

Water: Drinking Water Contaminants

You are here: [Water](#) » [Drinking Water](#) » Drinking Water Contaminants

Drinking Water Contaminants

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 the levels of contaminants in drinking water. Visit the list of regulated contaminants with links for more details.

On this Page

- [National Primary DW Regulations](#)
- [List of DW Contaminants & MCLs](#)
- [National Secondary DW Regs](#)
- [List of Secondary DW Regulations](#)
- [Unregulated Contaminants](#)



- [List of Contaminants & their Maximum Contaminant Level \(MCLs\)](#)
- [Regulation Development](#)
- [EPA's Regulated Contaminant Timeline \(PDF\)](#) (1 pp, 86 K) ([About PDF](#))
- [National Primary Drinking Water Regulations](#)- The complete regulations regarding these contaminants available from the Code of Federal Regulations Website

List of Contaminants & their MCLs

An alphabetical listing with links to fact sheets on the primary drinking water regulations.

- [Microorganisms](#)
- [Disinfectants](#)
- [Disinfection Byproducts](#)
- [Inorganic Chemicals](#)
- [Organic Chemicals](#)
- [Radionuclides](#)

Information on this section

- [Alphabetical List \(PDF\)](#) (6 pp, 924 K) ([About PDF](#)) EPA 816-F-09-0004, May 2009

Microorganisms

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (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	TT ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Giardia lamblia	zero	TT ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste
Heterotrophic plate count	n/a	TT ³	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	TT ³	Legionnaire's Disease, a type of pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and E. Coli)	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 <i>E. coli</i> only come from human and animal fecal waste.
Turbidity	n/a	TT ³	Turbidity is a measure of the cloudiness of water. It is used to indicate water quality	Soil runoff

			and filtration effectiveness (e.g., 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.	
<u>Viruses (enteric)</u>	zero	TT ³	Gastrointestinal illness (e.g., diarrhea, vomiting, cramps)	Human and animal fecal waste

Disinfection Byproducts

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
<u>Bromate</u>	zero	0.010	Increased risk of cancer	Byproduct of drinking water disinfection
<u>Chlorite</u>	0.8	1.0	Anemia; infants & young children: nervous system effects	Byproduct of drinking water disinfection
<u>Haloacetic acids (HAA5)</u>	n/a ⁶	0.060 ⁷	Increased risk of cancer	Byproduct of drinking water disinfection
<u>Total Trihalomethanes (TTHMs)</u>	--> n/a ⁶	--> 0.080 ⁷	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection

Disinfectants

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
<u>Chloramines (as Cl₂)</u>	MRDLG=4 ¹	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort, anemia	Water additive used to control microbes
<u>Chlorine (as Cl₂)</u>	MRDLG=4 ¹	MRDL=4.0 ¹	Eye/nose irritation; stomach discomfort	Water additive used to control microbes
<u>Chlorine dioxide (as ClO₂)</u>	MRDLG=0.8 ¹	MRDL=0.8 ¹	Anemia; infants & young children: nervous system effects	Water additive used to control microbes

Inorganic Chemicals

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
<u>Antimony</u>	0.006	0.006	Increase in blood cholesterol; decrease in blood sugar	Discharge from petroleum refineries; fire retardants; ceramics; electronics; solder
<u>Arsenic</u>	0 ⁷	0.010 as of 01/23/06	Skin damage or problems with circulatory systems, and may have increased risk of getting cancer	Erosion of natural deposits; runoff from orchards, runoff from glass & electronics production wastes
<u>Asbestos (fiber >10 micrometers)</u>	7 million fibers per liter	7 MFL	Increased risk of developing benign intestinal polyps	Decay of asbestos cement in water mains; erosion of natural deposits
<u>Barium</u>	2	2	Increase in blood pressure	Discharge of drilling wastes; discharge from metal refineries; erosion of natural deposits

<u>Beryllium</u>	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
<u>Cadmium</u>	0.005	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
<u>Chromium (total)</u>	0.1	0.1	Allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits
<u>Copper</u>	1.3	TT ^Z ; Action Level=1.3	Short term exposure: Gastrointestinal distress Long term exposure: Liver or kidney damage People with Wilson's Disease should consult their personal doctor if the amount of copper in their water exceeds the action level	Corrosion of household plumbing systems; erosion of natural deposits
<u>Cyanide (as free cyanide)</u>	0.2	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories
<u>Fluoride</u>	4.0	4.0	Bone disease (pain and tenderness of the bones); Children may get mottled teeth	Water additive which promotes strong teeth; erosion of natural deposits; discharge from fertilizer and aluminum factories
<u>Lead</u>	zero	TT ^Z ; Action Level=0.015	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	Corrosion of household plumbing systems; erosion of natural deposits
<u>Mercury (inorganic)</u>	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and croplands
<u>Nitrate (measured as Nitrogen)</u>	10	10	Infants below the age of six months who drink water containing nitrate in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
<u>Nitrite (measured as Nitrogen)</u>	1	1	Infants below the age of six months who drink water containing nitrite in excess of the MCL could become seriously ill and, if untreated, may die. Symptoms include shortness of breath and blue-baby syndrome.	Runoff from fertilizer use; leaking from septic tanks, sewage; erosion of natural deposits
<u>Selenium</u>	0.05	0.05	Hair or fingernail loss; numbness in fingers or toes; circulatory problems	Discharge from petroleum refineries; erosion of natural deposits; discharge from mines
<u>Thallium</u>	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and drug factories

Organic Chemicals

--	--	--	--	--

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
<u>Acrylamide</u>	zero	TT ³	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/wastewater treatment
<u>Alachlor</u>	zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
<u>Atrazine</u>	0.003	0.003	Cardiovascular system or reproductive problems	Runoff from herbicide used on row crops
<u>Benzene</u>	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
<u>Benzo(a)pyrene (PAHs)</u>	zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
<u>Carbofuran</u>	0.04	0.04	Problems with blood, nervous system, or reproductive system	Leaching of soil fumigant used on rice and alfalfa
<u>Carbon tetrachloride</u>	zero	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
<u>Chlordane</u>	zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
<u>Chlorobenzene</u>	0.1	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
<u>2,4-D</u>	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
<u>Dalapon</u>	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
<u>1,2-Dibromo-3-chloropropane (DBCP)</u>	zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards
<u>o-Dichlorobenzene</u>	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
<u>p-Dichlorobenzene</u>	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories
<u>1,2-Dichloroethane</u>	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
<u>1,1-Dichloroethylene</u>	0.007	0.007	Liver problems	Discharge from industrial chemical factories
<u>cis-1,2-Dichloroethylene</u>	0.07	0.07	Liver problems	Discharge from industrial chemical factories
<u>trans-1,2-Dichloroethylene</u>	0.1	0.1	Liver problems	Discharge from industrial chemical factories

<u>Dichloromethane</u>	zero	0.005	Liver problems; increased risk of cancer	Discharge from drug and chemical factories
<u>1,2-Dichloropropane</u>	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
<u>Di(2-ethylhexyl) adipate</u>	0.4	0.4	Weight loss, liver problems, or possible reproductive difficulties.	Discharge from chemical factories
<u>Di(2-ethylhexyl) phthalate</u>	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
<u>Dinoseb</u>	0.007	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
<u>Dioxin (2,3,7,8-TCDD)</u>	zero	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories
<u>Diquat</u>	0.02	0.02	Cataracts	Runoff from herbicide use
<u>Endothall</u>	0.1	0.1	Stomach and intestinal problems	Runoff from herbicide use
<u>Endrin</u>	0.002	0.002	Liver problems	Residue of banned insecticide
<u>Epichlorohydrin</u>	zero	TT ^g	Increased cancer risk, and over a long period of time, stomach problems	Discharge from industrial chemical factories; an impurity of some water treatment chemicals
<u>Ethylbenzene</u>	0.7	0.7	Liver or kidneys problems	Discharge from petroleum refineries
<u>Ethylene dibromide</u>	zero	0.00005	Problems with liver, stomach, reproductive system, or kidneys; increased risk of cancer	Discharge from petroleum refineries
<u>Glyphosate</u>	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use
<u>Heptachlor</u>	zero	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide
<u>Heptachlor epoxide</u>	zero	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor
<u>Hexachlorobenzene</u>	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
<u>Hexachlorocyclopentadiene</u>	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
<u>Lindane</u>	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens
<u>Methoxychlor</u>	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock
<u>Oxamyl (Vydate)</u>	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes

<u>Polychlorinated biphenyls (PCBs)</u>	zero	0.0005	Skin changes; thymus gland problems; immune deficiencies; reproductive or nervous system difficulties; increased risk of cancer	Runoff from landfills; discharge of waste chemicals
<u>Pentachlorophenol</u>	zero	0.001	Liver or kidney problems; increased cancer risk	Discharge from wood preserving factories
<u>Picloram</u>	0.5	0.5	Liver problems	Herbicide runoff
<u>Simazine</u>	0.004	0.004	Problems with blood	Herbicide runoff
<u>Styrene</u>	0.1	0.1	Liver, kidney, or circulatory system problems	Discharge from rubber and plastic factories; leaching from landfills
<u>Tetrachloroethylene</u>	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
<u>Toluene</u>	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
<u>Toxaphene</u>	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
<u>2,4,5-TP (Silvex)</u>	0.05	0.05	Liver problems	Residue of banned herbicide
<u>1,2,4-Trichlorobenzene</u>	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories
<u>1,1,1-Trichloroethane</u>	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
<u>1,1,2-Trichloroethane</u>	0.003	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
<u>Trichloroethylene</u>	zero	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
<u>Vinyl chloride</u>	zero	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
<u>Xylenes (total)</u>	10	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories

Radionuclides

Contaminant	MCLG ¹ (mg/L) ²	MCL or TT ¹ (mg/L) ²	Potential Health Effects from Long-Term Exposure Above the MCL (unless specified as short-term)	Sources of Contaminant in Drinking Water
<u>Alpha particles</u>	none ⁷ -- ----- zero	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits of certain minerals that are radioactive and may emit a form of radiation known as alpha radiation
<u>Beta particles and photon emitters</u>	none ⁷ -- ----- zero	4 millirems per year	Increased risk of cancer	Decay of natural and man-made deposits of certain minerals that are radioactive and may emit forms of radiation known as photons and beta radiation

<u>Radium 226 and Radium 228 (combined)</u>	none ⁷ -- ----- zero	5 pCi/L	Increased risk of cancer	Erosion of natural deposits
<u>Uranium</u>	zero	30 ug/L as of 12/08/03	Increased risk of cancer, kidney toxicity	Erosion of natural deposits

Notes

¹ 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 a 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. (TT) Treatment Technique - A required process intended to reduce the level of a contaminant in drinking water. 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.

² Units are in milligrams per liter (mg/L) unless otherwise noted. Milligrams per liter are equivalent to parts per million.

³ EPA's surface water treatment rules require systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water or meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels:

- *Cryptosporidium*: Unfiltered systems are required to include *Cryptosporidium* in their existing watershed control provisions.
- *Giardia lamblia*: 99.9% removal/inactivation
- Viruses: 99.99% removal/inactivation
- *Legionella*: No limit, but EPA believes that if *Giardia* and viruses are removed/inactivated, according to the treatment techniques in the Surface Water Treatment Rule, *Legionella* will also be controlled.
- Turbidity: For systems that use conventional or direct filtration, at no time can turbidity (cloudiness of water) go higher than 1 nephelometric turbidity unit NTU, and samples for turbidity must be less than or equal to 0.3 NTU in at least 95 percent of the samples in any month. Systems that use filtration other than the conventional or direct filtration must follow state limits, which must include turbidity at no time exceeding 5 NTU.
- HPC: No more than 500 bacterial colonies per milliliter.
- Long Term 1 Enhanced Surface Water Treatment: Surface water systems or (GWUDI) systems serving fewer than 10,000 people must comply with the applicable Long Term 1 Enhanced Surface Water Treatment Rule provisions (e.g. turbidity standards, individual filter monitoring, *Cryptosporidium* removal requirements, updated watershed control requirements for unfiltered systems).
- Long Term 2 Enhanced Surface Water Treatment Rule This rule applies to all surface water systems or ground water systems under the direct influence of surface water. The rule targets additional *Cryptosporidium* treatment requirements for higher risk systems and includes provisions to reduce risks from uncovered finished water storage facilities and to ensure that the systems maintain microbial protection as they take steps to reduce the formation of disinfection byproducts.
- Filter Backwash Recycling; The Filter Backwash Recycling Rule requires systems that recycle to return specific recycle flows through all processes of the system's existing conventional or direct filtration system or at an alternate location approved by the state.

⁴ No more than 5.0% samples total coliform-positive in a month. (For water systems that collect fewer than 40 routine samples per month, no more than one sample can be total coliform-positive per 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.

⁵ 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.

⁶ Although there is no collective MCLG for this contaminant group, there are individual MCLGs for some of the individual contaminants:

- Trihalomethanes: bromodichloromethane (zero); bromoform (zero); dibromochloromethane (0.06 mg/L); chloroform (0.07mg/L).
- Haloacetic acids: dichloroacetic acid (zero); trichloroacetic acid (0.02 mg/L); monochloroacetic acid (0.07 mg/L). Bromoacetic acid and dibromoacetic acid are regulated with this group but have no MCLGs.

⁷ 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 the action level, water systems must take additional steps. For copper, the action level is 1.3 mg/L, and for lead is 0.015 mg/L.

⁸ Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used 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)

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.

- [National Secondary Drinking Water Regulations](#) - The complete regulations regarding these contaminants available from the Code of Federal Regulations Web Site.
- For more information, read [Secondary Drinking Water Regulations: Guidance for Nuisance Chemicals](#).

List of National Secondary Drinking Water Regulations

Contaminant	Secondary Standard
Aluminum	0.05 to 0.2 mg/L
Chloride	250 mg/L
Color	15 (color units)
Copper	1.0 mg/L
Corrosivity	noncorrosive
Fluoride	2.0 mg/L
Foaming Agents	0.5 mg/L
Iron	0.3 mg/L
Manganese	0.05 mg/L
Odor	3 threshold odor number
pH	6.5-8.5
Silver	0.10 mg/L
Sulfate	250 mg/L
Total Dissolved Solids	500 mg/L
Zinc	5 mg/L

Unregulated Contaminants

This list of contaminants which, at the time of publication, are not subject to any proposed or promulgated national primary drinking water regulation (NPDWR), are known or anticipated to occur in public water systems, and may require regulations under SDWA. For more information check out the list, or visit the Drinking Water Contaminant Candidate List (CCL) web site.

- [Drinking Water Contaminant Candidate List 2](#)
- [Drinking Water Contaminant Candidate List \(CCL\) Web Site](#)
- [Unregulated Contaminant Monitoring Program \(UCM\)](#)
- **Information on specific unregulated contaminants**
 - [MTBE \(methyl-t-butyl ether\) in drinking water](#)