

## Health Effects of Drinking Water Contaminants

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Chemical contaminants occur in drinking water supplies throughout the United States, ranging from barely detectable amounts to levels that could possibly threaten human health. Determining the health effects of these contaminants is difficult, especially since researchers are still learning how chemicals react in the body to damage cells and cause illness.

### Acute and Chronic Health Effects

Toxic doses of chemicals cause either acute or chronic health effects. An acute effect usually follows a large dose of a chemical and occurs almost immediately. Examples of acute health effects are nausea, lung irritation, skin rash, vomiting, dizziness and even death.

The levels of chemicals in drinking water, however, are seldom high enough to cause acute health effects. They are more likely to cause chronic health effects — effects that occur long after exposure to small amounts of a chemical. Examples of chronic health effects include; cancer, birth defects, organ damage, disorders of the nervous system, and damage to the immune system.

Evidence relating chronic health effects to specific drinking water contaminants is limited. In the absence of

exact scientific information, scientists predict the likely adverse effects of chemicals in drinking water using laboratory animal studies and, when available, human data from clinical reports and epidemiological studies. **The possible chronic health effects of the chemicals listed in this fact sheet are conservative estimates, rarely based on documented human health effects.**

### Setting Standards

In setting standards for drinking water contaminants, regulators estimate the concentration of a contaminant that a person can drink safely over a lifetime. These calculations are based on all available toxicological information and allow a generous safety margin. The following chart lists contaminants currently regulated by U.S. Environmental Protection Agency (EPA) standards.

The EPA standard for drinking water, the **Maximum Contaminant Level (MCL)**, is the highest amount of a contaminant allowed in drinking water supplied by municipal water systems. Although MCLs are set primarily to protect health, they also take into consideration the feasibility and cost of analysis and treatment of the regulated contaminant.

Contaminants are regulated when they occur in drinking water supplies and are expected to threaten public health. The EPA will continue to set standards for many other drinking water contaminants not listed in this fact sheet which meet these criteria.

### National Primary Drinking Water Standards

ORGANIC CHEMICALS	MCL (mg/L) <sup>1</sup>	HEALTH EFFECTS
Acrylamide	TT <sup>2</sup>	probable cancer, nervous system
Adipate (diethylhexyl)	0.4	liver damage, reduced bone mass
Alachlor	0.002	probable cancer
Atrazine	0.003	reproductive and cardiac
Benzene	0.005	cancer, chromosome changes

<sup>1</sup> Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.

<sup>2</sup> TT = Treatment technique requirement in effect.

<b>ORGANIC CHEMICALS</b>	<b>MCL (mg/L)<sup>1</sup></b>	<b>HEALTH EFFECTS</b>
Benzo(a)pyrene (PAH)	0.0002	developmental and reproductive effects
Carbofuran	0.04	nervous and reproductive system
Carbon tetrachloride	0.005	cancer, liver damage
Chlordane	0.002	probable cancer
2,4-D	0.07	liver, kidney, nervous system
Dalapon	0.2	increased kidney-to-body weight
Di[2-ethylhexyl]adipate	0.4	liver damage, reduced bone mass
Dibromochloropropane (DBCP)	0.0002	probable cancer
o-Dichlorobenzene	0.6	liver, kidney, nervous system, blood cells
p-Dichlorobenzene	0.075	liver, anemia, skin lesions
1,2-Dichloroethane	0.005	probable cancer
1,1-Dichloroethylene	0.007	liver/kidney effects, cancer, toxicity to fetus
cis-1,2-Dichloroethylene	0.07	nervous and circulatory systems, liver
trans-1,2-Dichloroethylene	0.1	nervous and circulatory systems, liver
Dichloromethane	0.005	probable cancer, liver damage
1,2-Dichloropropane	0.005	probable cancer, liver, lungs, kidney
Di(2-ethylhexyl)phthalate (PAE)	0.006	possible cancer, liver, reproductive effects
Dinoseb	0.007	decreased body and thyroid weight
Dioxin (2,3,7,8-TCDD)	3.0 x 10 <sup>-8</sup>	liver damage, birth defects, probable cancer
Diquat	0.02	cataracts
Endothall	0.1	increased organ weight
Endrin	0.002	nervous system, kidney effects
Epichlorohydrin	TT <sup>2</sup>	probable cancer, changes in blood and chromosomes
Ethylbenzene	0.7	liver, kidney, nervous system, eyes
Ethylene dibromide (EDB)	0.00005	probable cancer
Glyphosphate	0.7	lung congestion
Heptachlor	0.0004	probable cancer
Heptachlor epoxide	0.0002	probable cancer
Hexachlorobenzene (HCB)	0.001	skin lesions, nerve and liver damage
Hexachlorocyclopentadiene (HEX)	0.05	damage to liver, kidney, stomach, heart
Lindane	0.0002	liver, kidney
Methoxychlor	0.04	liver, kidney, nervous system, heart
Monochlorobenzene (Chlorobenzene)	0.1	liver, kidney, nervous system

<sup>1</sup> Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.

<sup>2</sup> TT = Treatment technique requirement in effect.

<b>ORGANIC CHEMICALS</b>	<b>MCL (mg/L)<sup>1</sup></b>	<b>HEALTH EFFECTS</b>
Oxamyl (Vydate)	0.2	decreased body weight
Pentachlorophenol	0.001	probable cancer, liver, kidney, reproductive effects
Picloram	0.5	liver damage
Polychlorinated byphenyls (PCBs)	0.0005	possible cancer, nose and throat irritation, liver function
Simazine	0.004	possible cancer, tremors, liver, kidney, nervous system
Styrene	0.1	liver, nervous system, cancer
Tetrachloroethylene	0.005	probable cancer, liver, kidney, nervous system
Toluene	1.0	kidney, liver, nervous system (memory, speech, hearing)
Toxaphene	0.003	possible cancer, liver, kidney, nervous system
2-4-5-TP (Silvex)	0.05	liver, kidney
1,2,4-Trichlorobenzene	0.07	increased adrenal gland weight
1,1,1-Trichloroethane	0.2	nervous system
1,1,2-Trichloroethane	0.005	liver, kidney, cancer
Trichloroethylene (TCE)	0.005	possible cancer, liver damage
Vinyl chloride	0.002	cancer, liver, nervous system
Xylenes (Total)	10.0	liver, kidney, cancer, bladder, respiratory tract

<sup>1</sup> Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.

<sup>2</sup> TT = Treatment technique requirement in effect.

<b>RADIONUCLIDES</b>	<b>MCL</b>	<b>HEALTH EFFECTS</b>
Beta particle and photon activity	4 mrem/yr <sup>1</sup>	cancer
Gross alpha particle activity	15 pCi/L <sup>2</sup>	cancer
Combined radium 226 + 228	5 pCi/L <sup>2</sup>	bone cancer

<sup>1</sup> "Rem" (Roentgen Equivalent in Man) means a dosage of ionizing radiation that gives the same biological effect as one roentgen of X-ray or gamma-ray radiation. A millirem (mrem) is 1/1000 of a rem.

<sup>2</sup> "Picocurie" (pCi) is the quantity of radioactive material producing 2.22 nuclear transformations per minute.

### **An Explanation of Treatment Technique**

Treatment Technique requirements vary with each contaminant. In general, depending upon the size of the population served by a water supplier, a predetermined number of samples must be taken within a specific time period. Only a certain percentage of these samples may exceed a specified level for each contaminant. For example, a water supplier serving more than 100,000 people must sample for lead from 100 household taps every six months. If more than 10% of these samples exceed 0.015 mg/L of lead, the water supplier must begin treatment. Treatment may consist of reducing the corrosivity of the water (highly corrosive water tends to leach lead out from pipe fittings), or removing the lead from the supply source, or replacing water lines that contain lead compounds. For microbes, treatment standards should reduce the risk of infection to less than one in 10,000 per year.

<b>INORGANIC CHEMICALS</b>	<b>MCL (mg/L)<sup>1</sup></b>	<b>HEALTH EFFECTS</b>
Antimony	0.006	possible cancer
Arsenic <sup>2</sup>	0.05	dermal and nervous system toxicity
Asbestos	7 MFL (million fibers per liter, >10 microns long)	lung disease, cancer
Barium	2.0	circulatory system (high blood pressure)
Beryllium	0.004	bones, lung, cancer
Cadmium	0.005	kidney, liver, bones, blood
Chromium (total)	0.1	liver/kidney, skin, circulatory system, nerve tissues
Copper (at tap)	TT <sup>3</sup>	stomach and intestinal distress, liver, kidney, anemia
Cyanide	0.2	weight loss, thyroid, nerve damage
Fluoride	4.0	skeletal damage
Lead (at tap)	TT <sup>3</sup>	central and peripheral nervous system damage, kidney, highly toxic to infants and pregnant women
Mercury (inorganic)	0.002	kidney, nervous system
Nickel	0.1	heart and liver damage, skin irritation
Nitrate-Nitrogen	10.0	spleen hemorrhage, methemoglobinemia
Nitrite (as N)	1.0	spleen hemorrhage, methemoglobinemia
Nitrate + Nitrite (both as N)	10.0	spleen hemorrhage, methemoglobinemia
Selenium	0.05	nervous and circulatory system, liver, kidney, hair loss
Thallium	0.002	blood changes, liver, kidney, hair loss

<sup>1</sup> Milligrams per liter (mg/L) = one part per million (ppm) or 1 ounce in 7800 gallons.

<sup>2</sup> Under review

<sup>3</sup> TT = Treatment Technique requirement in effect.

<b>MICROBIOLOGICAL</b>	<b>MCL</b>	<b>HEALTH EFFECTS</b>
<i>Giardia lamblia</i>	TT <sup>1</sup>	stomach and intestinal distress
<i>Legionella</i>	TT <sup>1</sup>	Legionnaire's disease (pneumonia)
Standard Plate Count	TT <sup>1</sup>	varies with organism
Turbidity	PS <sup>2</sup>	interferes with disinfection
Viruses	TT <sup>1</sup>	intestinal distress, infectious hepatitis

<sup>1</sup> Treatment Technique requirement in effect.

<sup>2</sup> PS (Performance Standard) 0.5 NTU - 1.0 NTU, (Nephelometric Turbidity Unit).

## National Secondary Drinking Water Standards

CONTAMINANTS	SUGGESTED LEVELS	EFFECTS
Aluminum	0.05-0.2 mg/l	discoloration of water
Chloride	250 mg/l	taste, corrosion of pipes
Color	15 color units	aesthetic
Copper	1 mg/l	taste, staining of porcelain
Corrosivity	non-corrosive	aesthetic and health related (corrosive water can leach lead from pipes into drinking water).
Fluoride	2.0 mg/l	brownish discoloration of teeth
Foaming agents	0.5 mg/l	aesthetic
Iron	0.3 mg/l	taste, staining of laundry
Manganese	0.05 mg/l	taste, staining of laundry
Odor	3 (Threshold Odor Number)	aesthetic
pH	6.5 - 8.5	water is too corrosive
Silver	0.1 mg/l	discoloration of the skin (argyria)
Sulfate	250 mg/l	taste, laxative effects
Total Dissolved Solids (TDS)	500 mg/l	taste and possible relation between low hardness and cardiovascular disease, also an indicator of corrosivity (related to lead levels in water), can damage plumbing and limit effectiveness of detergents.
Zinc	5 mg/l	taste

**Note:** Copper and fluoride appear on both the Primary and Secondary Standards lists. The effects of each contaminant at the lower levels found on the Secondary list are aesthetic only. At higher concentrations each can cause adverse health reactions and are therefore listed as Primary Standards. "Aesthetic" refers to effects of contaminants that may make water look, taste, or smell unpleasant, yet are not necessarily harmful to health.

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