

# Safe Drinking Water Is In Our Hands

Existing Standards  
and Future Priorities



**EPA**

United States  
Environmental Protection  
Agency

Office of Water  
(4607)

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August 1999





## National Primary Drinking Water Regulations

Contaminant	MCLG <sup>1</sup> (mg/L) <sup>4</sup>	MCL <sup>2</sup> TT <sup>3</sup> (mg/L) <sup>4</sup>	Potential Health Effects From Exposure Above the MCL	Common Sources of Contaminants in Drinking Water
Beryllium	0.004	0.004	Intestinal lesions	Discharge from metal refineries and coal-burning factories; discharge from electrical, aerospace, and defense industries
Cadmium	0.005	0.005	Kidney damage	Corrosion of galvanized pipes; erosion of natural deposits; discharge from metal refineries; runoff from waste batteries and paints
Chromium (total)	0.1	0.1	Some people who use water containing chromium well in excess of the MCL over many years could experience allergic dermatitis	Discharge from steel and pulp mills; erosion of natural deposits

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Copper	1.3	Action Level=1.3; TT <sup>6</sup>	Short term exposure: Gastrointestinal distress. Long term exposure: Liver or kidney damage. Those with Wilson's Disease should consult their personal doctor if their water systems exceed the copper action level.	Corrosion of household plumbing systems; erosion of natural deposits; leaching from wood preservatives
Cyanide (as free cyanide)	0.2	0.2	Nerve damage or thyroid problems	Discharge from steel/metal factories; discharge from plastic and fertilizer factories
Fluoride	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

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Lead	zero	Action Level=0.015; TT <sup>6</sup>	Infants and children: Delays in physical or mental development. Children: Slight deficits in attention span and learning disabilities. Adults: Kidney problems; high blood pressure	Corrosion of household plumbing systems; erosion of natural deposits
Inorganic Mercury	0.002	0.002	Kidney damage	Erosion of natural deposits; discharge from refineries and factories; runoff from landfills and cropland
Nitrate (measured as Nitrogen)	10	10	"Blue baby syndrome" in infants under six months — life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits

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Nitrite (measured as Nitrogen)	1	1	"Blue baby syndrome" in infants under six months — life threatening without immediate medical attention. Symptoms: Infant looks blue and has shortness of breath.	Runoff from fertilizer use; leaching from septic tanks, sewage; erosion of natural deposits
Selenium	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
Thallium	0.0005	0.002	Hair loss; changes in blood; kidney, intestine, or liver problems	Leaching from ore-processing sites; discharge from electronics, glass, and pharmaceutical companies

### Organic Chemicals

Acrylamide	zero	TT <sup>7</sup>	Nervous system or blood problems; increased risk of cancer	Added to water during sewage/ wastewater treatment
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Alachlor	zero	0.002	Eye, liver, kidney or spleen problems; anemia; increased risk of cancer	Runoff from herbicide used on row crops
Atrazine	0.003	0.003	Cardiovascular system problems; reproductive difficulties	Runoff from herbicide used on row crops
Benzene	zero	0.005	Anemia; decrease in blood platelets; increased risk of cancer	Discharge from factories; leaching from gas storage tanks and landfills
Benzo(a)-pyrene	zero	0.0002	Reproductive difficulties; increased risk of cancer	Leaching from linings of water storage tanks and distribution lines
Carbofuran	0.04	0.04	Problems with blood or nervous system; reproductive difficulties.	Leaching of soil fumigant used on rice and alfalfa

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Carbon tetrachloride	zero	0.005	Liver problems; increased risk of cancer	Discharge from chemical plants and other industrial activities
Chlordane	zero	0.002	Liver or nervous system problems; increased risk of cancer	Residue of banned termiticide
Chlorobenzene	0.1	0.1	Liver or kidney problems	Discharge from chemical and agricultural chemical factories
2,4-D	0.07	0.07	Kidney, liver, or adrenal gland problems	Runoff from herbicide used on row crops
Dalapon	0.2	0.2	Minor kidney changes	Runoff from herbicide used on rights of way
1,2-Dibromo-3-chloropropane (DBCP)	zero	0.0002	Reproductive difficulties; increased risk of cancer	Runoff/leaching from soil fumigant used on soybeans, cotton, pineapples, and orchards

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o-Dichlorobenzene	0.6	0.6	Liver, kidney, or circulatory system problems	Discharge from industrial chemical factories
p-Dichlorobenzene	0.075	0.075	Anemia; liver, kidney or spleen damage; changes in blood	Discharge from industrial chemical factories
1,2-Dichloroethane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
1-1-Dichloroethylene	0.007	0.007	Liver problems	Discharge from industrial chemical factories
cis-1, 2-Dichloroethylene	0.07	0.07	Liver problems	Discharge from industrial chemical factories
trans-1,2- Dichloroethylene	0.1	0.1	Liver problems	Discharge from industrial chemical factories

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Dichloromethane	zero	0.005	Liver problems; increased risk of cancer	Discharge from pharmaceutical and chemical factories
1-2-Dichloropropane	zero	0.005	Increased risk of cancer	Discharge from industrial chemical factories
Di(2-ethylhexyl) adipate	0.4	0.4	General toxic effects or reproductive difficulties	Discharge from chemical factories
Di(2-ethylhexyl) phthalate	zero	0.006	Reproductive difficulties; liver problems; increased risk of cancer	Discharge from rubber and chemical factories
Dinoseb	0.007	0.007	Reproductive difficulties	Runoff from herbicide used on soybeans and vegetables
Dioxin (2,3,7,8-TCDD)	zero	0.00000003	Reproductive difficulties; increased risk of cancer	Emissions from waste incineration and other combustion; discharge from chemical factories

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Diquat	0.02	0.02	Cataracts	Runoff from herbicide use
Endothall	0.1	0.1	Stomach and intestinal problems	Runoff from herbicide use
Endrin	0.002	0.002	Liver problems	Residue of banned insecticide
Epichlorohydrin	zero	TT <sup>7</sup>	Stomach problems; increased risk of cancer	Discharge from industrial chemical factories; an impurity of some water treatment chemicals
Ethylbenzene	0.7	0.7	Liver or kidney problems	Discharge from petroleum refineries
Ethylene dibromide	zero	0.00005	Stomach, liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from petroleum refineries
Glyphosate	0.7	0.7	Kidney problems; reproductive difficulties	Runoff from herbicide use

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Heptachlor	zero	0.0004	Liver damage; increased risk of cancer	Residue of banned termiticide
Heptachlor epoxide	zero	0.0002	Liver damage; increased risk of cancer	Breakdown of heptachlor
Hexachlorobenzene	zero	0.001	Liver or kidney problems; reproductive difficulties; increased risk of cancer	Discharge from metal refineries and agricultural chemical factories
Hexachlorocyclopentadiene	0.05	0.05	Kidney or stomach problems	Discharge from chemical factories
Lindane	0.0002	0.0002	Liver or kidney problems	Runoff/leaching from insecticide used on cattle, lumber, gardens
Methoxychlor	0.04	0.04	Reproductive difficulties	Runoff/leaching from insecticide used on fruits, vegetables, alfalfa, livestock

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Oxamyl (Vydate)	0.2	0.2	Slight nervous system effects	Runoff/leaching from insecticide used on apples, potatoes, and tomatoes
Polychlorinated biphenyls (PCBs)	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
Pentachlorophenol	zero	0.001	Liver or kidney problems; increased risk of cancer	Discharge from wood preserving factories
Picloram	0.5	0.5	Liver problems	Herbicide runoff
Simazine	0.004	0.004	Problems with blood	Herbicide runoff
Styrene	0.1	0.1	Liver, kidney, and circulatory problems	Discharge from rubber and plastic factories; leaching from landfills

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Tetrachloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from factories and dry cleaners
Toluene	1	1	Nervous system, kidney, or liver problems	Discharge from petroleum factories
Total Trihalomethanes (TTHMs)	none <sup>5</sup>	0.10	Liver, kidney or central nervous system problems; increased risk of cancer	Byproduct of drinking water disinfection
Toxaphene	zero	0.003	Kidney, liver, or thyroid problems; increased risk of cancer	Runoff/leaching from insecticide used on cotton and cattle
2,4,5-TP (Silvex)	0.05	0.05	Liver problems	Residue of banned herbicide
1,2,4-Trichlorobenzene	0.07	0.07	Changes in adrenal glands	Discharge from textile finishing factories

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## Water Regulations

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1,1,1-Trichloroethane	0.20	0.2	Liver, nervous system, or circulatory problems	Discharge from metal degreasing sites and other factories
1,1,2-Trichloroethane	0.003	0.005	Liver, kidney, or immune system problems	Discharge from industrial chemical factories
Trichloroethylene	zero	0.005	Liver problems; increased risk of cancer	Discharge from metal degreasing sites and other factories
Vinyl chloride	zero	0.002	Increased risk of cancer	Leaching from PVC pipes; discharge from plastic factories
Xylenes (total)	10	10	Nervous system damage	Discharge from petroleum factories; discharge from chemical factories

## Radionuclides

Beta particles and photon emitters	none <sup>5</sup>	4 millirems per year (mrem/yr)	Increased risk of cancer	Decay of natural and man-made deposits
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## National Primary Drinking

## Water Regulations

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Gross alpha particle activity	none <sup>5</sup>	15 picocuries per Liter (pCi/L)	Increased risk of cancer	Erosion of natural deposits
Radium 226 and Radium 228 (combined)	none <sup>5</sup>	5 pCi/L	Increased risk of cancer	Erosion of natural deposits

## Microorganisms

<i>Giardia lamblia</i>	none <sup>5</sup>	TT <sup>8</sup>	Giardiasis, a gastroenteric disease	Human and animal fecal waste
Heterotrophic plate count	n/a	TT <sup>8</sup>	HPC has no health effects, but can indicate how effective treatment is at controlling microorganisms	n/a

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<i>Legionella</i>	zero	TT <sup>8</sup>	Legionnaire's Disease, commonly known as pneumonia	Found naturally in water; multiplies in heating systems
Total Coliforms (including fecal coliform and <i>E. Coli</i> )	zero	5.0% <sup>9</sup>	Used as an indicator that other potentially harmful bacteria may be present <sup>10</sup>	Naturally present in the environment and human and animal fecal waste
Turbidity	n/a	TT <sup>8</sup>	Turbidity has no health effects but can interfere with disinfection and provide a medium for microbial growth. It may indicate the presence of microbes.	Soil runoff
Viruses (enteric)	zero	TT <sup>8</sup>	Gastroenteric disease	Human and animal fecal waste

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## National Primary Drinking Water Regulations

### Notes

1. Maximum Contaminant Level Goal (MCLG) — The maximum level of a contaminant in drinking water at which no known or anticipated adverse effect on the health effect of persons would occur, and which allows for an adequate margin of safety. MCLGs are non-enforceable public health goals.
2. Maximum Contaminant Level (MCL) — The maximum permissible level of a contaminant in water which is delivered to any user of a public water system. MCLs are enforceable standards.
3. Treatment Technique — An enforceable procedure or level of technical performance which public water systems must follow to ensure control of a contaminant.
4. Units are in milligrams per Liter (mg/L) unless otherwise noted.
5. MCLGs were not established before the 1986 Amendments to the Safe Drinking Water Act. Therefore, there is no MCLG for this contaminant.
6. Lead and copper are regulated in a Treatment Technique which requires systems to take tap water samples at sites with lead pipes or copper pipes that have lead solder and/or are served by lead service lines. The action level, which triggers water systems into taking treatment steps if exceeded in more than 10% of tap water samples, for copper is 1.3 mg/L, and for lead is 0.015 mg/L.

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7. Each water system must certify, in writing, to the state (using third-party or manufacturer's certification) that when acrylamide and epichlorohydrin are used in drinking water systems, 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)
8. The Surface Water Treatment Rule requires systems using surface water or ground water under the direct influence of surface water to (1) disinfect their water, and (2) filter their water to meet criteria for avoiding filtration so that the following contaminants are controlled at the following levels: *Giardia lamblia*—99.9% killed/inactivated; Viruses—99.99% killed/inactivated; *Legionella*—No limit, but EPA believes that if *Giardia* and viruses are inactivated, *Legionella* will also be controlled; Turbidity—At no time can turbidity (cloudiness of water) go above 5 nephelometric turbidity units (NTU) [systems that filter must ensure that the turbidity is no higher than 1 NTU (0.5 NTU for conventional or direct filtration) in at least 95% of the daily samples for any month]; HPC—No more than 500 bacterial colonies per milliliter.
9. 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). Every sample that has total coliforms must be analyzed for fecal coliforms. No fecal coliforms are allowed.
10. Fecal coliform and *E. coli* are bacteria whose presence indicates that the water may be contaminated with human or animal fecal wastes. Microbes in these wastes can cause diarrhea, cramps, nausea, headaches, or other symptoms. They may pose a special health risk for infants, young children, and people with severely compromised immune systems.

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## National Secondary Drinking Water Regulations

Contaminant	NSDWR
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	0.1 mg/L
Sulfate	250 mg/L
Total Dissolved Solids (TDS)	500 mg/L
Zinc	5 mg/L

A National Secondary Drinking Water Regulation is a non-enforceable guideline regarding contaminants that may cause cosmetic effects (such as taste, odor or color). Some states choose to adopt them as enforceable standards.

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# Microbial and Disinfection Byproduct Rules

Disinfection of drinking water is one of the major public health advances of the 20th century. However, the disinfectants themselves can react with naturally-occurring materials in the water to form unintended byproducts which may pose health risks. A major challenge for water suppliers is balancing the risks from microbial pathogens and disinfection byproducts. The new Stage 1 Disinfectants and Disinfection Byproducts Rule and Interim Enhanced Surface Water Treatment Rule together address these risks.

These rules, announced by President Clinton on December 3, 1998, are the first two public health standards issued under the Safe Drinking Water Act Amendments of 1996. They are part of a group of microbial and disinfection byproduct rules that will continue to address the "risk-risk balance" between protecting against microbial contaminants, including *Cryptosporidium*, and the byproducts of chemical disinfection.

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Implementation of the IESWTR will increase protection against gastrointestinal illnesses from *Cryptosporidium* and other pathogens through improvements in filtration. The rule applies to all public water systems that use surface water or ground water under the direct influence of surface water and serve 10,000 or more people. Implementation of the Stage 1 DBP Rule will result in increased protection from disinfection byproducts; 24 percent average reduction nationally in trihalomethane levels; and reduction in exposure to the major disinfection byproducts from use of ozone (bromate) and chlorine dioxide (chlorite). The rule applies to all sizes of community and non-transient, non-community water systems that add disinfectant to water during any part of the treatment process.

Other rules within the M-DBP Rule Cluster are scheduled to be finalized according to the following schedule:

**August 2000**

Filter Backwash Recycling Rule

**November 2000**

Long Term 1 Enhanced Surface Water  
Treatment Rule & Ground Water Rule

**May 2002**

Stage 2 Disinfection Byproduct Rule & Long  
Term 2 Enhanced Surface Water Treatment Rule

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# Major Provisions of the Stage 1 Microbial & Disinfection Byproduct Rules

Interim Enhanced Surface Water Treatment Rule	Stage 1 Disinfectants and Disinfection Byproducts Rule
<p>Public water systems that use surface water or ground water under the direct influence of surface water and serve 10,000 or more people must comply by 2002.</p> <p><i>Cryptosporidium</i> (treatment technique)</p> <ul style="list-style-type: none"> <li>• Systems that filter must remove 99 percent of <i>Cryptosporidium</i></li> <li>• Include in watershed control programs for unfiltered systems</li> </ul> <p><b>Turbidity</b> (performance standards)</p> <ul style="list-style-type: none"> <li>• At least 95 percent of monthly readings do not exceed 0.3 of nephelometric turbidity units (NTU).</li> <li>• Maximum level of 1 NTU</li> </ul>	<p>Community and nontransient, noncommunity water systems that add disinfectant to water during any part of the treatment process must comply by 2002.</p> <p><b>Maximum Contaminant Levels</b></p> <ul style="list-style-type: none"> <li>• <b>Total Trihalomethanes</b> (Chloroform, bromodichloromethane, chlorodibromomethane, and bromoform) - 0.080 mg/L</li> <li>• <b>Five Haloacetic Acids</b> (monochloroacetic acid, dichloroacetic acid, trichloroacetic acid, bromoacetic acid, and dibromoacetic acid) - 0.060 mg/L</li> </ul>

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# Major Provisions of the Stage 1 Microbial & Disinfection Byproduct Rules

Interim Enhanced Surface Water Treatment Rule	Stage 1 Disinfectants and Disinfection Byproducts Rule
<p><i>Giardia lamblia</i> and Viruses (treatment technique) Disinfection profiling and benchmarking requirements</p> <p><b>Additional Components</b></p> <ul style="list-style-type: none"> <li>• Continuous monitoring of individual filters</li> <li>• Prohibits construction of new uncovered finished water reservoirs</li> <li>• States, as a condition of primacy, must carry out periodic sanitary surveys for all systems using surface water and ground water under the direct influence of surface water regardless of system size (every 3 years for community water systems and within 5 years for non-community water systems.)</li> </ul>	<ul style="list-style-type: none"> <li>• <b>Bromate</b> (water systems that use ozone) - 0.010 mg/L.</li> <li>• <b>Chlorite</b> (water systems that use chlorine dioxide) - 1.0 mg/L</li> </ul> <p><b>Maximum Residual Disinfectant Levels</b> (similar to MCLs but specific to disinfectants):</p> <ul style="list-style-type: none"> <li>• <b>Chlorine</b> - 4.0 mg/L</li> <li>• <b>Chloramines</b> - 4.0 mg/L</li> <li>• <b>Chlorine Dioxide</b> - 0.8 mg/L</li> </ul>

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# Major Provisions of the Stage 1 Microbial & Disinfection Byproduct Rules

## Interim Enhanced Surface Water Treatment Rule

### Profiling and Benchmarking

A procedure requiring certain public water systems to evaluate the impact on microbial risk before changing disinfection practices to ensure adequate protection is maintained. The 3 major steps are:

- 1) Determine if a public water system needs to profile based on Total Trihalomethane and five Haloacetic Acid levels.
- 2) Develop a disinfection profile that reflects *Giardia lamblia* inactivation for at least a year.
- 3) Calculate a disinfection benchmark based on the profile. Consult with the state prior to making a significant change to disinfection practices.

## Stage 1 Disinfectants and Disinfection Byproducts Rule

### Treatment Technology

- **Enhanced Coagulation** – addition of a coagulant (alum) or improved removal of precursors to disinfection byproducts.

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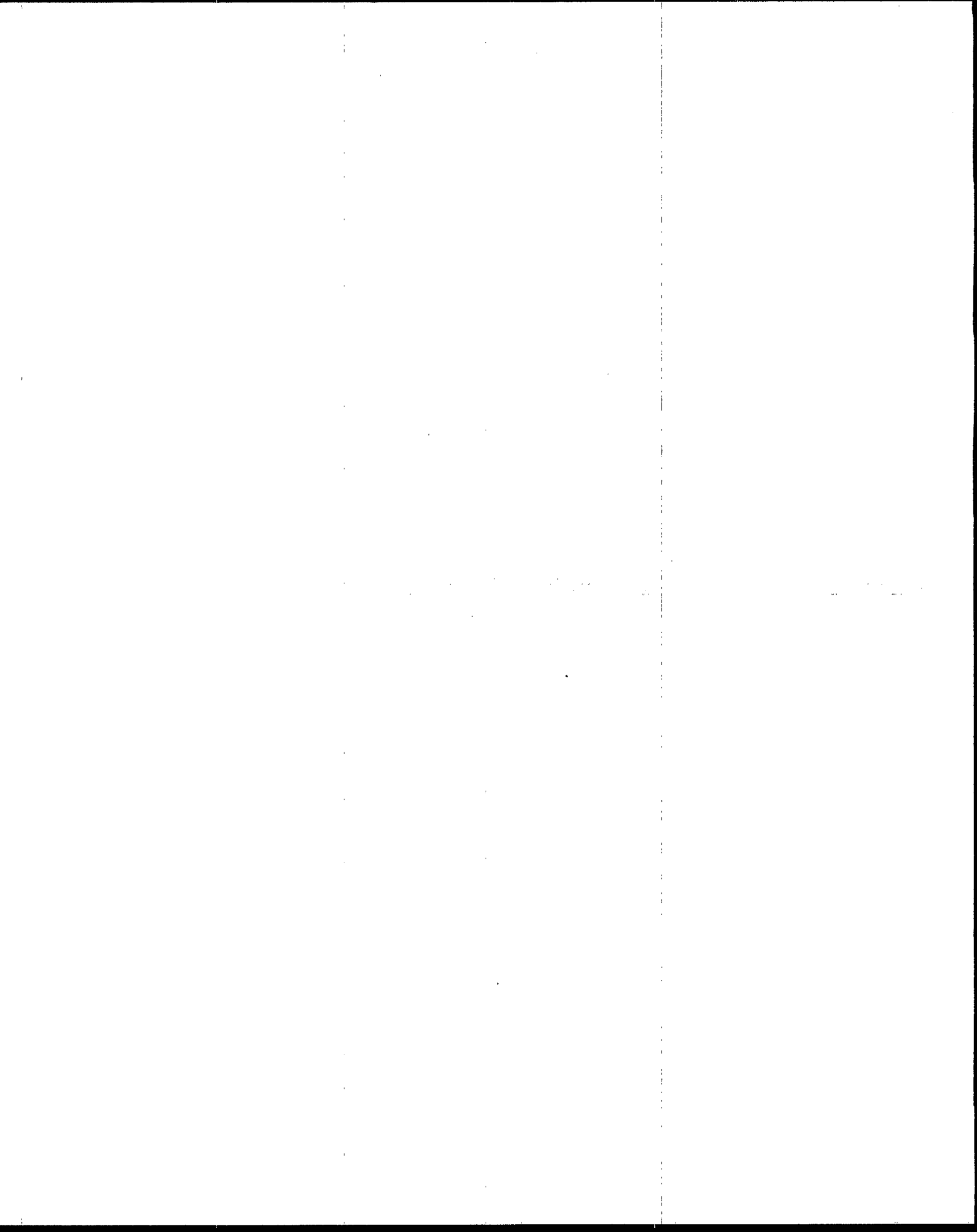
## Current Standards Timetable

REGULATION	FINAL
National Interim Primary Drinking Water Regulations	December 24, 1975
Radionuclides National Interim Primary Drinking Water Regulation	July 9, 1976
National Secondary Drinking Water Regulations	July 19, 1979
Trihalomethane National Interim Primary Drinking Water Rule	November 29, 1979
Fluoride Rule	April 2, 1986
Phase 1 VOCs & Unregulated Contaminant Monitoring	July 8, 1987
Public Notification Rule	October 18, 1987
Total Coliform Rule	June 29, 1989
Surface Water Treatment Rule	June 29, 1989

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# Current Standards Timetable

REGULATION	FINAL
Lead & Copper Rule	June 7, 1991
Phase II/IIB SOCs, IOCs (38 Contaminants & Unregulated Contaminant Monitoring)	January 30, 1991 (II) July 1, 1991 (IIB)
Phase V Rule (18 SOCs and 5 Inorganic Chemicals)	July 19, 1992
Information Collection Rule	May 14, 1996
Safe Drinking Water Act Reauthorized	August 6, 1996
Interim Enhanced Surface Water Treatment Rule	December 16, 1999
Stage 1 Disinfectants and Disinfection Byproducts Rule	December 16, 1999





# **For More Information**

EPA Office of Ground Water & Drinking Water

<http://www.epa.gov/safewater/>

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