Complying with the Safe Drinking Water Act

Handbook on National Primary and Secondary Regulations

Developed by

The National Environmental Training Association

in Cooperation with

U.S. Environmental Protection Agency

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Handbook on National Primary and Secondary Regulations

A Reference Guide for
State Drinking Water Regulators
and Local Health Officials

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The *Handbook on National Primary and Secondary Drinking Water Regulations* is a complete one-stop reference for all the national (that is, Federal) drinking water regulations. It offers regulators easy access to information they need to implement the requirements of the SDWA. The handbook complements the ***Complying with the Safe Drinking Water Act*** video and learner's guide series. To learn about the national primary and secondary drinking water regulations, drinking water regulatory officials should use all of the training materials in this series. To facilitate study, this handbook cross-references all the training materials in the ***Complying with the Safe Drinking Water Act*** video and learner's guide series. Study of these training materials is not meant, however, to replace use of the regulations themselves (as promulgated in the *Federal Register* and codified in Title 40 of the *Code of Federal Regulations*, Parts 141, 142, and 143) and U.S. Environmental Protection Agency (EPA) administrative policy and guidance.

Section 1 of this handbook is a general overview of the national drinking water regulations, including the rationale for and historical background on their development. This section also briefly describes primacy and accompanying administrative responsibilities related to the national drinking water regulations.

Section 2 gives information about the various groups of contaminants regulated by the primary and secondary drinking water regulations. This section describes current status of regulations; health effects and occurrence of contaminants; special conditions related to the applicability of regulations; general requirements of the regulations; and interrelationships between the areas of regulation.

Section 3 consists of summary tables which outline the specific requirements of the national primary and secondary drinking water regulations. These tables specify maximum contaminant level goals and maximum contaminant levels; monitoring schedules; approved analytical methods; best available technology, treatment technique, or other means of contaminant control; and general public notification requirements.

The handbook also contains a bibliography, a glossary, and a detailed subject index. The handbook covers rules and regulations promulgated as of December 1994.

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General Overview

(refer also to the *Introduction of the Safe Drinking Water Act and the Lead Contamination Control Act* video and Learner's Guide in the *Safe Drinking Water Act* series)

Laws to Control Contamination of Drinking Water

The first modern-day drinking water standards were adopted by the U.S. Public Health Service in 1914. In 1969 it became evident that the PHS Standards were not enforceable under federal law and that new, more comprehensive standards were needed to protect public health, especially to protect against the adverse health effects associated with chemical contaminants in drinking water. Therefore, Congress passed the Safe Drinking Water Act in 1974. The following key provisions are contained in the 1974 SDWA:

1. definition of "public water system";
2. establishment of a process for developing national drinking water regulations and specification of the general nature of the regulations;
3. establishment of the applicability of national drinking water regulations to all facilities meeting the definition of a public water system;
4. establishment of criteria and procedures for granting variances and exemptions to public water systems, provided there is no unreasonable risk to public health;
5. requirement that public water suppliers inform customers of regulatory violations; and
6. establishment of an enforcement mechanism to help ensure compliance with the national drinking water regulations.

In response to requirements set forth in the SDWA, the U.S. Environmental Protection Agency (EPA) created two programs: (1) the Underground Injection Control (UIC) Program, which is intended to prevent the contamination of underground sources of drinking water by controlling the injection of solid or hazardous wastes and municipal wastewaters into subsurface water supplies, and (2)

the Public Water Systems Supervision (PWSS) Program, which regulates the quality of water delivered by public water suppliers to their customers. The ***Complying with the Safe Drinking Water Act*** video and learner's guide series focuses on the requirements of the PWSS Program.

The SDWA was substantially amended in 1986. The major focus of the amendments was to increase EPA's authority in the areas of enforcement and groundwater protection and to mandate an increase in the number of contaminants regulated.

Another law designed to control contamination of drinking water is the Lead Contamination Control Act (LCCA). The LCCA was enacted in 1988 and amends the SDWA and the Public Health Service Act. The LCCA banned the manufacture, or sale through interstate commerce, of drinking water coolers that are not lead-free. It required EPA to identify models and brands of drinking water coolers that are not lead-free; develop guidance to help schools and day care centers assess and correct lead contamination from plumbing and water coolers; and provide grants to States for school assistance programs. It also mandated that the Consumer Product Safety Commission (CPSC) order the repair, replacement, or recall and refund of drinking water coolers that the EPA identified as containing lead-lined storage tanks. The Centers for Disease Control is required by the LCCA to provide grants to State and local governments for developing community programs to screen infants and children for high blood lead levels, provide referral assistance, and provide information on childhood lead poisoning.

National Drinking Water Regulations

Under authority of the SDWA, the Environmental Protection Agency promulgates national drinking water regulations. Proposed regulations are printed in the *Federal Register*, which is published daily, and then are finalized after a period of public comment and revision. The regulations are often published as sets of requirements called "rules." A rule may add sections to or revise different sections of the regulations. A summary of the major rules and their *Federal Register* citations appears in TABLE 1. Note that the drinking water regulations are periodically reviewed by EPA and revised if necessary. The table below notes only the dates of initial promulgation and major amendments.

TABLE 1

Rule Name	Date Promulgated	*Federal Register* Citation
Surface Water Treatment Rule	June 29, 1989	54 *FR* 27486
Total Coliform Rule	June 29, 1989	54 *FR* 27544
Enhanced Surface Water Treatment Rule	Proposed July 29, 1994	59 *FR* 38832
Groundwater Disinfection Rule	To be proposed	
Disinfectant/Disinfection By-Products Rule	Proposed July 29, 1994	59 *FR* 38668
Chemical Rules		
Phase I	July 8, 1987	52 *FR* 25690
Phase II	January 30, 1991	56 *FR* 3526
Phase IIB	July 1, 1991	56 *FR* 30266
Phase V	July 17, 1992	57 *FR* 31776
Lead and Copper Rule	June 7, 1991	56 *FR* 26460
Public Notification Rule	October 28, 1987	52 *FR* 41546
Radionuclides Rule	Proposed July 18, 1991	56 *FR* 33050
Information Collection Rule	Proposed February 10, 1994	59 *FR* 6332

Once a year, all of the final changes to the regulations are published in the *Code of Federal Regulations (CFR)*. Regulations related to drinking water appear in Parts 141, 142, and 143 of Title 40 of the *CFR*.

In general, the national drinking water regulations set forth:

- maximum contaminant level goals (MCLGs), which are non-enforceable *health* goals;
- maximum contaminant levels (MCLs) which are enforceable health standards;
- schedules and techniques for monitoring and analyzing contaminants;
- treatment techniques, best available technologies, or other means to control contaminants;

- criteria for allowing variances and exemptions from the national drinking water regulations;
- public notification requirements;
- public water system reporting and recordkeeping requirements;
- administrative responsibilities related to implementation and enforcement of the national drinking water regulations; and
- secondary MCLs, which are non-enforceable guidelines related to the *aesthetic* qualities of drinking water.

Part 141 National Primary Drinking Water Regulations

The national primary drinking water regulations (NPDWRs) are enforceable standards which are applicable to all public water systems (PWSs). A water system that can meet **all** of the following conditions is exempted from the NPDWRs:

1. consists only of distribution and storage facilities,
2. obtains all water from (but are not owned or operated by) PWSs to which NPDWRs do apply,
3. does not sell water, **and**
4. does not convey passengers in interstate commerce (40 *CFR* 141.3).

Public water systems may be classified as community water systems or non-community water systems. A community water system serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents. A non-community water system may be classified as either (1) transient non-community (regularly serving fewer than 25 of the same persons over six months per year), such as a park, or (2) non-transient non-community (regularly serving at least 25 of the same persons over six months per year), such as a rural school with its own water supply system.

Part 141 sets out MCLGs and MCLs. MCLGs are non-enforceable health goals which are set at the maximum level at which no known or anticipated adverse effect on the health would occur and which allows an adequate margin of safety. If there is strong evidence that exposure to a contaminant in drinking water causes cancer, the MCLG for that contaminant is set at zero. The MCL is the

maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

Part 141 also establishes requirements for PWS monitoring and analytical methods; identifies best available technologies, treatment techniques, or other means for controlling contaminants; outlines public notification requirements; and specifies requirements for PWS reporting and recordkeeping.

Some requirements are general and apply to many contaminants; other requirements are very specific and designed to control a specified group of contaminants. Many of these requirements are outlined in the following section of this handbook and in the summary tables in Section 3.

Part 142 National Primary Drinking Water Regulations Implementation

(refer also to the *Compliance and Enforcement* video and Learner's Guide in the ***Safe Drinking Water Act*** series)

Part 142 establishes requirements for the implementation and enforcement of the NPDWRs, which are set forth in Part 141. To qualify for primary enforcement responsibility, a State (or territory or Indian Tribe which qualifies to be treated as a State) must:

1. adopt drinking water standards that are no less stringent than the Federal standards in effect under Part 141;
2. adopt and implement adequate procedures for the enforcement of State drinking water regulations;
3. establish and maintain recordkeeping and reporting procedures;
4. handle variances and exemptions as allowed under the SDWA; **and**
5. adopt and implement an adequate plan for the provision of safe drinking water under emergency circumstances.

Almost all of the States have primary enforcement responsibility (primacy). A State which has primacy must adopt all new and revised NPDWRs in order to retain primacy. The EPA Administrator functions as the primary enforcement agent in States which do not

have primacy. The EPA Administrator also reviews State drinking water programs to ensure that the States are properly implementing and enforcing the NPDWRs.

Part 142 also describes specific requirements related to variances and exemptions from the NPDWRs. It specifies circumstances under which bottled water and point-of-use or point-of-entry devices can be used as conditions for granting exemptions to the NPDWRs. Conditions for variances related to the requirements for best available technologies, treatment techniques, or other means generally available are also specified.

Part 143 National Secondary Drinking Water Regulations

National secondary drinking water regulations (NSDWRs) control contaminants that primarily affect the aesthetic qualities related to the public acceptance of drinking water. When contaminants are present at considerably higher concentrations, health implications may also exist. The NSDWRs are not federally enforceable, but are intended as guidelines for States. The secondary MCLs are reasonable goals for drinking water quality. As long as public health and welfare are not adversely affected, States may establish higher or lower levels at their discretion. The drinking water parameters established in the NSDWRs should be monitored no less frequently than the monitoring performed for inorganic contaminants listed in the national primary drinking water regulations applicable to community water systems (see 40 *CFR* 141.23).

Fluoride is a special case, because it has both a primary MCL (an enforceable standard) and a secondary MCL (a non-enforceable aesthetic guideline). For protection from dental caries, a fluoride concentration of 0.7 to 1.2 mg/L is desirable. Fluoride concentrations above the secondary MCL (>2 mg/L) negatively affect the aesthetic quality of drinking water. Fluoride concentrations above the primary MCL (4.0 mg/L, as specified in 141.62) can cause negative health effects. The secondary drinking water regulations establish public notification requirements for community water systems which violate the MCL or SMCL for fluoride [40 *CFR* 141.32(f) and 143.5].

Contaminant Groups

To make it easier to discuss the drinking water regulations, regulatory requirements have been grouped according to the type of contaminant being controlled: microbiological contaminants, disinfectants and disinfection by-products, chemicals, and radiological contaminants. Summary tables in Section 3 outline the maximum contaminant levels; monitoring frameworks; analytical methods; and best available technologies, treatment techniques, or other methods specified in each rule.

Microbiological Contaminants

To protect the public from diseases caused by waterborne pathogens, NPDWRs have been promulgated for microbiological contaminants. A number of rules are designed to control microbiological contaminants: the Surface Water Treatment Rule; the Total Coliform Rule; the Enhanced Surface Water Treatment Rule; and the Groundwater Disinfection Rule (to be proposed).

These rules are closely interrelated and work together to reduce the risks associated with pathogens in drinking water. Proper water treatment and distribution can prevent almost all microbiological contamination of drinking water.

The proposed Information Collection Rule will facilitate collection of data related to the health effects of microbes and disinfectants and disinfection by-products in drinking water. As new data become available, the national drinking water regulations will be reviewed to ensure continued protection of public health.

Surface Water Treatment Rule

(refer also to the *Surface Water Treatment Rule* video and Learner's Guide in the ***Safe Drinking Water Act*** series)

The Surface Water Treatment Rule (SWTR) establishes filtration and disinfection as treatment techniques for *Giardia lamblia*, viruses, het-

erotrophic plate count (HPC) bacteria, *Legionella,* and turbidity. The treatment techniques requirements are applicable to all PWSs which are supplied by surface water sources, including groundwater sources under the direct influence of surface water (40 *CFR* 141.71).

Compliance with the treatment technique requirements consists of installing and properly operating water treatment processes (either disinfection alone, or disinfection and filtration) that reliably and consistently achieve at least 99.9 percent (3-log) removal and/or inactivation of *Giardia lamblia* and at least 99.99 percent (4-log) removal and/or inactivation of viruses. By regulating these contaminants, the SWTR also controls other, less resistant types of pathogens and thereby reduces the incidence of disease such as acute gastrointestinal illness and Legionnaire's disease (a form of pneumonia).

The SWTR requires filtration for systems that cannot meet source water quality and site-specific conditions (40 *CFR* 141.71). Systems that meet these conditions are able to avoid the filtration requirements of the SWTR. Disinfection requirements, however, are set for both filtering and non-filtering systems using surface water sources or groundwater sources under the direct influence of surface water (40 *CFR* 141.72).

Enhanced Surface Water Treatment Rule

The Enhanced Surface Water Treatment Rule (ESWTR) was proposed to amend the existing Surface Water Treatment Rule. The proposed rule addresses the control of *Cryptosporidium,* which causes acute gastrointestinal illness, and the impact of the proposed Disinfectant/Disinfection By-Products Rule. It also proposes increased pathogen reductions and increased disinfection CT (disinfectant concentration times the contact time) values for viruses.

Total Coliform Rule

(refer also to the *Total Coliform Rule* video and Learner's Guide in the ***Safe Drinking Water Act*** series)

The Total Coliform Rule (TCR) is designed to control microbiological contamination by regulating total coliforms, fecal coliforms, and *Escherichia coli (E. coli).* Coliform bacteria are not considered a human pathogen, although some types (e.g., *E. coli*) can cause dis-

ease when ingested in large numbers. The presence of coliform bacteria in drinking water, however, indicates the possibility that water is contaminated with organisms that can cause disease. These pathogens can include bacteria which cause diseases such as typhoid fever, cholera, and dysentery; viruses such as hepatitis; and protozoans like *Giardia lamblia*, which cause amoebic dysentery.

The requirements of the TCR apply to all public water systems and are closely related to the requirements of the SWTR. The TCR sets maximum contaminant levels (MCLs) for total and fecal coliforms (40 *CFR* 141.63). Compliance with the MCL is based on the absence of coliforms in a specified number of water samples. Samples which are representative of water throughout the distribution system are collected according to a written siting plan which is subject to review and revision by the State. The TCR also establishes sanitary survey requirements for small systems, which do not collect at least five or more routine samples/month. Exemptions from the MCL for total coliforms are not permitted. For systems that demonstrate to the State that a violation of the total coliform MCL is due to persistent growth of biofilm in the distribution system, variances are permitted.

Disinfectants and Disinfection By-Products

Disinfectants are applied to drinking water to inactivate microbial contaminants. Disinfection by-products are formed when disinfectants react with organic materials. Although health effects data are limited and health risks for compounds can differ greatly, exposure to some disinfectants and disinfection by-products has been linked to both long-term and short-term negative health effects, such as cancer, adverse reproductive effects, immunotoxicity, and adverse neurobehavioral effects.

Since 1979, an MCL of 0.10 mg/L has been established for the disinfection by-product total trihalomethanes (40 *CFR* 141.12). This standard applies only to CWSs serving at least 10,000 persons and adding a disinfectant (oxidant) during the treatment of drinking water.

The proposed Disinfectant/Disinfection By-Products Rule is designed to further reduce the risks associated with disinfection of drinking water. A risk assessment for disinfectants and disinfection by-products (D/DBPs) must consider the potential for negative health effects from exposure to pathogens, as well as negative

health effects from exposure to D/DBPs. The proposed Information Collection Rule will facilitate collection of data on the risks associated with microbiological contaminants and disinfectants and disinfection by-products in drinking water. Review of the data will allow promulgation of a final D/DBP Rule (and ESWTR) which will limit the risks associated with D/DBPs without substantially increasing the incidence of disease caused by pathogens.

The requirements of the Disinfectant/Disinfection By-Products Rule apply to all community water systems and non-transient non-community water systems that add a disinfectant during treatment. Certain provisions apply to transient non-community water systems.

The Disinfectant/Disinfection By-Products Rule proposes to reduce the risks associated with disinfectants and disinfection by-products by controlling:

1. the application and concentration of disinfectants—chlorine, chloramines, and chlorine dioxide;
2. organic disinfection by-products—total trihalomethanes (chloroform, bromodichloromethane, dibromochloromethane, bromoform) and five haloacetic acids (dichloroacetic acid, trichloroacetic acid, monochloroacetic acid, and mono- and dibromoacetic acids); and
3. inorganic disinfection by-products—chlorite and bromate.

The rule proposes maximum residual disinfectant levels or MCLs for disinfectants and disinfection by-products. It also proposes treatment techniques for control of disinfectants and disinfection by-products.

Chemicals

(refer also to the *Inorganic and Organic Chemical Rules* video and Learner's Guide in the ***Safe Drinking Water Act*** series)

As knowledge about the health effects of chemical contamination of drinking water has increased, regulation has also increased. Chemicals can be separated into two major categories: organic and inorganic.

Organic compounds are characterized by the presence of molecular carbon and hydrogen. Organic chemicals of concern may be further

referred to as synthetic organic compounds (SOCs) and volatile organic compounds (VOCs). SOCs are manmade organic compounds. Pesticides and industrial solvents are examples of products containing SOCs. Exposure to SOCs in drinking water may cause cancer and chronic nervous system disorders. VOCs are a subset of SOCs and are often used as solvents in industry and manufacturing. Some are also found in pesticides and home cleaning products. The primary health effects of exposure to VOCs in drinking water are cancer, liver, and kidney damage, and chronic nervous system disorders.

Inorganic chemicals are a group of metals or ionized compounds of mineral origin. Many come from natural mineral deposits, are leached from soil, or result from industrial or agricultural activities. Undesirable inorganic chemicals in drinking water can cause a wide range of symptoms from gastrointestinal and nervous system disorders to cancer. These health effects may be acute and/or chronic.

Rules to control chemical contamination of drinking water have been promulgated in phases. Phases I, II, and V have been promulgated. They establish MCLs; monitoring and analytical requirements; and best available technologies, treatment techniques, or other means generally available for a total of 65 chemical contaminants. A new MCLG and NPDWR for sulfate was proposed on December 20, 1994.

In addition to these rules, the Lead and Copper Rule has been promulgated to control lead and copper contamination of drinking water. Lead and copper are regulated differently than other inorganic contaminants because lead and copper usually occur in drinking water due to corrosion of distribution systems and customer plumbing. The Lead and Copper Rule establishes monitoring and analysis, reporting, and recordkeeping requirements and a set of treatment techniques that includes requirements for corrosion control treatment, source water treatment, lead service line replacement, and public education.

The MCLs for organic and inorganic contaminants apply to community water systems and non-transient non-community water systems, except that the MCL for fluoride applies only to community water systems. The MCLs for nitrate, nitrite, and total nitrate plus nitrite apply to community water systems and non-transient and transient non-community water systems. (See 40 *CFR* 141.61 and 141.62.) The MCL proposed for sulfate will also apply to all public water systems.

Radiological Contaminants

Regulations establishing MCLs and monitoring requirements for radium-226, radium-228, alpha emitters, and beta particle and photon emitters are currently in place for community water systems. New regulations for all of the radiological contaminants listed above, as well as uranium and radon, were proposed for community water systems and non-transient non-community water systems. These radionuclides, some of which are man-made and some of which occur naturally, are classified as human carcinogens.

Risk assessment for radon is complicated by the fact that radon is a volatile contaminant. While the most significant contributor to indoor radon is clearly soil gas, volatilization of radon from drinking water can increase indoor radon levels, and ingestion of radon in drinking water may pose some health risk.

Summary Tables

Maximum Contaminant Level Goals and Maximum Contaminant Levels

Monitoring Requirements

Best Available Technologies, Treatment Techniques, or Other Methods

Analytical Methods

Public Notification

Summary of National Primary and Secondary Drinking Water Regulations: Maximum Contaminant Levels

40 *CFR*	Contaminant	MCLG	MCL, Action Level (AL), or Treatment Technique (TT) Req.
NATIONAL PRIMARY DRINKING WATER REGULATIONS			
Organic Chemicals			
141.111	Acrylamide	0	TT—≤0.05% dosed at 1 ppm
141.61(c)(1)	Alachlor	0	0.002 mg/L
141.61(c)(2)	Aldicarb (postponed)	0.001 mg/L	0.003 mg/L
141.61(c)(4)	Aldicarb sulfone (postponed)	0.001 mg/L	0.002 mg/L
141.61(c)(3)	Aldicarb sulfoxide (postponed)	0.001 mg/L	0.004 mg/L
141.61(c)(5)	Atrazine	0.003 mg/L	0.003 mg/L
141.61(a)(2)	Benzene	0	0.005 mg/L
141.61(c)(19)	Benzo(a)pyrene	0	0.0002 mg/L
141.61(c)(6)	Carbofuran	0.04 mg/L	0.04 mg/L
141.61(a)(3)	Carbon tetrachloride	0	0.005 mg/L
141.61(c)(7)	Chlordane	0	0.002 mg/L

141.61(c)(20)	Dalapon	0.2 mg/L	0.2 mg/L
141.61(c)(9)	2,4-D	0.07 mg/L	0.07 mg/L
141.61(a)(13)	o-Dichlorobenzene	0.6 mg/L	0.6 mg/L
141.61(a)(6)	para-Dichlorobenzene	0.075 mg/L	0.075 mg/L
141.61(c)(8)	Dibromochloro-propane (DBCP)	0	0.0002 mg/L
141.61(a)(4)	1,2-Dichloroethane	0	0.005 mg/L
141.61(a)(7)	1,1-Dichloroethylene	0.007 mg/L	0.007 mg/L
141.61(a)(9)	cis-1,2-Dichloroethylene	0.07 mg/L	0.07 mg/L
141.61(a)(17)	trans-1,2-Dichloroethylene	0.1 mg/L	0.1 mg/L
141.61(a)(19)	Dichloromethane	0	0.005 mg/L
141.61(c)(21)	Di(2-ethylhexyl)adipate	0.4 mg/L	0.4 mg/L
141.61(c)(22)	Di(2-ethylhexyl)phthalate	0	0.006 mg/L
141.61(a)(10)	1,2-Dichloropropane	0	0.005 mg/L
141.61(c)(23)	Dinoseb	0.007 mg/L	0.007 mg/L
141.61(c)(24)	Diquat	0.02 mg/L	0.02 mg/L
141.61(c)(25)	Endothall	0.1 mg/L	0.1 mg/L
141.61(c)(26)	Endrin	0.002 mg/L	0.002 mg/L
141.111	Epichlorohydrin	0	TT—≤0.01% dosed at 20 ppm
141.61(a)(11)	Ethylbenzene	0.7 mg/L	0.7 mg/L
141.61(c)(10)	Ethylene dibromide (EDB)	0	0.00005 mg/L
141.61(c)(27)	Glyphosate	0.7 mg/L	0.7 mg/L
141.61(c)(11)	Heptachlor	0	0.0004 mg/L
141.61(c)(12)	Heptachlor epoxide	0	0.0002 mg/L
141.61(c)(28)	Hexachlorobenzene	0	0.001 mg/L
141.61(c)(29)	Hexachloropentadiene	0.05 mg/L	0.05 mg/L
141.61(c)(13)	Lindane	0.0002 mg/L	0.0002 mg/L

40 *CFR*	Contaminant	MCLG	MCL, Action Level (AL), or Treatment Technique (TT) Req.
141.61(c)(14)	Methoxychlor	0.04 mg/l	0.04 mg/L
141.61(a)(12)	Monochlorobenzene	0.1 mg/L	0.1 mg/L
141.61(c)(30)	Oxamyl (Vydate)	0.2 mg/L	0.2 mg/L
141.61(c)(16)	Pentachlorophenol	0	0.001 mg/L
141.61(c)(31)	Picloram	0.5 mg/L	0.5 mg/L
141.61(c)(15)	Polychlorinated byphenyls (PCBs)	0	0.0005 mg/L
141.61(c)(32)	Simazine	0.004 mg/L	0.004 mg/L
141.61(a)(14)	Styrene	0.1 mg/L	0.1 mg/L
141.61(c)(33)	2,3,7,8-TCDD (Dioxin)	0	3×10^{-8} mg/L
141.61(a)(15)	Tetrachloroethylene	0	0.005 mg/L
141.61(a)(16)	Toluene	1 mg/L	1 mg/L
141.61(c)(17)	Toxaphene	0	0.003 mg/L
141.61(c)(18)	2-4-5-TP (Silvex)	0.05 mg/L	0.05 mg/L
141.61(a)(20)	1,2,4-Trichlorobenzene	0.07 mg/L	0.07 mg/L
141.61(a)(8)	1,1,1-Trichloroethane	0.2 mg/L	0.2 mg/L
141.61(a)(21)	1,1,2-Trichloroethane	0.003 mg/L	0.005 mg/L
141.61(a)(5)	Trichloroethylene (TCE)	0	0.005 mg/L
141.61(a)(1)	Vinyl chloride	0	0.002 mg/L
141.61(a)(18)	Xylenes (total)	10 mg/L	10 mg/L

Inorganic Chemicals

141.62(b)(11)	Antimony	0.006 mg/L	0.006 mg/L
141.11	Arsenic	n/a	0.05 mg/L
141.62(b)(2)	Asbestos	7 MFL (million fibers per liter, w/fiber length >10 microns)	7 MFL
141.62(b)(3)	Barium	2 mg/L	2 mg/L
141.62(b)(12)	Beryllium	0.004 mg/L	0.004 mg/L
141.62(b)(4)	Cadmium	0.005 mg/L	0.005 mg/L
141.62(b)(5)	Chromium	0.1 mg/L	0.1 mg/L
141.80(c)(2)	Copper*	1.3 mg/L	AL exceeded when 90th percentile >1.3 mg/L
141.62(b)(13)	Cyanide	0.2 mg/L	0.2 mg/L
141.62(b)(1)	Fluoride*	4 mg/L	4 mg/L
141.80(c)(1)	Lead	0	AL exceeded when 90th percentile >0.015 mg/L
141.62(b)(6)	Mercury	0.002 mg/L	0.002 mg/L
141.62(b)(14)	Nickel	0.1 mg/L	0.1 mg/L
141.62(b)(7)	Nitrate	10 mg/L (as Nitrogen)	10 mg/L (as Nitrogen)
141.62(b)(8)	Nitrite	1 mg/L (as Nitrogen)	1 mg/L (as Nitrogen)
141.62(b)(9)	Total Nitrate and Nitrite	10 mg/L (as Nitrogen)	10 mg/L
141.62(b)(15)	Thallium	0.0005 mg/L	0.002 mg/L
141.62(b)(10)	Selenium	0.05 mg/L	0.05 mg/L

*Fluoride and copper also have secondary maximum contaminant levels (SMCLs).

40 *CFR*	Contaminant	MCLG	MCL, Action Level (AL), or Treatment Technique (TT) Req.
Radionuclides			
141.16(a)	Beta particle and photon activity		4 mrem/yr
141.15(b)	Gross alpha particle activity		15 pCi/L
141.15(a)	Radium 226/228		5 pCi/L
Microbiological			
141.70(a)(1)	*Giardia lamblia*	0	TT under SWTR*—to achieve at least 99.9% (3-log) removal and/or inactivation
141.70(a)	*Legionella*	0	controlled under TT requirements of SWTR
141.63(a)–(b) & 141.71(a)	Total coliforms	0	TCR—(based on presence-absence) <40 samples/mo, no more than 1 TC-positive sample; ≥40 samples/mo, no more than 5% TC-positive samples. SWTR*—surface water systems avoiding filtration ≤100/100 mL

141.63(b) & 141.71(a)	Fecal coliform or *E. coli*		TCR—no fecal coliform-positive repeat sample or *E. coli*-positive repeat sample after a fecal coliform-positive routine sample or *E. coli*-positive routine sample. SWTR*—surface water systems avoiding filtration ≤20/100 mL
141.70(a)	Heterotrophic plate count (HPC) bacteria		controlled under TT requirements of SWTR
141.73(a)–(d) & 141.71(a)	Turbidity		SWTR*—<5 NTU for non-filtering systems; <0.5 NTU in 95% of samples for conventional or direct filtration; <1 NTU in 95% of samples for slow sand, diatomaceous earth, or other filtration technologies
141.70(a)	Viruses	0	TT under SWTR*—to achieve at least 99.99% (4-log) removal and/or inactivation

*The SWTR contains the following disinfection requirements: (a) non-filtering surface water systems must meet specified CT values and must have redundant disinfection components and (b) both filtering and non-filtering surface water systems must maintain disinfectant residual concentration ≥2.0 mg/L in water entering the distribution system and detectable in water in the distribution system.

40 *CFR*	Contaminant	MCLG	MCL, Action Level (AL), or Treatment Technique (TT) Req.
Disinfectants and Disinfection By-Products			
141.12(c)	Total trihalomethanes (for CWSs serving ≥10,000 and disinfecting)		0.10 mg/L
Unregulated Contaminants (see Monitoring Requirements Table)			

NATIONAL SECONDARY DRINKING WATER REGULATIONS

143.3	Aluminum	0.05–0.2 mg/L
143.3	Chloride	250 mg/L
143.3	Color	15 color units
143.3	Copper*	1 mg/L
143.3	Corrosivity	non-corrosive
143.3	Fluoride*	2 mg/L
143.3	Foaming agents	0.5 mg/L
143.3	Iron	0.3 mg/L
143.3	Manganese	0.05 mg/L
143.3	Odor	3 threshold odor number
143.3	pH	6.5–8.5
143.3	Silver	0.1 mg/L
143.3	Sulfate	250 mg/L
143.3	Total dissolved solids (TDS)	500 mg/L
143.3	Zinc	5 mg/L

*Fluoride and copper also have primary maximum contaminant levels (MCLs).

Summary of National Primary and Secondary Drinking Water Regulations:
Base Monitoring Requirements*

40 *CFR*	Contaminant	Monitoring Requirements
NATIONAL PRIMARY DRINKING WATER REGULATIONS		
Organic Chemicals		
141.24(f)	Volatile Organic Chemicals [listed in 141.61(a)]: Benzene Carbon tetrachloride o-Dichlorobenzene para-Dichlorobenzene 1,2-Dichloroethane 1,1-Dichloroethylene cis-1,2-Dichloroethylene trans-1,2-Dichloroethylene Dichloromethane 1,2-Dichloropropane	CWSs and NTNCWSs must take quarterly samples during each compliance period. Systems with detects must continue quarterly sampling until analytical results are reliably and consistently below the MCLs. After three years with no detects, groundwater systems may reduce monitoring to one sample during each compliance period. Non-vulnerable surface water systems with no detects during initial monitoring may apply for a waiver from the monitoring requirements.

	Ethylbenzene Monochlorobenzene Styrene Tetrachloroethylene Toluene Trichlorobenzene 1,1,1-Trichloroethane 1,1,2-Trichloroethane Trichloroethylene (TCE) Vinyl chloride Xylenes	
141.24(h)	SOCs and Pesticides [listed in 141.61(c)]: Alachlor Aldicarb Aldicarb sulfone Aldicarb sulfoxide Atrazine Benzo(a)pyrene Carbofuran Chlordane 2,4-D Dalapon	CWSs and NTNCWSs must take quarterly samples during each compliance period. Systems with detects must continue quarterly sampling until analytical results are reliably and consistently below the MCLs. Systems serving >3,300 persons with no detection during initial compliance period may reduce sampling to 2 samples during each compliance period. Systems serving <3,300 persons with no detection during initial compliance period may reduce sampling to one sample during each compliance period. Note that monitoring for aldicarb, aldicarb sulfone, and aldicarb sulfoxide is to be performed according to 40 *CFR* 141.40 (unregulated contaminant monitoring); the MCLs for these contaminants have been deferred.

*These requirements are for base (minimum) monitoring. See Parts 141 and 143 of the regulations for information on special monitoring, reduced monitoring, waivers, grandfathering data, and sample compositing.

40 *CFR*	Contaminant	Monitoring Requirements
	Dibromochloropropane (DBCP) Di(2-ethylhexyl)adipate Di(2-ethylhexyl)phthalate Dinoseb Diquat Endothall Ethylene dibromide (EDB) Glyphosate Heptachlor Heptachlor epoxide Hexachlorobenzene Hexachlorocyclo-pentadiene Lindane Methoxychlor Oxymal Pentachlorophenol Picloram Polychlorinated byphenyls (PCBs) Simazine Toxaphene 2,3,7,8-TCDD (Dioxin) 2-4-5-TP (Silvex)	
141.111	Treatment polymers: Acrylamide & Epichlorohydrin	PWSs which use these chemicals must provide annual cetification of dosage and monomer levels.

Inorganic Chemicals

141.23(b)	Asbestos	CWSs and NTNCWSs must sample at each sampling point* during the first three-year compliance period of each nine-year compliance cycle. If systems are vulnerable to asbestos within the distribution system, systems must sample at taps served by asbestos-cement pipe under conditions when contamination is likely to occur. If sample results exceed the MCL, repeat sampling must be carried out quarterly until sampling results are reliably and consistently below the MCL.
141.23(c)	Antimony Arsenic Barium Beryllium Cadmium Chromium Cyanide Fluoride Mercury Nickel Selenium Thallium	CWSs and NTNCWSs using groundwater sources must analyze at least one sample at each sampling point* during each compliance period. CWSs and NTNCWs using surface water sources must analyze at least one sample annually at each sampling point.* If MCL is exceeded, systems must sample quarterly until results are reliably and consistently below the MCL.

*Sampling points are defined as follows: groundwater systems sample at each entry point to the distribution system representative of each well after treatment; surface water systems sample at each entry point to the distribution system at a point representative of each source after treatment.

40 *CFR*	Contaminant	Monitoring Requirements
141.23(d)	Nitrate	All PWSs must monitor. CWSs and NTNCWSs using groundwater must monitor annually. If any sample is ≥50% of the MCL, groundwater systems must perform quarterly sampling for at least one year. CWSs and NTNCWSs using surface water must monitor quarterly. If, after at least one year of quarterly sampling, the results are consistently below the MCL surface water systems may be allowed to reduce monitoring to annually. TWSs must monitor annually. Systems which monitor annually must monitor during the quarters which previously yielded the highest analytical result.
141.23(e)	Nitrite	All PWSs must take an initial sample at each sampling point.* Any system whose analytical results are ≥50% of the MCL during initial monitoring must monitor quarterly. Systems with analytical results <50% of the MCL must monitor at the frequency specified by the State.
141.86, 141.87, & 141.88	Lead & Copper	CWSs and NTNCWSs must monitor. For tap water monitoring: One sample during each monitoring period at the number of sites required (determined by system size). Large systems must monitor during two consecutive six-month periods. Small and medium systems must monitor during each six-month period. All samples must be taken according to sample siting plans approved by the State.

		For source water monitoring: Systems that exceed the ALs for tap water samples must collect one source water sample at each entry point to the distribution system and must monitor source water after installation of source water treatment, after designation of maximum permissible source water lead and copper levels, or after it is determined that source water treatment is not necessary. Large systems and systems that exceed the lead or copper action level must monitor water quality parameters at the tap and at sampling points in the distribution system.
Radionuclides		
141.26(a)	Gross alpha particle activity and Radium 226/228	Quarterly sampling (compliance based on annual average or annual composite). Subsequent monitoring (quarterly sampling) at least every four years. If initial monitoring shows average annual results <50% of the MCL, analysis of a single sample may take the place of quarterly sampling.
141.26(b)	Beta particle and photon activity (man-made radioactivity)	Surface water systems serving >100,000 persons and other systems designated by the State must take four quarterly samples for gross beta particle activity. After initial monitoring, systems which have an average annual concentration of gross beta particle activity of <50 pCi/L and comply with the MCL for strontium-90

*Sampling points are defined as follows: groundwater systems sample at each entry point to the distribution system representative of each well after treatment; surface water systems sample at each entry point to the distribution system at a point representative of each source after treatment.

40 *CFR*	Contaminant	Monitoring Requirements
		and tritium perform base monitoring at least every four years. Systems the State designates as using waters contaminated by effluents from nuclear facilities must monitor quarterly for gross beta particle and iodine-131 radioactivity and must monitor annually for strontium-90 and tritium.
Microbiological		
141.74	Total inactivation ratio	Non-filtering surface water systems must calculate total inactivation ratio every day. This includes daily measurement of temperature, pH (if chlorine is used), disinfectant contact time, and residual disinfectant concentration to determine CT values.
141.21(a) & 141.74(b)	Total coliforms	TCR—All public water systems must monitor. Frequency and required number of samples determined by population served, source of supply, and results of sanitary survey. SWTR—Non-filtering surface water systems required to monitor weekly. Number of samples required is determined by population served. Also, one fecal or total coliform density measurement is required every day the system's turbidity exceeds 1 NTU.
141.74	Residual disinfectant concentration	All surface water systems must monitor. Residual disinfectant concentration must be monitored continuously in water entering the distribution system and must be monitored in water in the distribution system at the same points and frequency as for total coliforms.

		Systems serving ≤3,300 persons may use grab sampling; number of samples per day based on population served. HPC may be monitored in lieu of residual disinfectant concentration.
141.74	Turbidity	All surface water systems must analyze grab samples every four hours that the system serves water to the public. States may approve continuous monitoring in lieu of grab sampling. States may also allow reduced monitoring for small (≤500 persons) systems or systems using slow sand filtration or alternative filtration technologies (other than conventional treatment, direct treatment, or diatomaceous earth filtration).
Disinfectant and Disinfection By-Products		
141.30	Total trihalomethanes	All CWSs serving ≥10,000 persons which add a disinfectant must monitor at quarterly intervals, at least 4 samples for each treatment plant (25% at locations in distribution system reflecting maximum residence time, 75% at representative locations). Results per quarter are averaged. Groundwater systems may be eligible for reduced monitoring.
Other Substances		
141.41	Sodium	All CWSs must monitor. One sample required for each treatment plant. Surface water systems must monitor annually. Groundwater systems must monitor every three years.

40 *CFR*	Contaminant	Monitoring Requirements
141.42	Corrosivity characteristics	All CWSs must monitor. Surface water systems must take two samples for each treatment plant: one in mid-winter and one in mid-summer. Groundwater systems must take one sample for each treatment plant.
	Unregulated Chemicals	
141.40(e)	Bromobenzene Bromodichloromethane Bromoform Bromomethane Chlorodibromomethane Chloroethane Chloroform Chloromethane o-Chlorotoluene p-Chlorotoluene Dibromomethane m-Dichlorobenzene 1,1-Dichloroethane 1,1-Dichloropropane 1,3-Dichloropropane 2,2-Dichloropropane	All CWSs and NTNCWSs must monitor. Surface water systems must take samples at each sampling point* quarterly for one year. Groundwater systems must take one sample at each sampling point.*

	1,3-Dichloropropane 1,1,1,2-Tetrachloroethane 1,1,2,2-Tetrachloroethane 1,2,3-Trichloropropane	
141.40(j)	Bromochloromethane n-Butylbenzene Sec-Butylbenzene Tert-Butylbenzene Dichlorodifluoromethane Fluorotrichloromethane Hexachlorobutadiene Isopropylbenzene p-Isopropylbenzene Naphthalene n-Propylbenzene 1,2,3-Trichlorobenzene 1,2,4-Trimethylbenzene 1,2,5-Trimethylbenzene	Sampling required at the discretion of the State.
141.40(n) (11)	Aldicarb Aldicarb sulfone Aldicarb solfoxide Aldrin	CWSs and NTNCWSs must take four quarterly samples at each sampling point.*

*Sampling points are defined as follows: groundwater systems sample at each entry point to the distribution system representative of each well after treatment; surface water systems sample at each entry point to the distribution system at a point representative of each source after treatment.

40 *CFR*	Contaminant	Monitoring Requirements
	Butachlor Carbaryl Dicamba Dieldrin 3-Hydroxycarbofuran Methomyl Metolachlor Metribuzin Propachlor	
141.40(n)(12)	Sulfate	CWSs and NTNCWSs must take one sample at each sampling point.* (Note that sulfate is also monitored under the national secondary drinking water regulations.)

143.4(a)	Aluminum Chloride Color Copper Corrosivity Fluoride Foaming agents Iron Manganese Odor pH Silver Sulfate Total dissolved solids (TDS) Zinc	Recommended monitoring is the same as that required under the national primary drinking water regulations for inorganic contaminants.

*Sampling points are defined as follows: groundwater systems sample at each entry point to the distribution system representative of each well after treatment; surface water systems sample at each entry point to the distribution system at a point representative of each source after treatment.

Summary of National Primary and Secondary Drinking Water Regulations:
Best Available Technologies, Treatment Techniques, or Other Methods

40 *CFR*	Contaminant	BATs, TTs, or Other Methods*
NATIONAL PRIMARY DRINKING WATER REGULATIONS		
Organic Chemicals		
141.111	Acrylamide	annual certification of dose and monomer levels
141.61(b)	Alachlor	GAC
141.61(b)	Aldicarb	GAC
141.61(b)	Aldicarb sulfone	GAC
141.61(b)	Aldicarb sulfoxide	GAC
141.61(b)	Atrazine	GAC
141.61(b)	Benzene	GAC/PTA
141.61(b)	Benzo(a)pyrene	GAC
141.61(b)	Carbofuran	GAC
141.61(b)	Carbon tetrachloride	GAC/PTA
141.61(b)	Chlordane	GAC
141.61(b)	Dalapon	GAC
141.61(b)	2,4-D	GAC

141.61(b)	Dibromochloro-propane (DBCP)	GAC/PTA
141.61(b)	o-Dichlorobenzene	GAC/PTA
141.61(b)	para-Dichlorobenzene	GAC/PTA
141.61(b)	1,2-Dichloroethane	GAC/PTA
141.61(b)	1,1-Dichloroethylene	GAC/PTA
141.61(b)	cis-1,2-Dichloroethylene	GAC/PTA
141.61(b)	trans-1,2-Dichloroethylene	GAC/PTA
141.61(b)	Dichloromethane	PTA
141.61(b)	1,2-Dichloropropane	GAC/PTA
141.61(b)	Di(2-ethylhexyl)adipate	GAC/PTA
141.61(b)	Di(2-ethylhexyl)phthalate	GAC
141.61(b)	Dinoseb	GAC
141.61(b)	Diquat	GAC
141.61(b)	Endothall	GAC
141.61(b)	Endrin	GAC
141.111	Epichlorohydrin	annual certification of dose and monomer levels
141.61(b)	Ethylbenzene	GAC/PTA
141.61(b)	Ethylene dibromide (EDB)	GAC/PTA
141.61(b)	Glyphosate	OX
141.61(b)	Heptachlor	GAC
141.61(b)	Heptachlor epoxide	GAC
141.61(b)	Hexachlorobenzene	OX
141.61(b)	Hexachloropentadiene	GAC/PTA
141.61(b)	Lindane	GAC
141.61(b)	Methoxychlor	GAC

*GAC = Granular Activated Carbon; PTA = Packed Tower Aeration; OX = Oxidation.

40 *CFR*	Contaminant	BATs, TTs, or Other Methods*
141.61(b)	Monochlorobenzene	GAC/PTA
141.61(b)	Oxamyl (Vidate)	GAC
141.61(b)	Pentachlorophenol	GAC
141.61(b)	Picloram	GAC
141.61(b)	Polychlorinated byphenyls (PCBs)	GAC
141.61(b)	Simazine	GAC
141.61(b)	Styrene	GAC/PTA
141.61(b)	2,3,7,8-TCDD (Dioxin)	GAC
141.61(b)	Tetrachloroethylene	GAC/PTA
141.61(b)	Toluene	GAC/PTA
141.61(b)	Toxaphene	GAC
141.61(b)	2-4-5-TP (Silvex)	GAC
141.61(b)	1,2,4-Trichlorobenzene	GAC/PTA
141.61(b)	1,1,1-Trichloroethane	GAC/PTA
141.61(b)	1,1,2-Trichloroethane	GAC/PTA
141.61(b)	Trichloroethylene (TCE)	GAC/PTA
141.61(b)	Vinyl chloride	PTA
141.61(b)	Xylenes	GAC/PTA
Inorganic Chemicals		
141.62(c)	Antimony	coagulation/filtration; reverse osmosis
141.62(c)	Asbestos	coagulation/filtration; direct and diatomite filtration; corrosion control
141.62(c)	Barium	ion exchange; lime softening; reverse osmosis; electrodialysis

141.62(c)	Beryllium	activated alumina; coagulation/filtration; ion exchange; lime softening; reverse osmosis
141.62(c)	Cadmium	coagulation/filtration; ion exchange; lime softening; reverse osmosis
141.62(c)	Chromium	coagulation/filtration; ion exchange; lime softening (Chromium III only); reverse osmosis
141.82	Copper	corrosion control (alkalinity and pH adjustment, calcium hardness adjustment, addition of phosphate- or silicate-based corrosion inhibitor)
141.62(c)	Cyanide	ion exchange; reverse osmosis; chlorine
142.61(a)	Fluoride	activated alumina absorption; reverse osmosis
141.82, 141.83, 141.84, & 141.43	Lead	corrosion control (alkalinity and pH adjustment, calcium hardness adjustment, addition of phosphate- or silicate-based corrosion inhibitor); source water treatment (ion exchange, reverse osmosis, lime softening, or coagulation/filtration); lead service line replacement; restriction on lead content of pipe, solder, and flux
141.62(c)	Mercury	coagulation/filtration; GAC; lime softening; reverse osmosis (except for GAC, these are BATs only if influent mercury concentrations <10 µg/L)
141.62(c)	Nickel	ion exchange; lime softening; reverse osmosis
141.62(c)	Nitrate	ion exchange; reverse osmosis; electrodialysis
141.62(c)	Nitrite	ion exchange; reverse osmosis
141.62(c)	Selenium	activated alumina; coagulation/filtration (Selenium IV only); lime softening; reverse osmosis; electrodialysis
141.62(c)	Thallium	activated alumina; ion exchange

*GAC = Granular Activated Carbon; PAT = Packed Tower Aeration; OX = Oxidation.

40 *CFR*	Contaminant	BATs, TTs, or Other Methods
Radionuclides (proposed)		
141.64	Beta particle and photon activity	ion exchange; reverse osmosis
141.64	Gross alpha particle	ion exchange; lime softening; reverse osmosis
141.64	Radium 226/228	ion exchange; lime softening; reverse osmosis
Microbiological Contaminants		
Subpart H	*Giardia lamblia*	SWTR—filtration of surface water (turbidity requirements must be met); disinfection of groundwater and surface water; filtration and disinfection to be performed by qualified operators
141.70(a)	*Legionella*	controlled under SWTR TT requirements
141.63(d)	Total coliforms	TCR and SWTR—well protection; maintenance of disinfectant residual in distribution system; proper distribution system maintenance; surface water filtration/disinfection; groundwater disinfection; compliance with Wellhead Protection Program
141.70(a)	HPC	controlled under SWTR TT requirements
141.70(a)(2)	Viruses	controlled under SWTR TT requirements
141.73 (a)–(d)	Turbidity	SWTR—conventional or direct filtration, slow sand filtration, diatomaceous earth filtration, or other filtration technologies adequate to ensure removal of contaminants

Disinfectants and Disinfection By-Products

142.60(a)	Total trihalomethanes	using chloramines as an alternative or supplemental disinfectant or oxidant; using chlorine dioxide as an alternative or supplemental disinfectant or oxidant; improving existing clarification for THM precursor reduction; moving the point of chlorination to reduce TTHM formation and substituting chloramines, chlorine dioxide, or potassium permanganate instead of chlorine as a preoxidant; using powdered activated carbon for THM precursor or TTHM reduction seasonally or intermittently at dosages not to exceed 10 mg/L on an average annual basis.

BATs, TTs, or Other Methods are not specified for secondary or unregulated contaminants.

Summary of National Primary and Secondary Drinking Water Regulations: Approved Analytical Methods

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
NATIONAL PRIMARY DRINKING WATER REGULATIONS			
Organic Chemicals			
141.24(f)	Volatile Organic Chemicals [listed in 141.61(a)]:		
	Benzene	Gas Chromatography;	EPA[1] 502.1, 502.2, 503.1
	Carbon tetrachloride	Gas Chromatography, Mass	EPA[1] 524.1, 524.2
	o-Dichlorobenzene	Spectrometry	
	para-Dichlorobenzene		
	1,2-Dichloroethane		
	1,1-Dichloroethylene		
	cis-1,2-Dichloroethylene		
	trans-1,2-Dichloroethylene		
	Dichloromethane		
	1,2-Dichloropropane		

	Ethylbenzene		
	Monochlorobenzene		
	Styrene		
	Tetrachloroethylene		
	Toluene		
	1,2,4-Trichlorobemzene		
	1,1,1-Trichloroethane		
	1,1,2-Trichloromethane		
	Trichloroethylene (TCE)		
	Vinyl chloride		
	Xylenes		
141.24(h)	SOCs and Pesticides [listed in 141.61(c)]:		
	Alachlor	Gas Chromatography;	EPA[1] 505, 507
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	Aldicarb	Direct Aqueous Injection HPLC	EPA[1] 531.1
	Aldicarb sulfone	Direct Aqueous Injection HPLC	EPA[1] 531.1
	Aldicarb sulfoxide	Direct Aqueous Injection HPLC	EPA[1] 531.1
	Atrazine	Gas Chromatography;	EPA[1] 505, 507
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
	Benzo(a)pyrene	Liquid-Liquid Extraction and HPLC;	EPA[1] 550
		Liquid-Solid Extraction and HPLC	EPA[1] 550.1
	Carbofuran	Direct Aqueous Injection HPLC	EPA[1] 531.1
	Chlordane	Gas Chromatography;	EPA[1] 505, 508
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	2,4-D	Gas Chromatography	EPA[1] 515.1
	Dalapon	Gas Chromatography	EPA[1] 515.1
	Dibromochloropropane (DBCP)	Gas Chromatography	EPA[1] 504
	Di(2-ethylhexyl)adipate	Liquid-Liquid Extraction	EPA[1] 506
		Liquid-Solid Extraction and HPLC;	
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	Di(2-ethylhexyl)phthalate	Liquid-Liquid Extraction	EPA[1] 506
		Liquid-Solid Extraction and HPLC;	
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	Dinoseb	Gas Chromatography	EPA[1] 515.1
	Diquat	Liquid Chromatography	EPA[1] 549

Endothall	Aqueous	EPA[1] 548
Ethylene dibromide (EDB)	Gas Chromatography	EPA[1] 504
Glyphosate	Direct Aqueous Injection HPLC	EPA[1] 547
Heptachlor	Gas Chromatography;	EPA[1] 505, 508
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Heptachlor epoxide	Gas Chromatography;	EPA[1] 505, 508
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Hexachlorobenzene	Gas Chromatography;	EPA[1] 505, 508
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Hexachlorocyclo-pentadiene	Gas Chromatography;	EPA[1] 505
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Lindane	Gas Chromatography;	EPA[1] 505, 508
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Methoxychlor	Gas Chromatography;	EPA[1] 505, 508
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
Oxymal	Direct Aqueous Injection HPLC	EPA[1] 531.1
Pentachlorophenol	Gas Chromatography;	EPA[1] 515.1
	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
	Picloram	Gas Chromatography	EPA[1] 515.1
	Polychlorinated byphenyls (PCBs)	Gas Chromatography	EPA[1] 505, 508 (as screen) EPA[1] 508A
	Polynuclear aromatic hydrocarbons	Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
		Liquid-Liquid Extraction and HPLC	EPA[1] 550
		Liquid-Solid Extraction and HPLC	EPA[1] 550.1
	Simazine	Gas Chromatography	EPA[1] 505, 507
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	Toxaphene	Gas Chromatography	EPA[1] 505, 508
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1
	2,3,7,8-TCDD (Dioxin)	Isotope Dilution	EPA[1] 1613
	2-4-5-TP (Silvex)	Gas Chromatography	EPA[1] 515.1
141.12	Endrin	Gas Chromatography	EPA[1] 505, 508
		Gas Chromatography, Mass Spectrometry	EPA[1] 525.1

Inorganic Chemicals

141.23(k)	Antimony	Atomic Absorption, Furnace;[22]	EPA[3] 204.2 SM 3113
		Atomic Absorption, Platform;[22]	EPA[13] 200.9
		ICP-Mass Spec.;[22]	EPA[13] 200.8
		Hydride-Atomic Absorption[23]	ASTM D-3697-87
141.23(k)	Arsenic	Atomic Absorption, Furnace Tech.;	EPA[3] 206.2
		Atomic Absorption, Gaseous Hydride;	EPA[3] 206.3 SM 307A ASTM D2972-88B I-1062-85[4]
		Spectrophotometric	EPA[3] 206.4 SM 307B ASTM D2972-88A
		Inductively-Coupled Plasma	EPA[5] 200.7A
141.23(k)	Asbestos	Transmission Electron Microscopy	EPA[6]
141.23(k)	Barium	Atomic Absorption, Furnace Tech.;[22]	EPA[3] 208.2 SM 3113B
		Atomic Absorption, Direct Aspiration;[22]	EPA[3] 208.1 SM 3111D
		Inductively-Coupled Plasma[22]	EPA[13] 200.7 SM 3120

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
141.23(k)	Beryllium	Atomic Absorption, Furnace[22]	EPA[3] 210.2 ASTM D-3645-84B SM 3113
		Atomic Absorption, Platform;[22]	EPA[13] 200.9
		Inductively-Coupled Plasma;[22]	EPA[13] 200.7 SM 3120
		ICP-Mass Spec.[22]	EPA[13] 200.8
141.23(k)	Cadmium	Atomic Absorption, Furnace Tech.;[22]	EPA[3] 213.2 SM 3113B
		Inductively-Coupled Plasma	EPA[5] 200.7A
141.23(k)	Chromium	Atomic Absorption, Furnace Tech.;[22]	EPA[3] 218.2 SM 3113B
		Inductively-Coupled Plasma[22]	EPA[13] 200.7 SM 3120
141.89	Copper	Atomic Absorption, Furnace Tech.;	EPA[3] 220.2 ASTM D1688-90C SM 3113B
		Atomic Absorption, Direct Aspiration;	EPA[3] 220.1 ASTM D1688-90A

			SM 3111B
		Inductively-Coupled Plasma;	EPA[13] 200.7 SM 3120B
		Inductively-Coupled Plasma, Mass Spec.;	EPA[13] 200.8
		Atomic Absorption, Platform Furnace Tech.	EPA[13] 200.9
141.23(k)	Cyanide	Distillation, Spec.;	EPA[3] 335.2 ASTM D-2036-89A SM 4500-CN-D USGS[4] I330085
		Distillation. Automated, Spec.	EPA[3] 335.3 SM4500-CN-E
		Distillation, Selective Electrode	ASTM D-2036-89A SM 4500-CN-F
		Distillation, Amenable, Spec.	EPA[3] 335.1 ASTM D-2036-89B SM 4500-CN-G
141.23(k)	Fluoride	Colorimetric SPADNS;	EPA[3] 340.1 ASTM D1179-72A SM 413A&C
		Potentiometric Ion Selective Electrode;	EPA[3] 340.2 ASTM D1179-72B SM 413B

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
		Automated Alizarin Fluoride Blue;	EPA[3] 340.3 SM 413E 129-71W11
		Automated Ion Selective Electrode	380-75WE[12]
141.89	Lead	Atomic Absorption, Furnace Tech.;	EPA[3] 239.2 ASTM D3559-85D SM 3113
		Inductively-Coupled Plasma, Mass Spec.;	EPA[13] 200.8
		Atomic Absorption, Platform Furnace Tech.	EPA[13] 200.9
141.23(k)	Mercury	Manual Cold Vapor Tech.;[23]	EPA[3] 245.1 ASTM D3223-86
		Automated Cold Vapor Tech.[23]	SM 3112B EPA[3] 245.2
141.23(k)	Nickel	Atomic Absorption, Furnace;[22]	EPA[3] 249.2 SM 3113
		Atomic Absorption, Platform;[22]	EPA[13] 200.9
		Atomic Absorption, Direct;[22]	EPA[3] 249.1 SM 3111B

		Inductively-Coupled Plasma;[22]	EPA[13] 200.7 SM 3120
		ICP-Mass Spec.[22]	EPA[13] 200.8
141.23(k)	Nitrate	Manual Cadmium Reduction;	EPA[3] 353.3 ASTM D3867-90 SM 4500-NO_3-E
		Automated Hydrazine Reduction;	EPA[3] 353.1
		Automated Cadmium Reduction;	EPA[3] 353.2 ASTM D3867-90 SM 4500-NO_3-F
		Ion Selective Electrode;	WeWWG/5880[8]
		Ion Chromatography	EPA[7] 300.0 B-1011[9]
141.23(k)	Nitrite	Spectrophotometric;	EPA[3] 354.1
		Automated Cadmium Reduction;	EPA[3] 353.2 ASTM D3867-90 SM 4500-NO_3-F
		Manual Cadmium Reduction;	EPA[3] 353.3 ASTM D3867-90 SM 4500-NO_3-E
		Ion Chromatography	EPA[7] 300.0 B-1011[9]

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
141.23(k)	Selenium	Hydride-Atomic Absorption;[22]	ASTM D3859-84A
			SM 3114B
		Atomic Absorption, Furnace[21,23]	EPA[3] 270.2
			ASTM D3859-88
			SM 3113B[10]
141.23(k)	Thallium	Atomic Absorption, Furnace;[21]	EPA[3] 279.2
			SM 3113
		Atomic Absorption, Platform;[21]	EPA[13] 200.9
		ICP-Mass Spec.[21]	EPA[13] 200.8
Radionuclides			
141.25[14]	Gross alpha and beta particle activity	[15]	
	Tritium		SM 302
	Strontium-89, 90		SM 306
	Total Radium		SM 303
	Radium 226		SM 304
	Cesium-134		SM 305
	Uranium		ASTM D2459
			ASTM D2907

Microbiological

141.74	*Giardia lamblia* and viruses	Based on total inactivation ratio	CT value calculation [40 *CFR* 141.74(b)(3)]
141.21(f) & 141.74(a)	Total coliforms	Multiple Tube Fermentation (MTF) Technique;	EPA[16], Most Probable Number Method, Part III, Section B.4.1–4.6.4 SM 908, 908A, 908B, 908D EPA[16], Part III, Section B.2.1–2.6
		Membrane Filter (MF) Technique;	SM 909, 909A, 909B
		Presence-Absence (P-A) Coliform Test;	SM 908E
		Minimal Medium ONPG-MUG (MMO-MUG) Test (Autoanalysis Colilert System)	[17]
141.21(f) & 141.74(a)	Fecal coliforms	Multiple Tube Fermentation (MTF) Technique;	SM 908C
		Membrane Filter (MF) Technique;	SM 909C

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
141.74(a)	Residual disinfectant concentration:		
	Free Cl_2 and combined Cl_2	Amperometric Titration Method;	SM 408C
		DPD Ferrous Titrimetric Method;	SM 408D
		DPD Colorimetric Method;	SM 408E
		Leuco Crystal Violet Method	SM 408F
	Ozone	Indigo Method	[18]
	Cl_2 dioxide	Amperometric Method;	SM 410B
		DPD Method	SM 410C
141.74(a)	HPC	Pour Plate Method	SM 907A
141.74(a)	Turbidity	Nephelometric Method	SM 214A
Disinfectants and Disinfection By-Products			
141.30(e)	Total trihalomethanes	Purge and Trap Method;	EPA 501.1
		Liquid/Liquid Extraction;	EPA 501.2
		Gas Chromatography;	EPA[1] 502.2
		Gas Chromatography, Mass Spec.	EPA[1] 524.2

Other Substances

141.41(d)	Sodium	Flame Photometric Method;	SM
		Atomic Absorption, Direct Aspiration;	EPA[3] 273.1
		Atomic Absorption,Graphite Furnace	EPA[3] 273.2
			ASTM D1428-64(a)
141.42(c)	Corrosivity characteristics:		
	Langelier Index		SM 203
	Aggressive Index		AWWA C400-7719
	Temperature		SM 212
	Calcium		EPA[3] 215.2
			SM 306C
			ASTM D1126-67B
	Alkalinity		EPA[3] 310.1
			SM 403
			ASTM D1067-70B
	pH		EPA[3] 150.1
			SM 424
			ASTM D1293-78A or B
	Chloride	Potentiometric Method	SM
	Sulfate	Turbimetric Method	EPA or SM

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
Unregulated Contaminants			
141.40	Special monitoring for organics and inorganics		
	VOCs [141.40(g)]	Gas Chromatography;	EPA[1] 502.1, 503.1
		Gas Chromatography, Mass Spectrometry	EPA[1] 524.1, 524.2, 502.2[20]
	Organic Contaminants		see table in 141.40(n)(11)
	Inorganic Contaminants		see table in 141.40(n)(12)
NATIONAL SECONDARY DRINKING WATER REGULATIONS			
143.4(b)	Aluminum	Atomic Absorption, Direct Aspiration;	EPA[3] 202.1 SM 306A
		Atomic Absorption, Graphite Furnace;	USGS[4] I-305i-85 EPA[3] 202.2 SM 304
		ICP;	EPA[13] 200.7 SM 3120
		ICP, Mass Spec.	EPA[13] 200.8
		ICP, Platform	EPA[13] 200.9
	Chloride	Potentiometric Method	SM
	Color	Platinum Cobalt Method	EPA[3]

Copper	Atomic Absorption;	EPA[3] SM
	ICP, Atomic Emission	EPA[13]
Corrosivity—See "Other Substances"		
Fluoride—See "Inorganic Chemicals"		
Foaming agents	Methylene Blue Method	EPA[3] SM
Iron	Atomic Absorption	EPA[3] SM
	ICP, Atomic Emission	EPA[13]
Manganese	Atomic Absorption	EPA[3] SM
	ICP, Atomic Emission	EPA[13]
Odor	Consistent Series Method	EPA[3] SM
pH	Glass Electrode Method	EPA[3] SM
Silver	Atomic Absorption, Direct Aspiration;	EPA[3] 272.1 SM 324A
	Atomic Absorption, Graphite Furnace;	EPA[3] 272.2 USGS[4] I-3720-85 SM 304
	ICP;	EPA[13] 200.7 SM 3120
	ICP, Mass Spec.	EPA[13] 200.8
	ICP, Platform	EPA[13] 200.9

40 *CFR*	Contaminant	Methodology	Reference/Method # and Notes[2]
	Sulfate—see "Other Substances"		
	Total dissolved solids	Total Residue Method	EPA[3] SM
	Zinc	Atomic Absorption	EPA[3] SM
		ICP, Atomic Emission	EPA[11] 200.7

1 "Methods for the Determination of Organic Compounds in Drinking Water," EPA/600/4-88/039, December 1988. Revised July 1991 and in "Methods for the Determination of Organic Compounds in Drinking Water—Supplement I," EPA/600/4-90/020, July 1990, and "Supplement II," EPA/600/R-92/129, August 1992, Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268. Available from National Technical Information Service (NTIS), PB91-231480, PB91-146027 and PB92-207703, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161, (800) 553-6847.

2 Unless otherwise indicated:
- SM refers to *Standard Methods for the Examination of Water and Wastewater*, American Public Health Association, American Water Works Association, Water Pollution Control Federation (now Water Environment Federation).
- ASTM refers to *Annual Book of ASTM Standards*, part 31 Water, American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103.

3 "Methods of Chemical Analysis of Water and Wastes," EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 (EPA-600/4-79-020), March 1983. Available at NTIS as PB84-128677.

4 *Techniques of Water Resources Investigations of the United States Geological Survey*, Chapter A-1, "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," Book 5, Third Edition, 1989. Available from the Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

5 Method 200.7A, "Inductively-Coupled Plasma Atomic Emission Analysis of Drinking Water," Appendix to Method 200.7, March 1987, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

6 "Analytical Method for Determination of Asbestos Fibers in Water," EPA-600/4-83-043, September 1983, U.S. EPA, Environmental Research Laboratory, Athens, GA 30613.

7 "Methods for the Determination of Inorganic Substances in Environmental Samples," EPA/600/R-93-100, August 1993, Available at NTIS as PB94-1218111.

8 "Orion Guide to Water and Wastewater Analysis," Form WeWWG/5880, p.5, 1985. Orion Research, Inc., Cambridge, MA.

9 "Waters Test Method for the Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography, Method B-1011, Millipore Corporation, Waters Chromatography Division, 34 Maple Street, Milford, MA 01757.

10 Prior to dilution of the Se calibration standard, add 2 mL of 30% H_2O_2 for each 100 mL of standard.

11 "Fluoride in Water and Wastewater, Industrial Method = 129-71W." Technicon Industrial Systems, Tarrytown, NY 10591. December 1972.

12 "Fluoride in Water and Wastewater,." Technicon Industrial Systems, Tarrytown, NY 10591. February 1976.

13 "Methods for the Determination of Metals in Environmental Samples," Office of Research and Development, Washington, DC 20460, EPA/600/4-91/010, June 1991. Available at NTIS, PB 91-231498.

14 When identification and measurement of radionuclides other than those listed are necessary, use *Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions*, H.L. Krieger and S. Gold, EPA-R4-73-014, U.S. EPA, Cincinnati, OH, May 1973, or *HASL Procedure Manual*, edited by John H. Harley. HASL 300, ERDA Health and Safety Laboratory, New York, NY, 1973.

15 Methods specified in *Interim Radiochemical Methodology for Drinking Water*, Environmental Monitoring and Support Laboratory, EPA-600/4-75-008, U.S. EPA Cincinnati, OH 45268, or in other references as noted.

16 *Microbiological Methods for Monitoring the Environment, Water and Wastes*, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268, EPA-600/8-78-017, December 1978.

17 "National Field Evaluation of a Defined Substrate Method for the Simultaneous Detection of Total Coliforms and *Escherichia Coli* from Drinking Water: Comparison with Presence Absence Techniques," Edberg et al., *Applied and Environmental Microbiology*, Volume 55, pp. 1003-1008, April 1989.

18 "Determination of Ozone in Water by the Indigo Method: A Submitted Standard Method," H. Bader and J. Hoigne. *Ozone Science and Engineering*, Vol. 4, pp. 169-176, Pergamon Press Ltd., 1982.

19 "AWWA Standard for Asbestos-Cement Pipe, 4 in. through 24 in. for Water and Other Liquids," AWWA C400-77, Revision of C400-75, AWWA, Denver, CO.

20 Reference available from USEPA-OST, Sample Control Center, PO Box 1407, Alexandria, VA 22313.

21 Samples that contain less than 1 NTU (nephalometric turbidity unit) and are properly preserved (conc HNO_3 to pH <2) may be analyzed directly (without digestion) for total metals. Otherwise, digestion is required. Turbidity must be measured on the preserved samples just prior to the initiation of metal analysis. When digestion is required, the total recoverable technique as defined in the method must be used.

22 For the gaseous hydride determinations of antimony and selenium and for the determination of mercury by the cold vapor techniques, the proper digestion technique as defined in the method must be followed to ensure the element is in the proper state for analyses.

23 Add 2 mL of 30% H_2O_2 and a appropriate concentration of matrix modifier $Ni(NO_2)+6H_2O$ (nickel nitrate) to samples.

40 *CFR* 141.27 Alternative analytical techniques: The State and the Administrator of US EPA may give written permission for use of alternate analytical techniques, so long as the alternate techniques provide the same precision and accuracy in determining MCLs as do the prescribed tests.

40 *CFR* 141.28 Approved laboratories: To determine compliance with the MCLs for coliforms (141.21), turbidity (141.22), inorganic chemicals (141.23), organic chemicals other than TTHMs (141.24); analytical methods for radioactivity (141.25); monitoring for radioactivity (141.26), sodium (141.41), and corrosivity characteristics (141.42), sampling must be carried out by approved laboratories. Sampling for turbidity, free chlorine residual, temperature and pH may be performed by any person acceptable to the State.

Summary of National Primary and Secondary Drinking Water Regulations:
Public Notification Requirements

Violation Category Type	Mandatory Health Effects Information Required (All PWSs)	Notice to New Billing Unit (CWS only)	Type of PWS	Timeframe Within Which Notice Must be given (Box indicates timeframe for inital notice, and is followed by the frequency of repeat notice)
				Violation: 72 hours; 7 days; 14 days; 45 days; 3 months; Annual
TIER 1			Community	Acute Violations:
1. MCL	Yes	Yes		Elec. Media — No Repeat
2. Treatment Technique	Yes	Yes		Newspaper[1] — No Repeat Mail or Hand Delivery[2] — Quarterly Repeat
3. Variance or Exemption Schedule Violation	Yes	Yes		Non-Acute Violations: Newspaper[1] — No Repeat Mail or Hand Delivery[2] — Quarterly Repeat
				Option 1: Notice as for Community Water System or

			Non-Community	Acute Violations: Posting or Hand Delivery	Continuous/Quarterly Repeat
				Non-Acute Violations: Posting or Hand Delivery	Continuous/Quarterly Repeat
TIER 2			Community	Newspaper[1]	Continuous/ Repeat by Mail or Hand Delivery
1. Monitoring[4]	No	No			
2. Testing Procedure	No	No		Option 1: Notice as for Community Water System or	
3. Subject to a Variance or Exemption	Yes	Yes	Non-Community[3]	Option 2: Posting or Hand Delivery	Continuous/ Quarterly Repeat

Footnotes:

[1]If no newspaper of general circulation is available, posting or hand delivery is required as specified in §141.32(a)(3)(i) and §141.32(b)(3)(i).

[2]May be waived in accordance with §141.32(a)(1)(ii).

[3]Includes both transient non-community public water systems and non-transient, non-community public water systems.

[4]Less frequent notice (but no less than annual) to be required as in §142.16(a).

Source: Drinking Water Regulations; Public Notification, Final Rule, *Federal Register*, October 28, 1987 (52 *FR* 41534) and its amendment in *Federal Register*, April 17, 1989 (54 *FR* 15185).

Bibliography

Publications listed here are available from various sources. Ordering information appears next to the title. Many publications are available free of charge from the EPA's Office of Ground Water and Drinking Water (OGWDW). The OGWDW distributes free publications through the National Clearinghouse for Publications and Information (NCEPI) and through EPA's Water Resource Center (WRC). To receive a copy of the Office of Ground Water and Drinking Water Publications List, contact NCEPI.

When OGWDW's supply of a publication is depleted, requestors are referred to either the National Technical Information Service (NTIS) or the Educational Resources Information Center (ERIC). These clearinghouses provide copies of OGWDW publications for a fee.

National Clearinghouse for Publications and Information (NCEPI)
11029 Kenwood Road, Building 5
Cincinnati, OH 45242
(513) 891-6561
fax (513) 891-6685

U.S. Environmental Protection Agency
Office of Water Resource Center,
RC-4100
401 M Street, SW
Washington, DC 20460
voice mail (202) 260-7786
via Internet:
Wood.Patricia@EPAmail.EPA.gov

National Technical Information Service (NTIS)
U.S. Department of Commerce
5285 Port Royal Road
Springfield, VA 22161
(703) 487-4679 / (800) 553-NTIS
fax (703) 321-8547 or 9038
TDD (703) 487-4639

Educational Resources Information Center (ERIC)
1929 Kenny Road
Columbus, OH 43210-1080
(614) 292-6717
fax (614) 292-0263

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Surface Water Treatment Rule: Implementation Manual, U.S. Environmental Protection Agency, Office of Drinking Water, Washington, DC (June 27, 1990).

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A

†,*Act: The Safe Drinking Water Act of 1974 (Public Law 93-523), the Safe Drinking Water Act Amendments of 1986 (Public Law 99-339), and the Lead Contamination Control Act of 1988 (Public Law 100-572).

†Action level: the concentration of lead or copper in water specified in §141.80(c) which determines, in some cases, the treatment requirements contained in subpart I of this part that a water system is required to complete.

√Activity: the nuclear transformations of a radioactive substance which occur in a specific time interval.

√Adjusted gross alpha: the result of a gross alpha measurement, less radium-226 and less uranium. Radon is not included in adjusted gross alpha.

√Aquifer: a geological "formation," group of formations, or part of a formation that is capable of yielding a significant amount of water to a well or spring.

*Artesian aquifer (and well): water confined under pressure, greater than atmospheric pressure, in porous rock or soil confined by relatively impermeable geologic formations. Not all water from wells that penetrate artesian formations flows above the surface of the land. For a well to be artesian, the water in the well must stand above the top of the aquifer.

B

√Becquerel (Bq): a special unit of radioactivity in the international system of units (SI). One Becquerel is equal to one disintegration per second.

†Best available technology (BAT): the best technology, treatment techniques or other means which the Administrator finds, after examination for efficacy under field conditions and not solely under laboratory conditions, are available (taking cost into consideration). For the purposes of setting MCLs for synthetic organic chemicals, any BAT must be at least as effective as granular activated carbon.

*Bubbler: a water fountain fixture connected to the drinking water supply plumbing. A bubbler does not contain a refrigeration unit.

C

*Capital costs: costs (usually long-term debt) for financing water system construction and equipment. Capital costs are usually fixed, one-time expenses; for example, the loan repayments incurred for financing the purchase and installation of a new filtration system. (The total costs of owning and operating a water system consist of both capital and operation and maintenance costs.)

*Chloramines: compounds formed by the reaction of hypochlorous acid (or aqueous chlorine) with ammonia.

*Chronic: occurring over a long period of time, either continually or intermittently; used to describe ongoing exposures and effects that develop only after a long exposure.

†Coagulation: a process using coagulant chemicals and mixing by which colloidal and suspended materials are destabilized and agglomerated into flocs.

*Coliform: a group of bacteria found in the intestines of warm-blooded animals (including humans) and also in plants, soil, air and water. Fecal coliforms are a specific class of bacteria which only inhabit the intestines of warm-blooded animals. The presence of coliform bacteria is an indication that the water may contain pathogenic organisms.

†Community water system: a public water system which serves at least 15 service connections used by year-round residents or regularly serves at least 25 year-round residents.

†Compliance cycle: the nine-year calendar year cycle during which public water systems must monitor. Each compliance cycle consists of three three-year compliance periods. The first calendar year cycle begins January 1, 1993 and ends December 31, 2001; the second begins January 1, 2002 and ends December 31, 2010; the third begins January 1, 2011 and ends December 31, 2019.

†Compliance period: a three-year calendar year period within a compliance cycle. Each compliance cycle has three three-year compliance periods. Within the first compliance cycle, the first compliance period runs from January 1, 1993 to December 31, 1995; the second from January 1, 1996 to December 31, 1998; the third from January 1, 1999 to December 31, 2001.

†Confluent growth: a continuous bacterial growth covering the entire filtration area of a membrane filter, or a portion thereof, in which bacterial colonies are not discrete.

†Contaminant: any physical chemical, biological, or radiological substance or matter in water.

†Conventional filtration treatment: a series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

†Corrosion inhibitor: a substance capable of reducing the corrosivity of water toward metal plumbing materials, especially lead and copper, by forming a protective film on the interior surface of those materials.

*Cross-connection: any actual or potential connection between the public water supply and a source of contamination or pollution.

†"*CT*" or "*CT*calc": the product of "residual disinfectant concentration" (C) in mg/L determined before or at the first customer, and the corresponding "disinfectant contact time" (T) in minutes, i.e., "C" x "T". If a public water system applies disinfectants at more than one point prior to the first customer, it must determine the *CT* of each disinfectant sequence before or at the first customer to determine the total percent inactivation or "total inactivation ratio." In determining the total inactivation ratio, the public water system must determine the residual disinfectant concentration of each disinfection sequence and corresponding contact time before any subsequent disinfection application point(s). "$CT_{99.9}$" is the *CT* value required for 99.9 percent (3-log) inactivation of *Giardia lamblia* cysts. $CT_{99.9}$ for a variety of disinfectants and conditions appear in Tables 1.1-1.6, 2.1, and 3.1 of §141.74(b)(3).

$$\frac{CT\text{calc}}{CT_{99.9}}$$

is the inactivation ratio. The sum of the inactivation ratios or total inactivation ratio shown as:

$$\sum \frac{CT\text{calc}}{CT_{99.9}}$$

is calculated by adding together the inactivation ratio for each disinfection sequence. A total inactivation ratio equal to or greater than 1.0 is assumed to provide a 3-log inactivation of *Giardia lamblia* cysts.

√**Curie:** a special unit of activity equal to a nuclear transformation rate of 3.7×10^{10} disintegrations/second. One picocurie is equal to 10^{-12} curies, which is approximately 2 disintegrations per minute.

D

***Detention time:** (1) The theoretical (calculated) time required for a small amount of water to pass through a tank at a given rate of flow. (2) The actual time in hours, minutes or seconds that a small amount of water is in a settling basin, flocculating basin or rapid-mix chamber. In storage reservoirs, detention time is the length of time entering water will be held before being drafted for use (several weeks to years, several months being typical).

†**Diatomaceous earth filtration:** a process resulting in substantial particulate removal in which (1) a precoat cake of diatomaceous earth filter media is deposited on a support membrane (septum), and (2) while the water is filtered by passing through the cake on the septum, additional filter media known as body feed is continuously added to the feed water to maintain the permeability of the filter cake.

†**Direct filtration:** a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal.

†**Disinfectant:** any oxidant, including but not limited to chlorine, chlorine dioxide, chloramines, and ozone added to water in any part of the treatment or distribution process, that is intended to kill or inactivate pathogenic microorganisms. [Note: Nonoxidants such as ultraviolet radiation are also used as disinfectants, although they are not specified in the *Code of Federal Regulations*.]

†**Disinfectant contact time ("T" in CT calculations):** the time in minutes that it takes for water to move from the point of disinfectant application or the previous point of disinfectant residual measurement to a point before or at the point where residual disinfectant concentration ("C") is measured. Where only one "C" is measured, "T" is the time in minutes that it takes for water to move from the point of disinfectant application to a point before or at the point where residual disinfectant concentration ("C") is measured. Where more than one "C" is measured, "T" is (a) for the first measurement of "C", the time in minutes that it takes for water to move from the first or only point of disinfectant application to a point before or at the point where the first "C" is measured and (b) for subsequent measurements of "C", the time in minutes that it takes for water to move from the previous "C" measurement point to the "C" measurement point for which the particular "T" is being calculated. Disinfectant contact time in pipelines must be calculated based on "plug flow" by dividing the internal volume of the pipe by the maximum hourly flow rate through that pipe. Disinfectant contact time within mixing basins and storage reservoirs must be determined by tracer studies or an equivalent demonstration.

†**Disinfection:** a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

†**Domestic or other non-distribution system plumbing problem:** a coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken.

†**Dose equivalent:** the product of the absorbed dose from ionizing radiation and such factors as account for differences in biological effectiveness due to the type of radiation and its distribution in the body as specified by the International Commission on Radiological Units and Measurements (ICRU).

E

†,*__Effective corrosion inhibitor residual:__ a concentration of a corrosion inhibitor sufficient to form and maintain a passivating film on the interior walls of a pipe. A passivating film forms a protective coating on the interior pipe surface that reduces its chemical activity, thereby its rate of corrosion.

√**Effective dose equivalent:** the sum of the products of the dose equivalents in individual organs and the organ weighing factor.

*__Epidemiology:__ a branch of medicine which studies epidemics (diseases which affect significant numbers of people during the same time period in the same locality). The objective of epidemiology is to determine the factors that cause epidemic diseases and how to prevent them.

*__Exemption:__ a primacy agent may temporarily relieve a public water system from a requirement associated with an MCL, treatment technique, or both, by granting an exemption if certain conditions exist. These are: (1) the system cannot comply with a MCL or treatment technique due to compelling factors which may include economic factors; (2) the system was in operation on the effective date of the MCL or treatment technique requirement; and (3) the exemption will not result in an unreasonable public health risk.

*__Extrapolation:__ estimation of unknown values by extending or projecting from known values.

F

†__Filtration:__ a process for removing particulate matter from water by passage through porous media.

*__Finished water:__ water that has passed through a water treatment plant and all the treatment processes are completed or "finished." This water is ready to be delivered to consumers. It is also called *product water.*

†__First draw sample:__ a one-liter sample of tap water, collected in accordance with §141.86(b)(2), that has been standing in plumbing pipes at least 6 hours and is collected without flushing the tap.

†__Flocculation:__ a process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means.

*__Fluoridation:__ the addition of a chemical to increase the concentration of fluoride ions in drinking water to a predetermined optimum limit to reduce the incidence (number) of dental caries (tooth decay) in children. Defluoridation is the removal of excess naturally-occurring fluoride in drinking water to prevent the mottling (brown stains) of teeth.

*__Fluorosis:__ an abnormal condition caused by excessive intake of fluorine or its compounds, characterized chiefly by mottling of the teeth.

G

*__Gastroenteritis:__ an inflammation of the stomach and intestine resulting in diarrhea, with vomiting and cramps when irritation is excessive. When caused by an infectious biological agent (i.e., a pathogen), as opposed to a chemical agent, it is often associated with fever.

*Giardia lamblia: a flagellate protozoan which is shed during its cyst stage into the feces of man and animals. When water containing these cysts is ingested, the protozoan causes a severe gastrointestinal disease called giardiasis.

*Giardiasis: an intestinal disease caused by an infestation of Giardial flagellates.

*Grab sample: a single sample collected at a particular time and place which represents the composition of the water only at that time and place.

*Groundwater: water below the land surface in a zone of saturation.

†Groundwater under the direct influence of surface water: any water beneath the surface of the ground with (1) significant occurrence of insects or other macroorganisms, algae, or large-diameter pathogens such as *Giardia lamblia*, or (2) significant and relatively rapid shifts in water characteristics such as turbidity, temperature, conductivity, or pH which closely correlate to climatological or surface water conditions. Direct influence must be determined for individual sources in accordance with criteria established by the State. The State determination of direct influence may be based on site-specific measurements of water quality and/or documentation of well construction characteristics and geology with field evaluation.

†, *Gross alpha particle (emission) activity: the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

†, *Gross beta particle activity: the total radioactivity due to beta particle emission as inferred from measurements on a dry sample.

H

†Halogen: one of the chemical elements chlorine, bromine or iodine.

*Heterotrophic plate count (HPC): the number of colonies of heterotrophic bacteria grown on selected solid media at a given temperature and incubation period, usually expressed in number of bacteria per milliliter of sample.

*Heterotrophic bacteria: any bacteria which use organic compounds to obtain energy or as a source of carbon.

I

*Infiltration gallery: a subsurface groundwater collection system, typically shallow in depth, constructed with open-jointed or perforated pipes that discharge collected water into a watertight chamber. From this chamber, the water is pumped to treatment facilities and into the distribution system. Infiltration galleries are usually located close to streams or ponds and may be under the direct influence of surface water.

†**Initial compliance period:** the first full three-year compliance period which begins at least 18 months after [rule] promulgation, except for contaminants listed at §141.61(a)(19)–(21), (c)(19)–(33), and §141.62(b)(11)–(15), initial compliance period means the first full three-year compliance period after promulgation for systems with 150 or more service connections (January 1993–December 1995), and first full three-year compliance period after the effective date of the regulation (January 1996–December 1998) for systems having fewer than 150 service connections.

*__Interstate carrier:__ any vehicle or transport which conveys passengers in interstate commerce (i.e., a commercial train or aircraft).

L

†__Large water system:__ a water system that serves more than 50,000 persons.

†__Lead service line:__ a service line made of lead which connects the water main to the building inlet and any lead pigtail, gooseneck or other fitting which is connected to such lead line.

†*Legionella:* a genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires Disease.

*__Lifetime exposure:__ the total amount of exposure to a substance that a human would receive in a lifetime (usually assumed to be 70 years).

M

†,√__Man-made beta particle and photon emitters:__ all radionuclides emitting beta particles and/or photons listed in Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure, NBS Handbook 69, except the daughter products of thorium-232, uranium-235 and uranium-238.

†__Maximum contaminant level:__ the maximum permissible level of a contaminant in water which is delivered to any user of a public water system.

†__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 of persons would occur, and which allows an adequate margin of safety. Maximum contaminant level goals are nonenforceable health goals.

†__Maximum Total Trihalomethane Potential (MTP):__ the maximum concentration of total trihalomethanes produced in a given water containing a disinfectant residual after 7 days at a temperature of 25°C or above.

†__Medium-size water system:__ a water system that serves greater than 3,300 and less than or equal to 50,000 persons.

*__Mutagen:__ an agent capable of causing an inheritable change in the genetic material of a cell.

N

√**Natural uranium:** uranium with combined uranium-234 plus uranium-235 plus uranium-238 which has a varying isotopic composition but typically is 0.006% uranium-234, 0.7% uranium-235, and 99.27% uranium-238.

†**Near the first service connection:** at one of the 20 percent of all service connections in the entire system that are nearest the water supply treatment facility, as measured by water transport time within the distribution system.

†**Non-community water system:** a public water system that is not a community water system.

†**Non-transient non-community water system or (NTNCWS):** a public water system that is not a community water system and that regularly serves at least 25 of the same persons over 6 months per year.

O

*__Operation and maintenance costs:__ the ongoing, repetitive costs associated with the continual operation of a water system; for example, employee wages and costs for treatment chemicals and periodic equipment repairs. (The total costs of owning and operating a water system consist of both capital and operation and maintenance costs.)

†**Optimal corrosion control treatment:** the corrosion control treatment that minimizes the lead and copper concentrations at users' taps while ensuring that the treatment does not cause the water system to violate any national primary drinking water regulations.

√**Organ weighting factor:** the ratio of the stochastic risk for that organ to the total risk when the whole body is irradiated uniformly.

P

†**Performance evaluation sample:** a reference sample provided to a laboratory for the purpose of demonstrating that the laboratory can successfully analyze the sample within limits of performance specified by the Agency [EPA]. The true value of the concentration of the reference material is unknown to the laboratory at the time of the analysis.

*__Person:__ an individual; corporation; company; association; partnership; municipality; or State, Federal, or tribal agency.

*__pH:__ an expression of the intensity of the basic or acid condition of a liquid. Mathematically, pH is the logarithm (base 10) of the reciprocal of the hydrogen ion concentration.

$$pH = \text{Log } 1/[H+]$$

The pH may range from 0 to 14, where 0 is most acidic, 14 most basic, and 7 neutral. Natural waters usually have a pH between 6.5 and 8.5.

†**Picocurie (pCi):** the quantity of radioactive material producing 2.22 nuclear transformations per minute.

†**Point of disinfectant application:** the point where the disinfectant is applied and water downstream of that point is not subject to recontamination by surface water runoff.

†**Point-of-entry treatment device:** a treatment device applied to the drinking water entering a house or building for the purpose of reducing contaminants in the drinking water distributed throughout the house or building.

†**Point-of-use treatment device:** a treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.

***Primacy:** the responsibility for ensuring that a law is implemented, and the authority to enforce a law and related regulations. A primacy agency has the primary responsibility for administrating and enforcing regulations.

†**Public water system:** a system for the provision to the public of piped water for human consumption, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year. Such term includes (1) any collection, treatment, storage, and distribution facilities under control of the operator of such system and used primarily in connection with such system, and (2) any collection or pretreatment storage facilities not under such control which are used primarily in connection with such system. A public water system is either a "community water system" or a "noncommunity water system."

R

***Radionuclide:** any man-made or natural element with an unstable nucleus which emits radiation in the form of alpha or beta particles, or as gamma rays.

†,√**Rem:** the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. It is equal to the absorbed dose in rads multiplied by a quality factor (to account for different radiation types). A rem ede (effective dose equivalent) is a dose to organs adjusted for different radiation types and by an organ weighting factor to account for organ sensitivity to the effect of radiation. A "millirem (mrem)" is 1/1000 of a rem.

†**Repeat compliance period:** any subsequent compliance period after the initial compliance period.

†**Residual disinfectant concentration ("C" in CT calculations):** the concentration of disinfectant measured in mg/L in a representative sample of water.

***Risk assessment:** a qualitative or quantitative evaluation of the environmental and/or health risk resulting from exposure to

a chemical or physical agent (pollutant); combines exposure assessment results with toxicity assessment results to estimate risk.

*Risk management: decisions about whether an assessed risk is sufficiently high to present a public health concern and about the appropriate means for control of a risk judged to be significant.

S

†Sanitary survey: an onsite review of the water source, facilities, equipment, operation and maintenance of a public water system for the purpose of evaluating the adequacy of such source, facilities, equipment, operation and maintenance for producing and distributing safe drinking water.

†Sedimentation: a process for removal of solids before filtration by gravity or separation.

†Service line sample: a one-liter sample of water collected in accordance with §141.86(b)(3), that has been standing for at least 6 hours in a service line.

√Sievert (Sv): the unit of dose equivalent in the international system of units (SI) from ionizing radiation to the total body or any internal organ or organ system. One Sievert equals 100 rems.

†Single family structure: a building constructed as a single-family residence that is currently used as either a residence or a place of business.

†Slow sand filtration: a process involving passage of raw water through a bed of sand at low velocity (generally less than 0.4 m/h) resulting in substantial particulate removal by physical and biological mechanisms.

†Small water system: a water system that serves 3,300 persons or fewer.

*Sole source aquifer: an aquifer that supplies 50 percent or more of the drinking water for a given area.

†Standard sample: the aliquot of finished drinking water that is examined for the presence of coliform bacteria.

†State: the agency of the State or Tribal government which has jurisdiction over public water systems. During any period when a State or Tribal government does not have primary enforcement responsibility pursuant to Section 1413 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

†Supplier of water: any person who owns or operates a public water system.

†Surface water: all water which is open to the atmosphere and subject to surface runoff.

†**System with a single service connection:** a system which supplies drinking water to consumers via a single service line.

T

†**Too numerous to count:** that the total number of bacterial colonies exceeds 200 on a 47-mm diameter membrane filter used for coliform detection.

†**Total trihalomethanes (TTHM):** the sum of the concentration in milligrams per liter of the trihalomethane compounds (trichlor-omethane [chloroform], dibromo-chloromethane, bromodichloro-methane and tribromo-methane [bromoform]) rounded to two significant figures.

*__Transient non-community water system (TWS):__ a non-community water system that does not regularly serve at least 25 of the same persons over six months per year.

†**Trihalomethane (THM):** one of the family of organic compounds, named as derivatives of methane, wherein three of the four hydrogen atoms in methane are each substituted by a halogen atom in the molecular structure.

U

*__User fee:__ a fee which is collected only from those persons who use a particular service, as opposed to one collected from the public in general. User fees generally vary in proportion to the degree of use of the service. A monthly water bill issued to system customers is a type of user fee and can vary with the amount of water used by the customer.

V

*__Variance:__ when a public water system cannot meet a requirement associated with an MCL, the primacy agent may temporarily relieve a public water system from a requirement by granting a variance if certain conditions exist. These are: (1) the supplier cannot meet the MCL in spite of the application of best available treatment technology, treatment techniques or other means (taking costs into consideration), due to the characteristics of the raw water sources which are reasonably available to the system, and (2) the variance will not result in an unreasonable public health risk.

†**Virus:** a virus of fecal origin which is infectious to humans by waterborne transmission.

W

†**Waterborne disease outbreak:** the significant occurrence of acute infectious illness epidemiologically associated with the ingestion of water from a public water system which is deficient in treatment as determined by the appropriate local or State agency.

*Water cooler: any mechanical device (e.g., a drinking water fountain) affixed to drinking water supply plumbing which actively cools water for human consumption. The reservoir can consist of a small tank or a pipe coil.

*Watershed: an area of land that contributes runoff to one specific delivery point. Large watersheds may be composed of several smaller "subsheds," each of which contributes runoff to different locations that ultimately combine at a common delivery point.

Key to Codes:

†These terms are contained in Sections 141.2, 142.2, and 143.2 of the *Code of Federal Regulations.*

√These terms are discussed in EPA's proposed National Primary Drinking Water Regulations for Radionuclides, *Federal Register,* Vol. 56, No. 138, July 18, 1991, pages 33118–33119.

*These terms have been derived from a variety of sources, including:

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