

Drinking Water Standards

Arizona Water Series: Number 6

The University of Arizona • College of Agriculture • Tucson, Arizona 85721

Revised 5/98

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When you fill a glass of water from your tap, you expect to drink water that is safe and pure. However, gasses, minerals, bacteria, metals or chemicals suspended or dissolved in your water can affect your health and influence the quality of your water.

Drinking water supplied by municipal water systems is monitored for many contaminants. As authorized by the 1974 Safe Drinking Water Act (SDWA) and its 1996 amendments, the U.S. Environmental Protection Agency (EPA) has established limits on the concentration of certain drinking water contaminants allowed in public water supplies. These limits, or standards, are set to protect your health and ensure that your water is of good quality.

Drinking Water Standards

Primary Drinking Water Standards

The EPA standards for drinking water fall into two categories: **Primary Standards** and **Secondary Standards**. Primary Standards are based on health considerations and are enforced by the EPA. They protect you from three classes of toxic pollutants: pathogens, radioactive elements and toxic chemicals. Primary Standards set a limit, called the **Maximum Contaminant Level (MCL)**, on the highest allowable concentration of a contaminant in drinking water supplied by municipal water systems. The MCL is usually expressed in milligrams per liter (mg/L). **Table 1** lists the current primary drinking water standards.

Secondary Drinking Water Standards

Secondary Standards regulate contaminants that cause offensive taste, odor, color, corrosivity, foaming and staining. The concentration limit is called the **Secondary**

Maximum Contaminant Level (SMCL). Secondary Standards are not enforced. They are guidelines for water treatment plant operators and state governments attempting to provide communities with the best quality water possible. **Table 2** lists the current secondary drinking water standards.

How Standards Are Set

EPA regulators develop Primary Standards for drinking water contaminants based on three criteria:

- The contaminant causes adverse health effects.
- Risk assessment and cost-benefit considerations.
- It is known to occur in drinking water.

In setting Primary Standards for a drinking water contaminant, the government first looks at all the toxicological data on that contaminant, usually obtained from acute and chronic animal studies. Occasionally human clinical or epidemiological data are also available. Experts use this information to estimate the concentration of a drinking water contaminant that may be toxic and the concentrations, if any that may cause no adverse effects.

Because the levels of contaminants found in drinking water are seldom high enough to cause acute health effects, health officials are most concerned about chronic health effects such as cancer, birth defects, miscarriages, nervous system disorders, and organ damage. These health effects may occur after prolonged exposure to small amounts of a substance. In addition, when regulators set drinking water standards, they treat substances that cause cancer (carcinogens) differently from contaminants that cause other health effects.

If a Chemical Does Not Cause Cancer

Officials set standards using a figure calculated from animal studies called the **Reference Dose (RfD)** for chemicals that cause adverse health effects other than cancer. The RfD is the daily dose of a substance that a person can ingest over a lifetime without suffering any adverse health effects and it includes a conservative safety margin.

Table 1. Current Primary Standards

ORGANIC CHEMICALS	MCL (mg/L)¹
Acrylamide	TT ²
Adipate (diethylhexyl)	0.4
Alachlor	0.002
Atrazine	0.003
Benzene	0.005
Benzo(a)pyrene (PAH)	0.0002
Carbofuran	0.04
Carbon tetrachloride	0.005
Chlordane	0.002
2,4-D	0.07
Dalapon	0.2
Di[2-ethylhexyl]adipate	0.4
Dibromochloropropane (DBCP)	0.0002
o-Dichlorobenzene	0.6
p-Dichlorobenzene	0.075
1,2-Dichloroethane	0.005
1,1-Dichloroethylene	0.007
cis-1,2-Dichloroethylene	0.07
trans-1,2-Dichloroethylene	0.1
Dichloromethane	0.005
1,2-Dichloropropane	0.005
Di(2-ethylhexyl)phthalate (PAE)	0.006
Dinoseb	0.007
Dioxin (2,3,7,8-TCDD)	3.0 x 10 ⁻⁸
Diquat	0.02
Endothall	0.1
Endrin	0.002

ORGANIC CHEMICALS	MCL (mg/L)¹
Epichlorohydrin	TT ²
Ethylbenzene	0.7
Ethylene dibromide (EDB)	0.00005
Glyphosphate	0.7
Heptachlor	0.0004
Heptachlor epoxide	0.0002
Hexachlorobenzene (HCB)	0.001
Hexachlorocyclopentadiene (HEX)	0.05
Lindane	0.0002
Methoxychlor	0.04
Monochlorobenzene	0.1
Oxamyl (Vydate)	0.2
Pentachlorophenol	0.001
Picloram	0.5
Polychlorinated byphenyls (PCB)	0.0005
Simazine	0.004
Styrene	0.1
Tetrachloroethylene	0.005
Toluene	1.0
Toxaphene	0.003
2-4-5-TP (Silvex)	0.05
1,2,4-Trichlorobenzene	0.07
1,1,1-Trichloroethane	0.2
1,1,2-Trichloroethane	0.005
Trichloroethylene (TCE)	0.005
Vinyl chloride	0.002
Xylenes	10.0

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

² Treatment Technique requirement in effect.

INORGANIC CHEMICALS	MCL(mg/L)
Antimony	0.006
Arsenic ¹	0.05
Asbestos	7MFL ²
Barium	2.0
Beryllium	0.004
Cadmium	0.005
Chromium (total)	0.1
Copper (at tap)	TT ³
Cyanide	0.2
Fluoride	4.0
Lead (at tap)	TT ³
Mercury (inorganic)	0.002
Nickel	0.1
Nitrate-Nitrogen	10.0
Nitrite (as N)	1.0
Nitrate-Nitrogen + Nitrite (both as N)	10.0
Selenium	0.05
Thallium	0.002

RADIONUCLIDES	MCL
Beta particle and photon activity	4 mrem/yr ⁴
Gross alpha particle activity	15 pCi/L ⁵
Combined radium 226 + 228	5 pCi/L ⁵

MICROBIOLOGICAL	MCL
<i>Giardia lamblia</i>	TT ³
<i>Legionella</i>	TT ³
Standard Plate Count	TT ³
Turbidity	0.5 - 1.0 NTU (Nephelometric Turbidity Unit)
Viruses	TT ³

- ¹ Under review
- ² MFL (Million Fibers per Liter; >10 microns in length.)
- ³ Treatment Technique in Effect.
- ⁴ "Rem" (Roentgen Equivalents 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.
- ⁵ "Picocurie" (pCi) is the quantity of radioactive material producing 2.22 nuclear transformations per minute.

NOTE 1: 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 percent of these samples exceed 0.15 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 are supposed to reduce the risk of infection to less than one in 10,000 per year.

NOTE 2: 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.

Maximum Contaminant Level Goal (MCLG)

Regulators use the RfD to establish a **Maximum Contaminant Level Goal (MCLG)**. The MCLG is the concentration of a contaminant that experts believe a person can drink safely over a lifetime. It is based entirely on health considerations and, as a health goal, is set at a level where no adverse health effects should occur. The MCLG, which is not enforced by the EPA, is used to set enforceable drinking water standards.

MAXIMUM CONTAMINANT LEVEL (MCL)

The MCL, the Primary Standard enforced by the EPA, is set as close as possible to the MCLG. In setting an MCL, EPA regulators consider, in addition to health effects, the feasibility and the combined cost of analyzing water for a contaminant and for treating water to remove the contaminant. Therefore, the MCL is often less stringent than the MCLG.

Table 2. Current Secondary Standards

CONTAMINANTS	SUGGESTED LEVELS
Aluminum	0.05-0.2 mg/l
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	non-corrosive
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	0.1 mg/l
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Zinc	5 mg/l

If a Chemical Causes Cancer

In setting Primary Standards for chemicals believed to cause cancer, regulators assume that no concentration is safe. Consequently, the MCLG is set at zero. But, a zero level is not always possible to achieve, so regulators estimate toxicity by calculating a figure called a **Risk Estimate**.

The Risk Estimate

In theory, any concentration of a carcinogen in drinking water may possibly cause cancer. In practice, however, at very low concentrations the risk of cancer becomes so small that it is considered negligible. Therefore, regulators must decide what level of risk is acceptable. It may be one excess cancer in 10,000 persons or one excess cancer in one million persons exposed over a lifetime (70 years). The concentration of chemical estimated to cause this "acceptable level" of risk is the **Risk Estimate**.

Drinking Water Standards Are Not Absolute

Setting drinking water standards is an imperfect process, rarely based on conclusive human evidence. Data relating human health effects to chemicals in drinking water are limited, and scientists have difficulty predicting the effects of drinking small amounts of chemicals for many years. In addition, regulatory decisions frequently incorporate economic, political and social considerations.

Therefore, it is important to understand that Primary Standards for drinking water contaminants do not guarantee that water with a contaminant level below the standard is risk-free, nor do they mean that water with a higher level is unsafe. The standards also do not take into account the possible presence of other chemicals, which may increase or decrease the toxicity of the contaminant.

Current Drinking Water Standards

Every five years the EPA must select and consider five new contaminants to add to the drinking water list. Contaminants that pose the greatest health risks are the primary targets for regulation. Provisions in the 1996 amendments to the SDWA also require the EPA to conduct health effects studies on radon, sulfate, and arsenic, and to set new standards based on those studies.

Working through state governments, the EPA monitors community drinking water. When a standard is exceeded, the EPA requires that the contaminant levels be reduced to the MCL. The corrective treatment is left to the individual water system, usually a private utility.

State Responsibilities

Ultimately, regulatory officials in each state set and enforce drinking water standards for EPA-regulated contaminants and for other contaminants. Florida, for example, has set standards for commonly used pesticides, and New York has joined other states in setting guidelines for organic chemicals not already regulated in drinking water supplies. However, states are not permitted to set standards that are less stringent than the MCLs set by the EPA.

Drinking water standards represent conservative judgments of scientists and regulators and are based on health effects of drinking water contaminants. Although current drinking water standards do not guarantee that the glass of water you draw from your tap will be absolutely safe and pure, they do reflect sound scientific judgment and are based on all the knowledge that is available.

This material is based upon work supported by the Extension Service, U.S. Department of Agriculture, under special project number 91-EWQI-1-9277. (Adapted from a publication written by Judith C. Stewart and Ann T. Lemley, Cornell University)

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