestinal problems	Activated Carbon
Endrin	0.002	Liver problems	Activated Carbon
Epichlorohydrin	Note: 3-1	Increased cancer risk, and over a long period of time, stomach problems	Control of water treatment chemicals and surfaces in contact with water

Note:

3-1. Each water system must certify, in writing, to the state (using third-party or manufacturers certification) that when it uses acrylamide and/or epichlorohydrin to treat water, the combination (or product) of dose and monomer level does not exceed the levels specified as follows: Acrylamide = 0.05% dosed at 1 mg/L (or equivalent); Epichlorohydrin = 0.01% dosed at 20 mg/L (or equivalent).

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Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Ethylbenzene	0.7	Liver or kidney problems	Activated Carbon, Aeration
Ethylene dibromide	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Activated Carbon, Aeration
Glyphosate	0.7	Kidney problems; reproductive difficulties	Activated Carbon
Heptachlor	0.0004	Liver damage; increased risk of cancer	Activated Carbon
Heptachlor epoxide	0.0002	Liver damage; increased risk of cancer	Activated Carbon
Hexachlorobenzene	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Activated Carbon
Hexachlorocyclopentadiene	0.05	Kidney or stomach problems	Activated Carbon, Aeration
Lindane	0.0002	Liver or kidney problems	Activated Carbon
Methoxychlor	0.04	Reproductive difficulties	Activated Carbon
Oxamyl (Vydate)	0.2	Slight nervous system effects	Activated Carbon
Pentachlorophenol	0.001	Liver or kidney problems; increased cancer risk	Activated Carbon
Picloram	0.5	Liver problems	Activated Carbon
Polychlorinated biphenyls (PCBs)	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Activated Carbon
Simazine	0.004	Problems with blood	Activated Carbon
Styrene	0.1	Liver, kidney, or circulatory system problems	Activated Carbon, Aeration
Tetrachloroethylene	0.005	Liver problems, increased risk of cancer	Activated Carbon, Aeration
Toluene	1	Nervous system, kidney, or liver problems	Activated Carbon, Aeration
Toxaphene	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Activated Carbon
2,4,5-TP (Silvex)	0.05	Liver problems	Activated Carbon
1,2,4-Trichlorobenzene	0.07	Changes in adrenal glands	Activated Carbon, Aeration
1,1,1-Trichloroethane	0.2	Liver, nervous system, or circulatory problems	Activated Carbon, Aeration
1,1,2-Trichloroethane	0.005	Liver, kidney, or immune system problems	Activated Carbon, Aeration
Trichloroethylene	0.005	Liver problems; increased risk of cancer	Activated Carbon, Aeration
Vinyl Chloride	0.002	Increased risk of cancer	Aeration
Xylenes (total)	10	Nervous system damage	Activated Carbon, Aeration

DISINFECTANT

Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Chloramines (as Cl ₂)	MRDL = 4.0	Eye/nose irritation; stomach discomfort, anemia	Activated Carbon
Chlorine (as Cl ₂)	MRDL = 4.0	Eye/nose irritation; stomach discomfort	Activated Carbon
Chlorine Dioxide (as ClO ₂)	MRDL = 0.8	Anemia; infants & young children, nervous system effects	Activated Carbon

DISINFECTANT BYPRODUCT

Contaminant	MCL(mg/L)	Potential Health Effects from Exposure above the MCL	Treatment Methods
Bromate	0.010	Increased risk of cancer	Call EPA for more info.
Chlorite	1	Anemia; infants & young children, nervous system effects	Call EPA for more info.
Haloacetic acids (HAA5)	0.060	Increased risk of cancer	Call EPA for more info.
Total Trihalomethanes (TTHMs)	0.080	Liver, kidney or central nervous system problems; increased risk of cancer	Activated Carbon



EPA National Secondary Drinking Water Standards

Contaminant	Secondary Standard	Treatment Methods
Aluminum	0.05 to 0.2 mg/L	Cation Exchange, Reverse Osmosis, Distillation, Electrodialysis
Chloride	250 mg/L	Reverse Osmosis, Distillation, Anion Exchange, Electrodialysis
Color	15 (color units) Note: 1	Anion Exchange, Reverse Osmosis, Activated Carbon, Distillation, Filtration, Ozonation, Chlorination, Activated Alumina
Copper	1.0 mg/L	Reverse Osmosis, Distillation, Cation Exchange (20%-90%), Electrodialysis
Corrosivity	Non-corrosive	Calcite or Calcite/Magnesium Oxide (Magnesia), (5 to 1) Filter to raise pH, Soda Ash Chemical Feed, Sodium Silicate Feed, Reduce TDS via Reverse Osmosis (partial, split stream treatment), Coatings, Insulating Unions
Fluoride	2.0	Activated Alumina, Activated Carbon, Reverse Osmosis, Distillation
Foaming Agents	0.5 mg/L	Chlorination, Reverse Osmosis, Activated Carbon, Distillation, Ozonation
Iron	0.3 mg/L Note: 2	Filtration (oxidizing filters), Cation Exchange, Reverse Osmosis, Pressure Aeration/Filtration, Chlorination - Precipitation/Filtration, Distillation, Electrodialysis
Manganese	0.05 mg/L Note: 3	Filtration (oxidizing filters), Cation Exchange, Reverse Osmosis, Distillation, Chlorination - Precipitation/Filtration, Pressure Aeration/Filtration, Electrodialysis
Odor	3 threshold odor # Note: 4	Activated Carbon, Aeration, Oxidation
pH	6.5 - 8.5	pH may be increased by alkalis and may be decreased by acids, Ion Exchange, Neutralizing Filter (Calcite, Magnesia)
Silver	0.10 mg/L	Coagulation/Filtration, Submicron Filtration/Activated Carbon, Ion Exchange (Anion or Cation depending on complexed Ion Species)
Sulfate	250 mg/L	Reverse Osmosis, Distillation, Anion Exchange, Electrodialysis
Total Dissolved Solids (TDS)	500 mg/L	Reverse Osmosis, Distillation, Deionization by Ion Exchange (Cation/Anion in two bed or mixed bed), Electrodialysis
Zinc	5 mg/L	Reverse Osmosis, Distillation, Cation Exchange, Electrodialysis

Notes:

- Color** - Color units are based on the APHA recommended standard of 1 color unit being equal to 1 mg/L of platinum or chloroplatinate ion.
- Iron** - Ferrous Iron (clear 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** - Manganese must be maintained in the soluble manganous ($Mn + 2$) stated to avoid fouling and interference with effective reverse osmosis membrane rejection.
- Odor** - Chlorine and hydrogen sulfide are examples of odors that may be reduced by the treatment methods suggested

