WEST VIRGINIA
SECRETARY OF STATE
KEN HECHLER
ADMINISTRATIVE LAW DIVISION

Form #1

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NOTICE OF PUBLIC HEARING ON A PROPOSED RULE

AGENCY: Board of Health TITLE NUMBER: 64

RULE TYPE: Legislative ; CITE AUTHORITY §16-1-7

AMENDMENT TO AN EXISTING RULE: YES X NO ___

IF YES, SERIES NUMBER OF RULE BEING AMENDED: 3

TITLE OF RULE BEING AMENDED: Public Water Supply Regulations

IF NO, SERIES NUMBER OF NEW RULE BEING PROPOSED: ___

TITLE OF RULE BEING PROPOSED: ___

DATE OF PUBLIC HEARING: May 29, 1990 TIME: 10:00 a.m.

LOCATION OF PUBLIC HEARING:
Room 522
Building #3 (Motor Vehicles Building)
Capitol Complex
Charleston, WV 25305

COMMENTS LIMITED TO: ORAL ___, WRITTEN X, BOTH ___

COMMENTS MAY ALSO BE MAILED TO THE FOLLOWING ADDRESS:
Regulatory Development Section
Dept. of Health & Human Resources
Room 204, Building 3
Capitol Complex
Charleston, WV25305

The Department requests that persons wishing to make comments at the hearing make an effort to submit written comments in order to facilitate the review of these comments.

The issues to be heard shall be limited to the proposed rule.

ATTACH A **BRIEF** SUMMARY OF YOUR PROPOSAL

Taunja Willis Miller, Secretary
Dept. of Health & Human Resources

STATE OF WEST VIRGINIA
DEPARTMENT OF HEALTH AND HUMAN RESOURCES
Building 3, Capitol Complex
Charleston, WV 25305

Gaston Caperton
Governor

April 20, 1990

The Honorable Ken Hechler
Secretary of State
State of West Virginia
State Capitol Building
Charleston, WV 25305

Dear Secretary Hechler:

The Public Water Supply Regulations rule is hereby approved for filing for public hearing and for emergency filing.

Sincerely,

Taunja Willis Miller, Secretary
Department of Health and
Human Resources

TWM/jpg

WEST VIRGINIA BOARD OF HEALTH
RULE ABSTRACT

Title: Public Water Supply Regulations Type: Legislative

CSR Title and Series: 64 CSR 3

Summary: This rule supersedes and amends the existing Public Water Supply Regulations. It includes existing requirements unique to West Virginia, but the body of the rule consists of 40 CFR Part 141, the National Primary Drinking Water Regulations, established by the federal government as the nationwide minimum requirements. This federal regulation is incorporated by reference due to recent amendments which increase both rule length and complexity.

For further information contact: Regulatory Development Section, telephone 348-3223 or Robert Paul, Office of Environmental Health, Telephone 348-2981, Division of Health, Building 3, Capitol Complex, Charleston, WV 25305.

FISCAL NOTE FOR PROPOSED RULES

Rule Title: Public Water Supply Regulations

Type of Rule: X Legislative ____ Interpretive ____ Procedural

Agency Health & Human Resources Address Capitol Complex Bldg #3, Rm 550

Charleston, WV 25305

1. Effect of Proposed Rule	ANNUAL Increase	ANNUAL Decrease	FISCAL YEAR Current	FISCAL YEAR Next	FISCAL YEAR Thereafter
Estimated Total Cost	$	$	$	$ 50,000	$ 50,000
Personal Services				45,000	45,000
Current Expense					
Repairs and Alterations					
Equipment				5,000	5,000
Other					

2. Explanation of above estimates.

It is estimated that two additional clerical personnel will be required, along with an additional personal computer, to handle the increased data management responsibilities specified by the new federal requirements.

3. Objectives of these rules:

These rules amend the existing Public Water Supply Regulations by adopting all federal primacy drinking water regulations applicable at this time. Sections which will be added include new microbiological contaminant sampling requirements, surface water treatment requirements, and public notification requirements. All remaining sections are in substance identical to existing State rules.

4. Explanation of Overall Economic Impact of Proposed Rule.

A. Economic Impact on State Government.

None; other than that noted on previous page. Failure to promulgate rule will result in loss of existing Public Water Supply Program receiving approximately $400,000 in federal funding annually.

B. Economic Impact on Political Subdivisions; Specific Industries; Specific groups of citizens.

Certain public water treatment plants may be required to upgrade facilities to meet the new federal treatment requirements. Availability of water treated to current national standard may encourage location of new businesses in West Virginia.

C. Economic Impact on Citizens/Public at Large.

Negligible for public at large. Systems required to upgrade facilities may increase rates to customers. Possible improved economic outlook in those areas in which water systems are upgraded.

Date April 10, 1990

Signature of Agency Head or Authorized Representative

Taunja Willis Miller, Secretary
Department of Health and
Human Resources

[PROPOSED]

TITLE 64

WEST VIRGINIA LEGISLATIVE RULES

BOARD OF HEALTH
PUBLIC WATER SUPPLY REGULATIONS

SERIES 3

1990

For Public Hearing
May 29, 1990

[PROPOSED]
WEST VIRGINIA LEGISLATIVE RULES
BOARD OF HEALTH

PUBLIC WATER SUPPLY REGULATIONS

64 CSR 3

INDEX

[PROPOSED]
TITLE 64
WEST VIRGINIA LEGISLATIVE RULES
BOARD OF HEALTH

SERIES 3
PUBLIC WATER SUPPLY REGULATIONS

§64-3-1. General

1.1. **Scope** - This legislative rule establishes the rules and regulations governing owners and operators of public water systems, and the production and distribution of bottled drinking water.

1.2. **Authority** - W.Va. Code 16-1-7.

1.3. **Filing Date** -

1.4. **Effective Date** -

1.5. **Public Hearing** - May 29, 1990

1.6. **Final Approval** - This rule was approved by the State Board of Health on ________________.

1.7. **Supersession or Repeal of Former Regulations** - This rule supersedes and repeals West Virginia Board of Health Legislative Rule **Public Water Supply Regulations**, 64 CSR 3, 1982; **Volatile Synthetic Organic Chemicals**, 64 CSR 61, 1989; and **Plumbing Requirements**, 64 CSR 57, 1989.

§64-3-2. Application And Enforcement

2.1. **Application** - This rule applies to owners and operators of public drinking water systems, and the production and distribution of bottled drinking water.

2.2. **Enforcement** - Enforcement of this rule is vested with the director of the division of health or his lawful designee.

§64-3-3. Definitions

3.1. **Bottled Water** - Any natural or artificial mineral, spring, well, distilled or other water bottled or containerized for use primarily as drinking water.

3.2. **Director** - Director of the division of health or his or her designee. For the purposes of this rule, the term "state" (as used in 40 CFR Parts 141, **National Primary Drinking Water Regulations, and 143, National Secondary Drinking Water Regulations**) shall mean "director."

3.3. **Operator** - A person who has been granted a certificate issued by the director to operate a specific class of public water supply.

3.4. **Permit** - A written document issued by the director giving a designated person permission to construct and/or operate, alter, or renovate a specific public water supply or system, or bottled water plant.

3.5. **Person** - Individual, partnership, association, syndicate, company, firm, trust, corporation, government corporation, institution, department, division, bureau, agency, federal agency or any other entity recognized by law.

3.6. **Public Water System** - Any water system or supply which regularly supplies or offers to supply, piped water to the public for human consumption, if serving at least an average of twenty-five individuals per day for at least sixty days per year, or which has at least fifteen service connections and shall include:

(1) Any collection, treatment, storage, and distribution facilities under the control of the owner or 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 shall not include a system which meets all of the following conditions:

(1) which consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(2) which obtains all of its water from, but is not owned or operated by a public water system which otherwise meets the definition;

(3) which does not sell water to any person;

(4) which is not a carrier conveying passengers in interstate commerce.

3.7. **State** - Director of the division of health or his or her designee.

§64-3-4. Permit To Construct

4.1. On and after the effective dates of these regulations, no person shall construct, or award a contract for any construction, except as provided for in Section 4.4, to a public water system, without obtaining a permit to construct from the director.

4.2. No person shall begin construction, alter or renovate a public water system without first submitting plans and specifications to the director for review and approval at least forty-five days prior to the date on which approval by the director is desired. The public water system shall be constructed, altered or renovated in accordance with the plans and specifications as approved by the director, and in accordance with the **West Virginia Department of Health Bulletin EW-99 Design Standards for Public Water Supply Systems"**. To the extent practicable, all new or expanded facilities should be located outside of the one hundred year flood plain.

4.3. Application for permit to construct shall be made to the director on forms prescribed by the director and shall be accompanied by an engineering report, maps, detailed plans and specifications of the public water system prepared by or under the direction of a registered professional engineer.

4.4. A permit to construct will not be required for any minor addition to, extension of, or alteration of an existing distribution system which will not affect the quality or quantity of water supply service rendered, providing the work is done in accordance with the provisions of the **West Virginia Department of Health Bulletin EW-99, Design Standards for Public Water Supply Systems.**

4.5. The director shall have the authority to issue an order requiring a change in the source of the water supply or in the manner of collection, treatment, storage, or distribution facilities of the supply before delivery to the consumer as may be necessary to safeguard the public health.

4.6. A permit to construct may be revoked by the director for failure to comply with the provisions of the permit or all applicable provisions of this rule.

4.7. A permit to construct, unless revoked, shall be valid for a period of two years from date of issuance.

S64-3-5. Permit To Operate

5.1. Application for a permit to operate a water system shall be made to the director at least thirty days before the scheduled operation of the public water system. Application shall be on forms prescribed by the director, and signed by the applicant or his authorized representative.

5.2. No person directly or indirectly shall manage, operate or maintain a public water system in the State of West Virginia without first making an application to, and receiving from the director, a permit to operate.

5.3. In the event of an intended change, or an actual change in ownership of a public water system, a written application for a permit to operate shall be made to the director by the current owner at least fifteen days before the proposed or actual change.

5.4. A permit to operate shall be posted in a conspicuous place at the public water system's treatment plant or main office.

§64-3-6. Inspections

6.1. Each community water system utilizing surface source water shall be inspected by the director at least once per year. Other public water systems shall be inspected as scheduled by the director.

6.2. The operator of the public water system shall, upon the request of the director, permit access to all parts of the system and shall furnish all information and records required to be kept by Section 8 of this rule.

§64-3-7. Chlorination Requirements

7.1. Disinfection with chlorine shall be required of all public water systems, unless otherwise approved in writing by the director.

7.2. Chlorine or any other approved disinfectant shall be applied at a point before entering the distribution system which will provide effective contact time; the minimum contact time shall be thirty minutes to the first consumer, unless otherwise stipulated in writing by the director or the Design Standards for Public Water Supply Systems, Bulletin EW-99. At the end of the contact time, the minimum free chlorine residuals at the various pH values, shall comply with the requirements of Table 64-3A at the end of this rule unless otherwise stipulated in writing by the director.

7.3. The owner or operator of a public water system shall determine the amount of residual disinfectant in the drinking water at the treatment plant and in the distribution system at least once per day, or more often if deemed necessary by the director.

7.4. Chlorine residual testing equipment shall enable measurement of free and total residuals to the nearest 0.2 mg/l in the range of 0.0 mg/l to 2.0 mg/l.

7.5. At least a trace of total chlorine residual shall be maintained throughout the distribution system at all times, unless otherwise approved in writing by the director.

§64-3-8. Control Tests and Record Maintenance

8.1. Owners or operators of a public water system shall retain at a convenient location on or near its premises, records of microbiological, turbidity, radiological and chemical analyses, or a summary thereof. Microbiological, turbidity and radiological analytical records shall be kept for ten years. Control tests and operational records shall be kept for five years.

8.2. The records shall include the date, place and time of sampling, name of the person who collected the sample; identification as to whether it was a routine distribution system sample, resample, raw or drinking water sample, or other special purpose sample; the date of analysis; laboratory and person responsible for performing the analysis; analytical technique or method used; and results of analysis.

8.3. Records of action taken by the system to correct violations shall be kept for three years after correction.

8.4. Copies of written reports relating to sanitary surveys of the system shall be kept for ten years.

8.5. Records concerning a variance or exemption shall be kept for not less than five years following the expiration of such variance or exemption.

§64-3-9. Fluoridation

9.1. This section applies to public water systems (except public schools) which add fluoride to the drinking water. The director shall establish policy and criteria for water fluoridation at public schools.

9.2. The presence of fluoride in average concentrations shall be as found in Table 64-3A at the end of this rule.

9.3. System owners or operators of fluoridated or defluoridated public water supplies shall monitor their drinking water once per day for fluoride concentration. Records for monitoring shall be maintained in accordance with Section 8.

9.4. At least once a month, a sample of drinking water shall be submitted to a certified laboratory for fluoride analysis.

§64-3-10. Bottled Water

10.1. No person shall manage, operate or maintain a bottled water treatment plant, or distribute bottled water in this state without receiving a permit from the director.

10.2. The procedure for applying for a permit shall be in accordance with Sections 4 and 5 of this rule and the current **Bottled Water Design Standards of the State Department of Health.**

10.3. In addition to Section 10.2, operators of out-of-state bottled water treatment plants who are distributing water in West Virginia, shall include with their application, a copy of their most recent permit to operate from their state regulatory agency.

10.4. Source waters, plant facilities, treatment techniques, equipment supplies, operations, and distribution methods shall be approved by the director and must be in accordance with the **State Health Department's Design Standards for Public Water Supply Systems and Bottled Water Design Standards.**

10.5. Bottled water treatment plants shall comply with all requirements of this rule pertaining to primary and secondary contaminants, sodium, fluoridation, maximum contaminant levels, sampling techniques and monitoring frequencies as for a community water system except that the monitoring frequency for microbiological contaminants shall be not less than once each week.

10.6. Each in-state bottled water treatment plant shall be inspected every six months or as otherwise determined by the director.

10.7. A permit issued by the director may be revoked for failure to comply with provisions of this rule.

§64-3-11. Adoption of National Drinking Water Regulations - 40 CFR Part 141, National Primary Drinking Water Regulations and 40 CFR Part 143, National Secondary Drinking Water Regulation are adopted by reference.

Copies of these regulations are available from:

U.S. Environmental Protection Agency
Region III
841 Chestnut Building
Philadelphia, PA 19106

§64-3-12. Penalties - Any person who violates any provision of this rule or orders issued hereunder, shall be guilty of a misdemeanor, and upon conviction thereof, shall be fined not less than twenty-five dollars nor more than two hundred dollars and each day's violation shall constitute a separate offense. In addition, thereto, the director of health or his or her authorized representative may seek injunctive relief in the circuit court of the county in which all or part of the public water system is situated for threatened or continuing violations. For a willful violation of this rule or orders issued hereunder, a person, upon a finding thereof by the circuit court of the county in which the violation occurs, shall be subject to a civil penalty of not more than five thousand dollars, and each day's violation shall be grounds for a separate penalty.

§64-3-13. Administrative Due Process - Those persons adversely affected by the enforcement of this rule desiring a contested case hearing to determine any rights, duties, interests or privileges shall do so in a manner prescribed in the **Rules of Procedure for Contested Case Hearings and Declaratory Rulings,** 64 CSR 1.

§64-3-14. Severability - The provisions of this rule are declared to be severable. If any provision of this rule shall be held invalid, the remaining provisions shall remain in effect.

TABLE 64-3A

pH VALUE	FREE CHLORINE RESIDUAL
up to 7.0	0.4 mg/l
7.1 to 8.0	0.6 mg/l
8.1 to 9.0	1.0 mg/l

TABLE 64-3B

ANNUAL AVG of MAXIMUM DAILY AIR TEMPERATURE	FLUORIDE CONCENTRATION IN MILLIGRAMS PER LITER		
	Lower	Optimum	Upper
53.8 - 58.3^oF 12.1 - 14.6^oC	0.8	1.1	1.5
58.4 - 63.8^oF 14.7 - 17.7^oC	0.8	1.0	1.3
63.9 - 70.6^oF 17.7 - 21.4^oC	0.7	0.9	1.2

PART 143 -- NATIONAL SECONDARY DRINKING WATER REGULATIONS

Authority: 42 U.S.C. 300f et seq.

Source: 44 FR 42198, July 19, 1979 unless otherwise noted.

143.1 PURPOSE

This part establishes National Secondary Drinking Water Regulations pursuant to Section 1412 of the Safe Drinking Water Act, as amended (42 U.S.C. 300g-1). These regulations control contaminants in drinking water that primarily affect the aesthetic qualities relating to the public acceptance of drinking water. At considerably higher concentrations of these contaminants, health implications may also exist as well as aesthetic degradation. The regulations are not federally enforceable but are intended as guidelines for the States.

143.2 DEFINITIONS

"Act" means the Safe Drinking Water Act as amended (42 U.S.C. 300f et seq.)

"Contaminant" means any physical, chemical, biological, or radiological substance or matter in water.

"Public water system" means a system for the provision to the public of piped water for human consumption, if such a system has at least fifteen (15) service connections or regularly serves an average of at least twenty-five (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 pre-treatment 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 non-community water system."

"State" means the agency of the State or Tribal government which has jurisdiction over public water systems. During any period when a State does not have responsibility pursuant to section 1443 of the Act, the term "State" means the Regional Administrator, U.S. Environmental Protection Agency.

"Supplier of water" means any person who owns or operates a public water system.

"Secondary maximum contaminant levels" means SMCLs which apply to public water systems and which, in the judgement of the Administrator, are requisite to protect the public welfare. The SMCL means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of public water system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

143.3 SECONDARY MAXIMUM CONTAMINANT LEVELS

The secondary maximum contaminant levels for public water systems are are follows:

CONTAMINANT	LEVEL
Chloride	250 mg/l
Color	15 color units
Copper	1 mg/l
Corrosivity	Noncorrosive
Fluoride	2.0 mg/l
Foaming agents	0.5 mg/l

Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 threshold odor number
pH	6.5 - 8.5
Sulfate	250 mg/l
Total Dissolved Solids (TDS)	500 mg/l
Zinc	5 mg/l

These levels represent reasonable goals for drinking water quality. The states may establish higher or lower levels which may be appropriate dependent upon local conditions such as unavailability of alternate source waters or other compelling factors, provided that public health and welfare are not adversely affected.

[44 FR 42198, July 19, 1979, as amended at 51 FR 11412, April 2, 1986]

143.4 MONITORING

(a) It is recommended that the parameters in these regulations should be monitored at intervals no less frequent than the monitoring performed for inorganic chemical contaminants listed in the National Interim Primary Drinking Water Regulations as applicable to community water system. More frequent monitoring would be appropriate for specific parameters such as pH, color, odor or others under certain circumstances as directed by the state.

(b) Analyses conducted to determine compliance with 143.3 should be made in accordance with the following methods:

(1) Chloride -- Potentiometric Method, "Standard Methods for the Examination of Water and Wastewater," 14th Editioin, p. 306

(2) Color -- Platinum-Cobalt Method, "Methods for Chemical Analysis of Water and Wastes," p.36-38, EPA Office of Technology Transfer, Washington,DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp 160-62; 14th Edition, pp 64-66.

(3) Copper -- Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp 108-09, EPA Office of Technology Transfer, Washington, DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp 210-15; 14th Edition, pp 144-47; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma - Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes -- Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268

(4) Foaming Agents -- Methylene Blue Method, "Methods for Chemical Analysis of Water and Wastes," pp 157-58, EPA Office of Technology Transfer, Washington, DC 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater, 13th Edition, pp 339-42; 14th Edition, p 600.

(5) Iron -- Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp 110-11, EPA Office of Technology Transfer, Washington, DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater, 13th Edition pp 210-15; 14th Edition, pp 144-47; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes - Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(6) Manganese -- Atomic Absorption Method, "Methods for Chemical Analysis of Water and Wastes," pp 116-17, EPA Office of Technology Transfer, Washington, DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp 210-15; 14th Edition, pp 144-47; or Inductively Coupled Plasma Method, "Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of Water and Wastes - Method 200.7" available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

(7) Odor -- Consistent Series Method, "Methods for Chemical Analysis of Water and Wastes pp 287-94, EPA Office of Technology Transfer, Washington, DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater, 13th Edition, pp 248-54; 14th Edition, p 75-82.

(8) pH -- Glass Electrode Mehtod. "Methods for Chemical Analysis of Water and Wastes, pp 239-40. EPA Office of Technology Transfer. Washington DC 20460. 1974, or "Standard Methods for the Examination of Water and Wastewater, 13th Edition. pp 276-81; 14th Edition, pp 460-65.

(9) Sulfate -- Turbidimetric Method, "Methods for Chemical Analysis of Water and Wastes, pp 277-78. EPA Office of Technology Transfer, Washington DC 20460, 1974; or "Standard Methods for the Examination of Water and Wastewater," 13th Edition, pp 334-35; 14th Edition, pp 496-98.

(10) Total Dissolved Solids -- Total Residue Methods, "Methods for Chemical Analysis of Water and Wastes, pp 270-71. EPA Office of Technology Transfer, Washington DC 20460. 1974. or "Standard Methods for the Examination of Water and Wastewater," 13th Edition. pp 288-90; 14th Edition. p 91-92.

(11) Zinc -- Atomic Absorption Method. "Methods for Chemical Analysis of WAter and Wastes," pp 155-56. EPA Office of Technology Transfer. Washington DC 20460, 1974 or "Standard Methods for the Examination of Water and Wastewater," 13th Edition. pp 210-15; 14th Edition pp 144-47; or Inductdively Coupled Plasma Method. "Inductively Coupled Plasma-Atomic Emission Spectrometric Method for Trace Element Analysis of WAter and Wastes - Method 200.7," available from EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

[44FR 42198, July 19, 1979, as amended at 53 FR 5147. February 19, 1988]

143.5 COMPLIANCE WITH SECONDARY MAXIMUM CONTAMINANT LEVEL AND PUBLIC NOTIFICATION FOR FLUORIDE

(a) Community water systems as defined in 40 CFR 141.2(e)(i) of this title, that exceed the secondary maximum contaminant level for fluoride as determined by the last single sample taken in accordance with the requirements of 141.23 of this title or any equivalent state law, but do not exceed the maximum contaminant level for fluoride as specified by 141.62 of this title or any equivalent state law, shall provide the notice described in paragraph (b) of all billing units annually, all new billing units at the time service begins and the state public health officer.

(b) The notice required by paragraph (a) shall contain the following language including the language necessary to replace the superscripts:

PUBLIC NOTICE

Dear User:
The U.S. Environmental Protection Agency requires that we send you this notice on the level of fluoride in your drinking water. The drinking water in you community has a fluoride concentration of * milligrams per liter (mg/l).

Federal regulations require that fluoride, which occurs naturally in your water supply, not exceed a concentration of 4.0 mg/l in drinking water. This is an enforceable standard called a Maximum Contaminant Level (MCL) and it has been established to protect the public health. Exposure to drinking water levels above the 4.0 mg/l for many years may result in some cases of crippling skeletal fluorosis, which is a serious bone disorder.

Federal law also requires that we notify you when monitoring indicates that the fluoride in your drinking water exceeds 2.0 mg/l. This is intended to alert families about dental problems that might affect children under nine years of age. The fluoride concentration of your water exceeds this federal guideline.

Fluoride in children's drinking water at levels of approximately 1 mg/l reduces the number of dental cavities. However, some children exposed to levels of fluoride greater than about 2.0 mg/l may develop dental fluorosis. Dental fluorosis, in its moderate and severe forms, is a brown staining and/or pitting of the permanent teeth.

Becuase dental fluorosis occurs when developing teeth (before they erupt from the gums) are exposed to elevated fluoride levels, households without children are not expected to be affected by this level of fluoride. Families with children under the age of nine are encouraged to seek other sources of drinking water for their children to avoid the possibility of staining and pitting.

Your water supplier can lower the concentration of fluoride in your water so that you will still receive the benefits of cavity prevention while the possibility of stained and pitted teeth is minimized Removal of fluoride may increase your water costs. Treatment systems are also commercially available for home use. Information on such systems is available at the address given below. Low fluoride bottled drinking water that would meet all standards is also commercially available.

For further information, contact ** at your water system.

* PWS shall insert the compliance result which triggered notification under this Part.

** PWS shall insert the name, address and telephone number of a contact person at the PWS.

(c) The effective date of this section is May 2. 1986.

[51 FR 11412, April 2, 1986; 51 FR 24329, July 3, 1986, as amended at 52 FR 41550, October 28. 1987.]

PART 141 - NATIONAL PRIMARY DRINKING WATER REGULATIONS

Subpart A - General

Subpart B -- Maximum Contaminant Levels

Subpart C -- Monitoring and Analytical Requirements

part D - Reporting, Public Notification and Recordkeeping

Subpart E - Special Regulations, Including Monitority Regulations and Prohibition on Lead Use

Subpart F - Maximum Contaminant Level Goals

Subpart G - National Revised Primary Drinking Water Regulations: Maximum Contamination Levels

Subpart J - Use of Non-Centralized Treatment Devices

AUTHORITY: 42 U.S.C. §§300f, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5. 300g-6, 300j-4, and 300j-9.

SOURCE: 40 FR 59570, Dec. 24, 1975, unless otherwise noted.

NOTE: For community water systems serving 75,000 or more persons, monitoring must begin 1 year following promulation and the effective date of the MCL is 2 years following promulgation. For community water systems serving 10,000 to 75,000 persons, monitoring must begin within 3 years from the date of promulgation and the effective date of the MCL is 4 years from the date of promulgation. Effective immediately, systems that plan to make significant modifications to their treatment processes for the purpose of complying with the TTHM MCL are required to seek and obtain State approval of their treatment modification plans. This note affects §§141.2, 141.6, 141.12, 141.24 and 141.30. For additional information see 44 FR 68641, Nov. 29, 1979.

Subpart A -- General

§141.1 Applicability.

This part establishes primary drinking water regulations pursuant to section 1412 of the Public Health Service Act, as amended by the Safe Drinking Water Act (Pub. L. 93-523); and related regulations applicable to public water systems.

§141.2 DEFINITIONS.

As used in this part, the term:

"Act" means the Public Health Service Act, as amended by the Safe Drinking Water Act, Pub. L. 93-523.

"Best available technology" or "BAT" means 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.

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

"Community water system" means 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.

"Confluent growth" means 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 means any physical, chemical, biological, or radiological substance or matter in water.

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

"CT" or "CTcalc" is 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). "$\text{CT}_{99.9}$" is the CT value required for 99.9 percent (3-log) inactivation of Giardia lamblia cysts. $\text{CT}_{99.9}$ for a variety of disinfectants and conditions appear in Tables 1.1-1.6, CTcalc 2.1, and 3.1 of §141.74(b)(3). $\text{CT}_{99.9}$ is the inactivation ratio. The sum of the inactivation ratios, or total inactivation (CTcalc) ratio shown as($\text{CT}_{99.9}$), 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.

"Diatomaceous earth filtration" means 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" means a series of processes including coagulation and filtration but excluding sedimentation resulting in substantial particulate removal.

"Disinfectant" means 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.

"Disinfectant contact time" ("T" in CT calculations) means 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" means a process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

"Domestic or other non-distribution system plumbing problem" means 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" means 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).

"Filtration" means a process for removing particulate matter from water by passage through porous media.

"Flocculation" means 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.

"Gross alpha particle activity" means the total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

"Gross beta particle activity" means the total radioactivity due to beta particle emission as inferred from measurements on a dry sample. "Halogen" means one of the chemical elements chlorine, bromine or iodine.

"Ground water under the direct influence of surface water" means any water beneath the surface of the ground with (1) 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.

"Legionella" means a genus of bacteria, some species of which have caused a type of pneumonia called Legionnaires Disease.

"Man-made beta particle and photon emitters" means 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" means the maximum permissible level of a contaminant in water which is delivered to the free flowing outlet of the ultimate user of a public water system, except in the case of turbidity where the maximum permissible level is measured at the point of entry to the distribution system. Contaminants added to the water under circumstances controlled by the user, except those resulting from corrosion of piping and plumbing caused by water quality, are excluded from this definition.

"Maximum contaminant level goal" or "MCLG" means 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)" means 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.

"Near the first service connection" means 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" means a public water system that is not a community water system.

"Non-transient non-community water system" or "NTNCWS" means 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.

"Performance evaluation sample" means 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. The true value of the concentration of the reference material is unknown to the laboratory at the time of the analysis.

"Person" means an individual, corporation, company, association, partnership, State, municipality, or Federal agency.

"Picocurie (pCi)" means the quantity of radioactive material producing 2.22 nuclear transformations per minute.

"Point of disinfectant application" is 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'' is 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" is a treatment device applied to a single tap used for the purpose of reducing contaminants in drinking water at that one tap.

"Public water system" means a system for the provision to the public of piped water for human consumption, if such system has at least fifteen service connections or regularly serves an average of at least twenty-five 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".

"Rem" means the unit of dose equivalent from ionizing radiation to the total body or any internal organ or organ system. A "millirem (mrem)" is 1/1000 of a rem.

"Residual disinfectant concentration" ("C" in CT calculations) means the concentration of disinfectant measured in mg/l in a representative sample of water.

"Sanitary survey" means 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" means a process for removal of solids before filtration by gravity or separation.

"Slow sand filtration" means 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.

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

"State" means the agency of the State government which has jurisdiction over public water systems. During any period when a State 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" means any person who owns or operates a public water system.

"Surface water" means all water which is open to the atmosphere and subject to surface runoff.

"System with a single service connection" means a system which supplies drinking water to consumers via a single service line.

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

"Total trihalomethanes" (TTHM) means the sum of the concentration in milligrams per liter of the trihalomethane compounds (trichloromethane (chloroform), dibromochloromethane, bromodichloromethane and tribromomethane (bromoform), rounded to two significant figures.

"Trihalomethane" (THM) means 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.

"Virus" means a virus of fecal origin which is infectious to humans by waterborne transmission.

"Waterborne disease outbreak" means 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.

[40 DE 59570, Dec. 24, 1975, as amended at 41 FR 28403, July 9, 1976; 44 FR 68641, Nov. 29, 1979; 51 FR 11410, Apr. 2, 1986; 52 FR 20674, June 2, 1987; 51 FR 25712, July 8, 1987]

Effective Date Note: At 52 FR 25712, July 8, 1987, 141.2 was amended by removing the paragraph designations, arranging the paragraphs in alphabetical order and effective January 9, 1989 adding new definitions for "Best available technology", "Non-transient non-community water system", "Point-of-entry treatment device" and "Point-of-use treatment device".

141.3 COVERAGE.

This part shall apply to each public water system, unless the public water system meets all of the following conditions:

(a) Consists only of distribution and storage facilities (and does not have any collection and treatment facilities);

(b) Obtains all of its water from, but is not owned or operated by, a public water system to which such regulations apply;

(c) Does not sell water to any person; and

(d) Is not a carrier which conveys passengers in interstate commerce.

§141.4 VARIANCES AND EXEMPTIONS.

Variances or exemptions from certain provisions of these regulations may be granted pursuant to sections 1415 and 1416 of the Act by the entity with primary enforcement responsibility, except that variances or exemptions from the MCL for total coliforms and variances from any of the treatment technique requirements of Subpart H of this part may not be granted.

§141.5 SITING REQUIREMENTS.

Before a person may enter into a financial commitment for or initiate construction of a new public water system or increase the capacity of an existing public water system, he shall notify the State and, to the extent practicable, avoid locating part or all of the new or expanded facility at a site which:

(a) Is subject to a significant risk from earthquakes, floods, fires or other disasters which could cause a breakdown of the public water system or a portion thereof;

or

(b) Except for intake structures, is within the floodplain of a 100-year flood or is lower than any recorded high tide where appropriate records exist. The U.S. Environmental Protection Agency will not seek to override land use decisions affecting public water systems siting which are made at the State or local government levels.

§141.6 EFFECTIVE DATES.

(a) Except as provided in paragraph (b) of this section, the regulations set forth in this part shall take effect on June 24, 1977.

(b) The regulations for total trihalomethanes set forth in § 141.12(c) shall take effect 2 years after the date of promulgation of these regulations for community water systems serving 75,000 or more individuals, and 4 years after the date of promulgation for communities serving 10,000 to 74,999 individuals.

(c) The regulations set forth in 141.11 (a), (d) and (e): 141.14(a)(1): 141.14(b)(1)(i); 141.14(b)(2)(i); 141.14(d); 141.21 (a), (c) and (i); 141.22 (a) and (e); 141.23 (a)(3) and (a)(4): 141.23(f): 141.24(a)(3): 141.24 (e) and (f): 141.25(e): 141.27(a); 141.28 (a) and (b): 141.31 (a), (d) and (e): 141.32(b)(3): and 141.32(d) shall take effect immediately upon promulgation.

(d) The regulations set forth in 141.41 shall take effect 18 months from the date of promulgation. Suppliers must complete the first round of sampling and reporting within 12 months following the effective date.

(e) The regulations set forth in 141.42 shall take effect 18 months from the date of promulgation. All requirements in 141.42 must be completed within 12 months following the effective date.

(f) The regulations set forth in 141.11(c) and 141.23(g) are effective May 2, 1986. Section 141.23(g)(4) is effective October 2, 1987.

[44 FR 68641, Nov. 29, 1979, as amended at 45 FR 57342, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 51 FR 11410, Apr. 2, 1986]

Subpart B - Maximum Contaminant Levels

§ 141.11 MAXIMUN CONTAMINANT LEVELS FOR INORGANIC CHEMICALS.

(a) The MCL for nitrate is applicable to both community water systems and non-community water systems except as provided by in paragraph (d) of this section. The levels for the other inorganic chemicals apply only to community water systems. Compliance with MCLs for inorganic chemicals is calculated pursuant to 141.23.

(b) The following are the maximum contaminant levels for inorganic chemicals other than fluoride:

CONTAMINANT	LEVEL, MILLIGRAMS PER LITER
Arsenic	0.05
Barium	1.
Cadmium	0.010
Chromium	0.05
Lead	0.05
Mercury	0.002
Nitrate (as Nitrogen)	10.
Selenium	0.01
Silver	0.05

(c) The maximum contaminant level for fluoride is 4.0 mg/l. See 40 CFR 143.3, which establishes a secondary maximum contaminant level at 2.0 mg/l.

(d) At the discretion of the State, nitrate levels not to exceed 20 mg/l may be allowed in a non-community water system if the supplier of water demonstrates to the satisfaction of the State that:

(1) Such water will not be available to children under 6 months of age; and

(2) There will be continuous posting of the fact that nitrate levels exceed 10 mg/l and the potential health effects of exposure; and

(3) Local and State public health authorities will be notified annually of nitrate levels that exceed 10 mg/l; and

(4) No adverse health effects shall result.

[40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57342, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 51 FR 11410, Apr. 2, 1986]

§141.12 MAXIMUM CONTAMINANT LEVELS FOR ORGANIC CHEMICALS.

The following are the maximum contaminant levels for organic chemicals. The maximum contaminant levels for organic chemicals in paragraphs (a) and (b) of this section apply to all community water systems. Compliance with the maximum contaminant levels in paragraphs (a) and (b) of this section, is calculated pursuant to 141.24. The maximum comtaminant level for total trihalomethanes in paragraph (c) of this section applies only to community water systems which serve a population of 10.000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process. Compliance with the maximum contaminant level for total trihalomethanes is calculated pursuant to §141.30.

	Level, ml/g per liter
Chlorinated hydrocarbons: Endrin (1.2,3,4,10, 10-hexachloro-6, 7-epoxy-1,4, 4a,5,6,7,8,8a,-octahydro-1,4-endo, endo-5-8 dimethano naphthalene).	0.0002
Lindane (1.2,3,4,5,6-hexachlorocyclohexane,gamma isomer).	0.004
Methoxychlor (1,1,1-Trichloro-2,2-bis (p-methoxyphenyl)	0.1

Toxaphene (C10H10C18-Technical chlorinated camphene, 67-69% chlorine).	0.005
.02 Chlorophenoxys: 2,4-D, (2,4-Dichlorophenoxyacetic acid).	0.1
2,4,5-TP Silvex (2,4,5-Trichlorophenoxypropionic acid).	0.01
.03 Total Trihalomethanes (TTHM)	0.10

[40 FR 59570, Dec. 24, 1975, as amended at 44 FR 68641, Nov. 29, 1979]

$ 141.13 MAXIMUM CONTAMINANT LEVELS FOR TURBIDITY.

The requirements in this section apply to unfiltered systems until December 30, 1991, unless the State has determined prior to that date, in writing pursuant to section 1412(b)(7)(C)(iii), that filtration is required. The requirements in this section apply to filtered systems until June 29, 1993. The requirements in this section apply to unfiltered systems that the State has determined, in writing pursuant to section 1412(b)(7)(C)(iii), must install filtration, until June 29, 1993, or until filtration is installed, whichever is later.

The maximum contaminant levels for turbidity are applicable to both community water systems and non-community water systems using surface water sources in whole or in part. The maximum contaminant levels for turbidity in drinking water, measured at a representative entry point(s) to the distribution system, are:

(a) One turbidity unit (TU), as determined by a monthly average pursuant to $ 141.22, except that five or fewer turbidity units may be allowed if the supplier of water can demonstrate to the State that the higher turbidity does not do any of the following:

(1) Interfere with disinfection;

(2) Prevent maintenance of an effective disinfectant agent throughout the distribution system; or

(3) Interfere with microbiological determinations.

(b) Five turbidity units based on an average for two consecutive days pursuant to $ 141.22.

141.15 MAXIMUM CONTAMINANT LEVELS FOR RADIUM-226, RADIUM-228, AND GROSS ALPHA PARTICLE RADIOACTIVITY IN COMMUNITY WATER SYSTEMS.

The following are the maximum contaminant levels for radium-226, radium-228, and gross alpha particle radioactivity:

(a) Combined radium-226 and radium-228 -- 5 pCi/l.

(b) Gross alpha particle activity (including radium-226 but excluding radon and uranium) -- 15 pCi/l.

[41 FR 28404, July 9, 1976]

§ 141.16 MAXIMUN CONTAMINANT LEVELS FOR BETA PARTICLE AND PHOTON RADIOACTIVITY FROM MAN-MADE RADIONUCLIDES IN COMMUNITY WATER SYSTEMS.

(a) The average annual concentration of beta particle and photon radioactivity from man-made radionuclides in drinking water shall not produce an annual dose equivalent to the total body or any internal organ greater than 4 millirem/year.

(b) Except for the radionuclides listed in Table A, the concentration of man-made radionuclides causing 4 mrem total body or organ dose equivalents shall be calculated on the basis of a 2 liter per day drinking water intake using the 168 hour data listed in "Maximum Permissible Body Burdens and Maximum Permissible Concentration of Radionuclides in Air or Water for Occupational Exposure," NBS Handbook 69 as amended August 1963, U.S. Department of Commerce. If two or more radionuclides are present, the sum of their annual dose equivalent to the total body or to any organ shall not exceed 4 millirem/year.

Table A - Average Annual Concentrations Assumed to Produce A Total Body or Organ Dose of 4 MREM/YR

RADIONUCLIDE	CRITICAL ORGAN	pCi PER LITER
Tritium	Total Body	20,000
Strontium 90	Bone Marrow	8

[41 FR 28404, July 9, 1976]

SUBPART C - MONITORING AND ANALYTICAL REQUIREMENTS

§ 141.21 COLIFORM SAMPLING.

(a) Routine monitoring. (1) Public water systems must collect total coliform samples at sites which are representative of water throughout the distribution system according to a written sample siting plan. These plans are subject to State review and revision.

(2) The monitoring frequency for total coliforms for community water systems is based on the population served by the system, as follows:

TOTAL COLIFORM MONITORING FREQUENCY
FOR COMMUNITY WATER SYSTEMS

Population served	Minimum number of samples per month
25 to 1,000[1]	1
1,001 to 2,500	2
2,501 to 3,300	3
3,301 to 4,100	4
4,101 to 4,900	5
4,901 to 5,800	6
5,801 to 6,700	7
6,701 to 7.600	8
7,601 to 8,500	9
8.501 to 12,900	10
12,901 to 17,200	15
17,201 to 21,500	20
21,501 to 25,000	25
25,001 to 33,000	30
33,001 to 41,000	40
41,001 to 50,000	50
50,001 to 59,000	60
59,001 to 70,000	70
70,001 to 83,000	80
83,001 to 96,000	90
96,001 to 130,000	100
130,001 to 220,000	120
220,001 to 320,000	150
320,001 to 450,000	180
450,001 to 600,000	210
600,001 to 780,000	240
780,001 to 970,000	270
970,001 to 1,230,000	300
1,230,001 to 1,520,000	330
1,520,001 to 1,850,000	360

1,850,001 to 2,270,000	390
2,270,001 to 3,020,000	420
3,020,001 to 3,960,000	450
3,960,001 or more	480

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[1] Includes public water systems which have at least 15 service connections, but serve fewer than 25 persons.

If a community water system serving 25 to 1,000 persons has no history of total coliform contamination in its current configuration, and a sanitary survey conducted in the past five years shows that the system is supplied solely by a protected groundwater source and is free of sanitary defects, the State may reduce the monitoring frequency specified above, except that in no case may the State reduce the monitoring frequency to less than one sample per quarter. The State must approve the reduced monitoring frequency in writing.

(3) The monitoring frequency for total coliforms for non-community water systems is as follows:

(i) A non-community water system using only groundwater (except ground water under the direct influence of surface water, as defined in §141.2) and serving 1,000 persons or fewer must monitor each calendar quarter that the system provides water to the public, except that the State may reduce this monitoring frequency, in writing, if a sanitary survey shows that the system is free of sanitary defects. Beginning June 29, 1994, the State cannot reduce the monitoring frequency for a non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in §141.2) and serving 1,000 persons or fewer to less than once/year.

(ii) A non-community water system using only ground water (except ground water under the direct influence of surface water, as defined in §141.2) and serving more than 1,000 persons during any month must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section except the State may reduce this monitoring frequency, in writing, for any month the system serves 1,000 persons or fewer. The State cannot reduce the monitoring frequency to less than once/year. For systems using ground water under the direct influence of surface water, paragraph (a)(3)(iv) of this section applies.

(iii) A non-community water system using surface water, in total or in part, must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section, regardless of the number of persons it serves.

(iv) A non-community water system using ground water under the direct influence of surface water, as defined in §141.2, must monitor at the same frequency as a like-sized community water system, as specified in paragraph (a)(2) of this section. The system must begin monitoring at this frequency beginning six months after the State determines that the ground water is under the direct influence of surface water.

(4) The public water system must collect samples at regular time intervals throughout the month, except that a system which uses only ground water (except ground water under the influence of surface water, as defined in §141.2), and serves 4,900 persons or fewer, may collect all required samples on a single day if they are taken from different sites.

(5) A public water system that uses surface water or ground water under the direct influence of surface water, as defined in §141.2, and does not practice filtration in compliance with Subpart H must collect at least one sample near the first service connection each day the turbidity level of the source water, measured as specified in §141.74(b)(2), exceeds 1 NTU. This sample must be analyzed for the presence of total coliforms. When one or more turbidity measurements in any day exceed 1 NTU, the system must collect this coliform sample within 24 hours of the first exceedance, unless the State determines that the system, for logistical reasons outside the system's control, cannot have the sample analyzed within 30 hours of collection. Sample results from this coliform monitoring must be included in determining compliance with the MCL for total coliforms in §141.63.

(6) Special purpose samples, such as those taken to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, shall not be used to determine compliance with the MCL for total coliforms in §141.63. Repeat samples taken pursuant to paragraph (b) of this section are not considered special purpose samples, and must be used to determine compliance with the MCL for total coliforms in §141.63.

(b) Repeat monitoring. (1) If a routine sample is total coliform-positive, the public water system must collect a set of repeat samples within 24 hours of being notified of the positive result. A system which collects more than one routine sample/month must collect no fewer than three repeat samples for each total coliform-positive sample found. A system which normally collects one routine sample/month or fewer must collect no fewer than four repeat samples for each total coliform-positive sample found. The State may extend the 24-hour limit on a case-by-case basis if the system has a logistical problem in collecting the repeat samples within 24 hours that is beyond its control. In the case of an extension, the State must specify how much time the system has to collect the repeat samples.

(2) The system must collect at least one repeat sample from the sampling tap where the original total coliform-positive sample was taken, and at least one repeat sample at a tap within five service connections upstream and at least one repeat sample at a tap within five service connections downstream of the original sampling site. If a total coliform-positive sample is at the end of the distribution system, or one away from the end of the distribution system, the State may waive the requirement to collect at least one repeat sample upstream or downstream of the original sampling site.

(3) The system must collect all repeat samples on the same day, except that the State may allow a system with a single service connection to collect the required set of repeat samples over a four-day period or to collect a larger volume repeat sample(s) in one or more sample containers of any size, as long as the total volume collected is at least 400 ml (300 ml for systems which collect more than one routine sample/month).

(4) If one or more repeat samples in the set is total coliform-positive, the public water system must collect an additional set of repeat samples in the manner specified in paragraphs (b)(1)-(3) of this section. The additional samples must be collected within 24 hours of being notified of the positive result, unless the State extends the limit as provided in paragraph (b)(1) of this section. The system must repeat this process until either total coliforms are not detected in one complete set of repeat samples or the system determines that the MCL for total coliforms in §141.63 has been exceeded and notifies the State.

(5) If a system collecting fewer than five routine samples/month has one or more total coliform-positive samples and the State does not invalidate the sample(s) under

paragraph (c) of this section, it must collect at least five routine samples during the next month the system provides water to the public, except that the State may waive this requirement if the conditions of paragraph (b)(5)(i) or (ii) are met. The State cannot waive the requirement for a system to collect repeat samples in paragraphs (b)(1)-(4) of this section.

(i) The State may waive the requirement to collect five routine samples the next month the system provides water to the public if the State, or an agent approved by the State, performs a site visit before the end of the next month the system provides water to the public. Although a sanitary survey need not be performed, the site visit must be sufficiently detailed to allow the State to determine whether additional monitoring and/or any corrective action is needed. The State cannot approve an employee of the system to perform this site visit, even if the employee is an agent approved by the State to perform sanitary surveys.

(ii) The State may waive the requirement to collect five routine samples the next month the system provides water to the public if the State has determined why the sample was total coliform-positive and establishes that the system has corrected the problem or will correct the problem before the end of the next month the system serves water to the public. In this case, the State must document this decision to waive the following month's additional monitoring requirement in writing, have it approved and signed by the supervisor of the State official who recommends such a decision, and make this document available to the EPA and public. The written documentation must describe the specific cause of the total coliform-positive sample and what action the system has taken and/or will take to correct this problem. The State cannot waive the requirement to collect five routine samples the next month the system provides water to the public solely on the grounds that all repeat samples are total coliform- negative. Under this paragraph, a system must still take at least one routine sample before the end of the next month it serves water to the public and use it to determine compliance with the MCL for total coliforms in §141.63, unless the State has determined that the system has corrected the contamination problem before the system took the set of repeat samples required in paragraphs (b)(1)-(4), and all repeat samples were total coliform-negative.

(6) After a system collects a routine sample and before it learns the results of the analysis of that sample, if it collects another routine sample(s) from within five adjacent service connections of the initial sample, and the initial sample, after analysis, is found to contain total coliforms, then the system may count the subsequent sample(s) as a repeat sample instead of as a routine sample.

(7) Results of all routine and repeat samples not invalidated by the State must be included in determining compliance with the MCL for total coliforms in §141.63.

(c) Invalidation of total coliform samples.

A total coliform-positive sample invalidated under this paragraph (c) does not count towards meeting the minimum monitoring requirements of this section. (1) The State may invalidate a total coliform-positive sample only if the conditions of paragraph (c)(i), (ii), or (iii) are met.

(i) The laboratory establishes that improper sample analysis caused the total coliform-positive result.

(ii) The State, on the basis of the results of repeat samples collected as required by paragraphs (b)(1)-(4) of this section, determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. The State cannot invalidate a sample on the basis of repeat sample results unless all repeat sample(s) collected at the same tap as the original total coliform-positive sample are also total coliform- positive, and all repeat samples collected within five service connections of the original tap are total coliform-negative (e.g., a State cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative, or if the public water system has only one service connection).

(iii) The State has substantial grounds to believe that a total coliform-positive result is due to a circumstance or condition which does not reflect water quality in the distribution system. In this case, the system must still collect all repeat samples required under paragraphs (b)(1)-(4) of this section, and use them to determine compliance with the MCL for total coliforms in §141.63. To invalidate a total coliform-positive sample under this paragraph, the decision with the rationale for the decision must be documented in writing, and approved and signed by the supervisor of the State official who recommended the decision. The State must make this document available to EPA and the public. The written documentation must state the specific cause of the total coliform-positive sample, and what action the system has taken, or will take, to correct this problem. The State may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative.

(2) A laboratory must invalidate a total coliform sample (unless total coliforms are detected) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined (e.g., the Multiple-Tube Fermentation Technique), produces a turbid culture in the absence of an acid reaction in the Presence-Absence (P-A) Coliform Test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter (e.g., Membrane Filter Technique). If a laboratory invalidates a sample because of such interference, the system must collect another sample from the same location as the original sample within 24 hours of being notified of the interference problem, and have it analyzed for the presence of total coliforms. The system must continue to re-sample within 24 hours and have the samples analyzed until it obtains a valid result. The State may waive the 24-hour time limit on a case-by-case basis.

(d) Sanitary surveys. (1)(i) Public water systems which do not collect five or more routine samples/month must undergo an initial sanitary survey by June 29, 1994 for community public water systems and June 24, 1999 for non-community water systems. Thereafter, systems must undergo another sanitary survey every five years, except that non-community water systems using only protected and disinfected ground water, as defined by the State, must undergo subsequent sanitary surveys at least every ten years after the initial sanitary survey. The State must review the results of each sanitary survey to determine whether the existing monitoring frequency is adequate and what additional measures, if any, the system needs to undertake to improve drinking water quality.

(ii) In conducting a sanitary survey of a system using ground water in a State having an EPA-approved wellhead protection program under section 1428 of the Safe Drinking Water Act, information on sources of contamination within the delineated wellhead protection area that was collected in the course of developing and implementing the program should be considered instead of collecting new information, if the information was collected since the last time the system was subject to a sanitary survey.

(2) Sanitary surveys must be performed by the State or an agent approved by the State. The system is responsible for ensuring the survey takes place.

(e) Fecal coliforms/Escherichia coli (E. coli) testing. (1) If any routine or repeat sample is total coliform-positive, the system must analyze that total coliform-positive culture medium to determine if fecal coliforms are present, except that the system may test for E. coli in lieu of fecal coliforms. If fecal coliforms or E. coli are present, the system must notify the State by the end of the day when the system is notified of the test result, unless the system is notified of the result after the State office is closed, in which case the system must notify the State before the end of the next business day.

(2) The State has the discretion to allow a public water system, on a case-by-case basis, to forgo fecal coliform or E. coli testing on a total coliform-positive sample if that system assumes that the total coliform- positive sample is fecal coliform-positive or E. coli- positive. Accordingly, the system must notify the State as specified in paragraph (e)(1) of this section and the provisions of §141.63(b) apply.

(f) Analytical methodology. (1) The standard sample volume required for total coliform analysis, regardless of analytical method used, is 100 ml.

(2) Public water systems need only determine the presence or absence of total coliforms; a determination of total coliform density is not required.

(3) Public water systems must conduct total coliform analyses in accordance with one of the following analytical methods:

(i) Multiple-Tube Fermentation (MTF) Technique, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition, Method 908, 908A, and 908B -- pp. 870-878, except that 10 fermentation tubes must be used; or Microbiological Methods for Monitoring the Environment, Water and Wastes, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/8-78-017, December 1978, available from ORD Publications, CERI, U.S. EPA, Cincinnati, Ohio 45268), Part III, Section B.4.1 - 4.6.4, pp. 114-118 (Most Probable Number Method), except that 10 fermentation tubes must be used; or

(ii) Membrane Filter (MF) Technique, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition, Method 909, 909A and 909B -- pp. 886-896; or Microbiological Methods for Monitoring the Environment, Water and Wastes, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/8-78-017, December 1978, available from ORD Publications, CERI, U.S. EPA, Cincinnati, Ohio 45268), Part III, Section B.2.1 - 2.6, pp. 108-112; or

(iii) Presence-Absence (P-A) Coliform Test, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition, Method 908E -- pp. 882-886; or

(iv) Minimal Medium ONPG-MUG (MMO-MUG) Test, as set forth in the article "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. (Note: The MMO-MUG Test is sometimes referred to as the Autoanalysis Colilert System.)

(4) In lieu of the 10-tube MTF Technique specified in paragraph (f)(3)(i) of this section, a public water system may use the MTF Technique using either five tubes

(20-ml sample portions) or a single culture bottle containing the culture medium for the MTF Technique, i.e., lauryl tryptose broth (formulated as described in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th Edition, Method 908A -- pp. 872), as long as a 100-ml water sample is used in the analysis.

(5) Public water systems must conduct fecal coliform analysis in accordance with the following procedure. When the MTF Technique or Presence-Absence (P-A) Coliform Test is used to test for total coliforms, shake the lactose- positive presumptive tube or P-A bottle vigorously and transfer the growth with a sterile 3-mm loop or sterile applicator stick into brilliant green lactose bile broth and EC medium to determine the presence of total and fecal coliforms, respectively. For EPA-approved analytical methods which use a membrane filter, remove the membrane containing the total coliform colonies from the substrate with a sterile forceps and carefully curl and insert the membrane into a tube of EC medium. (The laboratory may first remove a small portion of selected colonies for verification.) Gently shake the inoculated EC tubes to insure adequate mixing and incubate in a waterbath at 44.5 ±0.2°C for 24 ± 2 hours. Gas production of any amount in the inner fermentation tube of the EC medium indicates a positive fecal coliform test. The preparation of EC medium is described in Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 16th Edition, Method 908C -- pp. 879, paragraph 1a. Public water systems need only determine the presence or absence of fecal coliforms; a determination of fecal coliform density is not required.

(6) These incorporations by reference were approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the analytical methods cited in Standard Methods for the Examination of Water and Watewater may be obtained from the American Health Association et al.; 1015 Fifteenth Street, NW; Washington, DC 20005. Copies of the methods set forth in Microbiological Methods for Monitoring the Environment, Water and Wastes may be obtained from ORD Publications, U.S. EPA, 26 Martin Luther King Drive, Cincinnati, Ohio 45268. Copies of the MMO-MUG Test as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and Escherichia coli from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method" (Edberg et al.) may be obtained from the American Water Works Association Research Foundation, 6666 West Quincy Avenue, Denver, CO 80235. Copies may be inspected at EPA's Drinking Water Docket; 401 M Street, SW; Washington, DC 20460, or at the Office of the Federal Register; 1100 L Street, NW; Room 8401; Washington, DC 20408.

(g) Response to violation. (1) A public water system which has exceeded the MCL for total coliforms in §141.63 must report the violation to the State no later than the end of the next business day after it learns of the violation, and notify the public in accordance with §141.32.

(2) A public water system which has failed to comply with a coliform monitoring requirement, including the sanitary survey requirement, must report the monitoring violation to the State within ten days after the system discovers the violation, and notify the public in accordance with §141.32

141.22 TURBIDITY SAMPLING AND ANALYTICAL REQUIREMENTS.

The requirements in this section apply to unfiltered systems until December 30, 1991, unless the State has determined prior to that date, in writing pursuant to section 1412(b)(7)(iii), that filtration is required. The requirements in this section apply to filtered systems until June 29, 1993. The requirements in this section apply to unfiltered systems that the State has determined, in writing pursuant to section 1412(b)(7)(C)(iii), must install filtration, until June 29, 1993, or until filtration is installed, whichever is later.

(a) Samples shall be taken by suppliers of water for both community and non-community water systems at a representative entry point(s) to the water distribution system at least once per day, for the purposes of making turbidity measurements to determine compliance with 141.13. If the State determines that a reduced sampling frequency in a non-community will not pose a risk to public health, it can reduce the required sampling frequency. The option of reducing the turbidity frequency shall be permitted only in those public water systems that practice disinfection and which maintain an active residual disinfectant in the distribution system, and in those cases where the State has indicated in writing that no unreasonable risk to health existed under the circumstances of this option. The turbidity measurements shall be made by the Nephelometric Method in accordance with the recommendations set forth in "Standard Methods for Examination of Water and Wastewater," American Public Health Association, 14th Edition, pp. 132-134; or "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, March 1979, Method 180.1 -- Nephelometric Method. Calibration of the turbidimeter shall be made either by the use of a formazin standard as specified in the cited references or a styrene divinylbenzene polymer standard (Amco-AEPA-1 Polymer) commercially available from Amco Standards International, Inc., 230 Polaris Avenue, No. C, Mountain View, California 94043.

(b) If the result of a turbidity analysis indicates that the maximum allowable limit has been exceeded, the sampling and measurement shall be confirmed by resampling as soon as practicable and preferably within one hour. If the repeat sample confirms that the maximum allowable limit has been exceeded, the supplier of water shall report to the State within 48 hours. The repeat sample shall be the sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum allowable limit, or if the average of two samples taken on consecutive days exceeds 5 TU, the supplier of water shall report to the State and notify the public as directed in § 141.31 and § 141.32.

(c) Sampling for non-community water systems shall begin within two years after the effective date of this part.

(d) The requirements of this 141.22 shall apply only to public water systems which use water obtained in whole or in part from surface sources.

(e) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57344, Aug. 27, 1980; 47 FR 8998, Mar. 3, 1982; 47 FR 10998, Mar. 12, 1982]

§ 141.23 INORGANIC CHEMICAL SAMPLING AND ANALYTICAL REQUIREMENTS.

(a) Analyses for the purpose of determining compliance with 141.11 are required as follows:

(1) Analyses for all community water systems utilizing surface water sources shall be completed within one year following the effective date of this part. These analyses shall be repeated at yearly intervals.

(2) Analyses for all community water systems utilizing only ground water sources shall be completed within two years following th effective date of this part. These analyses shall be repeated at three-year intervals.

(3) For non-community water systems, whether supplied by surface or ground sources, analyses for nitrate shall be completed by December 24, 1980. These analyses shall be repeated at intervals determined by the State.

(4) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

(b) If the result of an analysis made under paragraph (a) of (g) of this section indicates that the level of any contaminant listed in § 141.11 or § 141.62 exceeds the maximum contaminant level, the supplier of the water shall report to the State within 7 days and initiate three additional analyses at the same sampling point within one month.

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall notify the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) The provisions of paragraphs (b) and (c) of this section notwithstanding, compliance with the maximum contaminant level for nitrate shall be determined on the basis of the mean of two analyses. When a level exceeding the maximum contaminant level for nitrate is found, a second analysis shall be initiated within 24 hours, and if the mean of the two analyses exceeds the maximum contaminant level, the supplier of water shall report his findings to the State pursuant to 141.31 and shall notify the public pursuant to § 141.32.

(e) For the initial analyses required by paragraph (a)(1), (2) or (3) of this section, data for surface waters acquired within one year prior to the effective dat and data for ground waters acquired within 3 years prior to the effective date of this part may be substituted at the discretion of the State.

(f) Analyses conducted to determine compliance with 141.11 shall be made in accordance with the following methods, or their equivalent as determined by the Administrator.

(1) Arsenic-Method /1/ 206.2, Atomic Absorption Furnance Technique; or Method /1/ 206.3, or Method /4/ D2972-78B or Method /2/ 301.A VII, pp. 159-162, or Method /3/ I-1062-78, pp. 61-63, Atomic Absorption-Gaseous Hydride; or Method /1/ 206.4, or Method /4/ D-2972-78A, or Method /2/ 404-A and 404-B(4), Spectrophotometric, Silver Diethyldithiocarbamate; or Method /8/ 200.7, Inductively Coupled Plasma Technique.

(2) Barium-Method /1/ 208.1, or Method /2/ 301-A IV, pp. 152-155, Atomic Absorption-Direct Aspiration; or Method /1/ 208.2, Atomic Absorption Furnace Technique; or Method /8/ 200.7, Inductively Coupled Plasma Technique.

(3) Cadmium-Method /1/ 213.1 or Method /4/ D 3557-78A or B, or Method /2/ 301-A II or III, pp. 148-152, Atomic Absorption-Direct Aspiration; or Method /1/ 213.2 Atomic Absorption Furnance Technique; or Method /8/ 200.7, Inductively Coupled Plasma Technique.

(4) Chromium-Method /1/ 218.1 or Method /4/ D 1687-77D, or Method /2/ 301-A II or III, pp. 148-152, Atomic Absorption-Direct Aspiration; or Chromium-Method /1/ 218.2, Atomic Absorption Furnace Technique; or Method /8/ 200.7, Inductively Coupled Plasma Technique.

(5) Lead-Method /1/ 239.1, or Method /4/ D 3559-78A or B, or Method /2/ 301-A II or III, pp. 148-152, Atomic Absorption-Direct Aspiration; or Method /1/ 239.2, Atomic Absorption Furnace Technique; or Method /8/ 200.7, Inductively Coupled Plasma Technique.

(6) Mercury -- Method1 245.1, or Method4 D-3223-79, or Method2 301-A VI, pp. 156-159, Manual Cold Vapor Technique; or Method1 245.2, Automated Cold Vapor Technique.

(7) Nitrate -- Method1 352.1, or Method4 D-992-71, or Method2 419-D, pp. 427-429, Colorimetric Brucine; or Method1 353.3, or Method4 D-3867-79B, or Method2 419-C, pp. 423-427, Spectrometric, Cadmium Reduction; Method 1 353.1, Automated Hydrazine Reduction; or Method1 353.2, or Method4 D-3867-79A, or Method2 605, pp. 620-624, Automated Cadmium Reduction.

(8) Selenium -- Method1 270.2, Atomic Absorption Furnace Technique; or Method1 270.3; or Method3 I-1667-78, pp. 237-239, or Method4 D-3859-79, or Method2

301-A VII, pp. 159-162, Hydride Generation -- Atomic Absorption Spectrophotometry.

(9) Silver-Method /1/ 272.1. or Method /2/ 301-A II. pp. 148-152. Atomic Absorption-Direct Aspiration: or Method /1/ 272.2. Atomic Absorption Furnace Technique: or Method /8/ 200.7. Inductively Coupled Plasma Technique.

(10) Fluoride:

REFERENCE (Method Number)

METHODOLOGY	EPA^1	ASTM^4	SM^5	Other
Colorimetric SPADNS, w/ distillation	340.1	D1179-72A	43 A&C	--
Potentiometric ion selective electrode	340.2	D1179-72B	413 B	--
Automated Alizann fluoride blue w/ distillation (complexone)	340.3	--	413 E	129-71W^6
Automated ion selective electrode	--	--	--	380-75WE^7

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^1 "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 (EPA-600/4-79-020). March 1979. Available from ORD Publications. CERI. EPA. Cincinnati. OH 45268. For approved analytical procedures for metals, the technique applicable to total metals must be used.

^2 RESERVED

^3 RESERVED

^4 Annual Book of ASTM Standards, part 31. Water. American Society for Testing and Materials, 1916 Race St., Philadelphia. PA 19103

^5 "Standard Methods for the Examination of Water and Wastewater." 16th Edition. American Public Health Association. American Water Works Association. Water Pollution Control Federation. 1985.

^6 "Fluoride in Water and Wastewater Industrial Method #129-71W" Technicon Industrial Systems. Tarrytown, New York, 10591 December 1972.

^7 "Fluoride in Water and Wastewater," Technicon Industrial Systems. Tarrytown, New York 10591. February 1976.

(g) Fluoride. In addition to complying with paragraphs (a) through (f) of this section, systems monitoring for fluoride must comply with the requirements of this paragraphs.

(1)(i) Where the system draws water from one source, the system shall take one sample at the entry point to the distribution system.

(ii) Where the system draws water from more than one source, the system must sample each source at the entry points to the distribution system.

(iii) If the system draws water from more than one source and sources are combined before distribution, the system must sample at an entry point to the distribution system during periods representative of the maximum fluoride levels occurring under normal operating conditions.

(2) The state may alter the frequencies for fluoride monitoring as set out in paragraph (a) of this section to increase or decrease such frequency considering the following factors:

(i) Reported concentrations from previously required monitoring,

(ii) The degree of variation in reported concentrations and,

(iii) Other factors which may affect fluoride concentrations such as changes in pumping rates in ground water supplies or significant changes in the system's configuration, operating procedures, source of water, and changes in stream flows.

(3) Monitoring may be decreased from the frequencies specified in paragraph (a) of this section upon application in writing by water systems if the state determines that the system is unlikely to exceed the MCL, considering the factors listed in paragraph (g)(2) of this section. Such determination shall be made in writing and set forth the basis for the determination. A copy of the determination shall be provided to the Administrator. In no case shall monitoring be reduced to less than one sample every 10 years. For systems monitoring once every 10 years, the state shall review the monitoring results every ten years to determine whether more frequent monitoring is necessary.

(4) Analyses for fluoride under this section shall only be used for determining compliance if conducted by laboratories that have analyzed Performance Evaluation samples to within 10% of the reference value at fluoride concentrations from 1.0 mg/l to 10.0 mg/l, within the last 12 months.

(5) Compliance with the MCL shall be determined based on each sampling point. If any sampling point is determined to be out of compliance, the system is deemed to be out of compliance.

[40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57344, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 51 FR 11410, Apr. 2, 1986; 51 FR 24329, July 3, 1986; 53 FR 5146, Feb. 19, 1988]

/1/ "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/4-79-020), March 1979. Available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268. For approved analytical procedures for metals, the technique applicable to total metals must be used.

/2/ "Standard Methods for the Examination of Water and Wastewater." 14th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1976.

/3/ Techniques of Water-Resources Investigation of the United States Geological Survey, Chapter A-1, "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," Book 5, 1979, Stock 024-001-03177-9. Available from Superintendent of Documents, U.S. Government Printing Office, Washington, DC 20402.

/4/ Annual Book of ASTM Standards, part 31 Water, American Society for Testing and Materials, 1976 Race Street, Philadelphia, Pennsylvania 19103.

/5/-/7/ [Reserved]

/8/ "Inductively Coupled Plasma-Atomic Emission Spectrometic Method for Trace Element Analysis of Water and Wastes -- Method 200.7" with Appendix to Method 200.7 entitled, "Inductively Coupled Plasma-Atomic Emission Analysis of Drinking Water," March 1987. Available from EPA's Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268.

141.24 ORGANIC CHEMICALS OTHER THAN TOTAL TRIHALOMETHANES. SAMPLING AND ANALYTICAL REQUIREMENTS.

(a) An analysis of substances for the purpose of determining compliance with 141.12(a) and § 141.12(b) shall be made as follows:

(1) For all community water systems utilizing surface water sources, analyses shall be completed within one year following the effective date of this part. Samples analyzed shall be collected during the period of the year designated by the State as the period when contamination by pesticides is most likely to occur. These analyses shall be repeated at intervals specified by the State but in no event less frequently than at three year intervals.

(2) For community water systems utilizing only ground water sources, analyses shall be completed by those systems specified by the State.

(3) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

(b) If the result of an analysis made pursuant to paragraph (a) of this section indicates that the level of any contaminant listed in § 141.24 (a) and (b) exceeds the maximum contaminant level, the supplier of water shall report to the State within 7 days and initiate three additional analyses within one month.

(c) When the average of four analyses made pursuant to paragraph (b) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall report to the State pursuant to § 141.31 and give notice to the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(d) For the initial analysis required by paragraphs (a) (1) and (2) of this section, data for surface water acquired within one year prior to the effective date of this part and data for ground water acquired within three years prior to the effective date of this part may be substituted at the discretion of the State.

(e) Analysis made to determine compliance with § 141.12(a) shall be made in accordance with the following methods, or their equivalent as determined by the Administrator: "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water.'' available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268; or "Organochlorine Pesticides in Water," Annual Book of ASTM Standards, part 31, Water, Method D-3086-79; or Method 509-A, pp. 555-565; /2/ or Gas Chromatographic Methods for Analysis of Organic Substances in Water, /5/ USGS, Book 5, Chapter A-3, pp. 24-39; or Solid Phase Extraction (SPE) /6/ Test Method Number SPE-500 for EPA's "Methods for Organochlorine Pesticides and Chlorophenoxy Acid in Herbicides in Drinking Water and Raw Source Water."

(f) Analysis made to determine compliance with § 141.12(b) shall be conducted in accordance with "Methods for Organochlorine Pesticides and Chlorophenoxy Acid Herbicides in Drinking Water and Raw Source Water," available from ORD Publications, CERI, EPA, Cincinnati, Ohio 45268; or "Chlorinated Phenoxy Acid Herbicides in Water," Annual Book of ASTM Standards, part 31, Method D-3478-79; or Method 509-B, pp. 565-569;2 or Gas Chromatographic Methods for Analysis of Organic Substances in Water,5 USGS, Book 5, Chapter A-3, pp. 24-39.

(g) Analysis of the contaminants listed in § 141.61(a) for purposes of determining compliance with the maximum contaminant levels shall be conducted as follows:

(1) Ground-water systems shall sample at points of entry to the distribution system representative of each well after any application of treatment. Sampling must be conducted at the same location(s) or more representative location(s) every three months for one year except as provided in paragraph (g)(8)(i) of this section.

(2) Surface water systems shall sample at points in the distribution system representative of each source or at entry points to the distribution system after any application of treatment. Surface water systems must sample each source every three months except as provided in paragraph (g)(8)(ii) of this section. Sampling must be conducted at the same location or a more representative location each quarter.

(3) If the system draws water from more than one source and sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions.

(4) All community water systems and non-transient, non-community water systems serving more than 10,000 people shall analyze all distribution or entry-point samples, as appropriate, representing all source waters beginning no later than January 1, 1988. All community water systems and non-transient non-community water systems serving from 3,300 to 10,000 people shall analyze all distribution or entry-point samples, as required in this paragraph (g), representing source waters no later than January 1, 1989. All other community and non-transient, non-community water systems shall analyze distribution or entry-point samples, as required in this paragraph (g), representing all source waters beginning no later than January 1, 1991.

(5) The State or EPA may require confirmation samples for positive or negative results. If a confirmation sample(s) is required by EPA or the State, then the sample result(s) should be averaged with the first sampling result and used for compliance determination in accordance with (g)(9) of this section. States have discretion to delete results of obvious sampling errors from this calculation.

(6) Analysis for vinyl chloride is required only for ground water systems that have detected one or more of the following two-carbon organic compounds: Trichloroethylene, tetrachloroethylene, 1,2-dichloroethane, 1,1,1-trichloroethane, cis-1,2-dichloroethylene, trans-1,2-dichloroethylene, or 1,1-dichloroethylene. The analysis for vinyl chloride is required at each distribution or entry point at which one or more of the two-carbon organic compounds were found. If the first analysis does not detect vinyl chloride, the State may reduce the frequency of vinyl chloride monitoring to once every three years for that sample location or other sample locations which are more representative of the same source. Surface water systems may be required to analyze for vinyl chloride at the discretion of the State.

(7) A State or individual public water systems may choose to composite up to five samples from one or more public water systems. Compositing of samples is to be done in the laboratory by the procedures listed below. Samples must be analyzed within fourteen days of collection. If any organic contaminant listed in § 141.61(a) VOC is detected in the original composite sample, a sample from each source that made up the composite sample must be reanalyzed individually within fourteen days from sampling. The sample for reanalysis cannot be the original sample but can be a duplicate sample. If duplicates of the original samples are not available, new samples must be taken from each source used in the original composite and analyzed for VOCs. Reanalysis must be accomplished within fourteen days of the second sample. To composite samples, the following procedure must be followed:

(i) Compositing samples prior to GC analysis.

(A) Add 5 ml or equal larger amounts of each sample (up to 5 samples are allowed) to a 25 ml glass syringe. Special precautions must be made to maintain zero headspace in the syringe.

(B) The samples must be cooled at 4 C during this step to minimize volatilization losses.

(C) Mix well and draw out a 5-ml aliquot for analysis.

(D) Follow sample introduction, purging, and desorption steps described in the method.

(E) If less than five samples are used for compositing, a proportionately smaller syringe may be used.

(ii) Compositing samples prior to GC/MS analysis.

(A) Inject 5-ml or equal larger amounts of each aqueous sample (up to 5 samples are allowed) into a 25-ml purging device using the sample introduction technique described in the method.

(B) The total volume of the sample in the purging device must be 25 ml.

(C) Purge and desorb as described in the method.

(8) The State may reduce the monitoring frequency specified in paragraphs (g) (1) and (2) of this section, as explained in this paragraph:

(i) The monitoring frequency for ground-water systems is as follows:

(A) When VOCs are not detected in the first sample (or any subsequent samples that may be taken) and the system is not vulnerable as defined in paragraph (g)(8)(iv) of this section, monitoring may be reduced to one sample and must be repeated every 5 years.

(B) When VOCs are not detected in the first sample (or any subsequent sample that may be taken) and the system is vulnerable as defined in paragraph (g)(8)(iv) of this section,

(1) Monitoring (i.e., one sample) must be repeated every 3 years for systems <500 connections.

(2) Monitoring (i.e., one sample) must be repeated every 5 years for systems >500 connections.

(C) If VOCs are detected in the first sample (or any subsequent sample that may be taken), regardless of vulnerability, monitoring must be repeated every 3 months, as required under paragraph (g)(1) of this section.

(ii) The repeat monitoring frequency for surface water systems is as follows:

(A) When VOCs are not detected in the first year of quarterly sampling (or any other subsequent sample that may be taken) and the system is not vulnerable as defined in paragraph (g)(8)(iv), monitoring is only required at state discretion.

(B) When VOCs are not detected in the first year of quarterly sampling (or any other subsequent sample that may be taken) and the system is vulnerable as defined in paragraph (g)(8)(iv) of this section,

(1) Monitoring must be repeated every three years (for systems 500 connections.)

(2) Monitoring must be repeated every five years (for systems >500 connections.)

(C) When VOCs are detected in the first year of quarterly sampling (or any other subsequent sample that may be taken), regardless of vulnerability, monitoring must be repeated every 3 months, as required under paragraph (g)(2) of this section.

(iii) States may reduce the frequency of monitoring to once per year for a ground-water system or surface water system detecting VOCs at levels consistently less than the MCL for three consecutive years.

(iv) Vulnerability of each public water system shall be determined by the State based upon an assessment of the following factors:

(A) Previous monitoring results.

(B) Number of persons served by public water system.

(C) Proximity of a smaller system to a larger system.

(D) Proximity to commercial or industrial use, disposal, or storage of Volatile Synthetic Organic Chemicals.

(E) Protection of the water source.

(v) A system is deemed to be vulnerable for a period of three years after any positive measurement of one or more contaminants listed in 141.40 (e) or (j) or § 141.61(a), except for trihalomethanes or other demonstrated disinfection by-products.

(9) Compliance with § 141.61(a) shall be determined based on the results of running annual average of quarterly sampling for each sampling location. If one location's average is greater than the MCL, then the system shall be deemed to be out of compliance. If a public water system has a distribution system separable from other parts of the distribution system with no interconnections, only that part of the system that exceeds any MCL

as specified in § 141.61(a) will be deemed out of compliance. States may reduce the public notice requirement to that portion of the system which is out of compliance. If any one sample result would cause the annual average to be exceeded, then the system shall be deemed to be out of compliance immediately. For systems that only take one sample per location because no VOCs were detected, compliance shall be based on that one sample.

(10) Analysis under this paragraph shall be conducted using the following EPA methods or their equivalent as approved by EPA. These methods are contained in "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," September 1986, available from Environmental and Support Laboratory (EMSL), EPA, Cincinnati, OH 45268 or the State.

(i) Method 502.1. "Volatile Halogenated Organic Chemicals in Water by Purge and Trap Gas Chromatography."

(ii) Method 503.1. "Volatile Aromatic and Unsaturated Organic Compounds in Water by Purge and Trap Gas Chromatography."

(iii) Method 524.1. "Volatile Organic Compounds in Water by Purge and Trap Gas Chromatography/Mass Spectrometry."

(iv) Method 524.2. "Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography/Mass Spectrometry."

(v) Method 502.2. "Volatile Organic Compounds in Water by Purge and Trap Capillary Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series."

(11) Analysis under this section shall only be conducted by laboratories that have received conditional approval by EPA or the State according to the following conditions:

(i) To receive conditional approval to conduct analyses for benzene, vinyl chloride, carbon tetrachloride, 1,2-dichloroethane, trichloroethylene, 1,1-dichloroethylene, 1,1,1-trichloroethane, and paradichlorobenzene the laboratory must:

(A) Analyze Performance Evaluation samples which include these substances provided by EPA Environmental Monitoring and Support Laboratory or equivalent samples provided by the State.

(B) Achieve the quantitative acceptance limits under paragraphs (g)(11)(i)(C) and (g)(11)(i)(D) of this section for at least six of the seven subject organic chemicals. States may allow fewer than six of the seven.

(C) Achieve quantitative results on the analyses performed under (g)(11)(i)(A) that are within 20 percent of the actual amount of the substances in the Performance Evaluation sample when the actual amount is greater than or equal to 0.010 mg/l.

(D) Achieve quantitative results on the analyses performed under (g)((11)(i)(A) of this section that are within 40 percent of the actual amount of the substances in the Performance Evaluation sample when the active amount is less than 0.010 mg/l.

(E) Achieve a method detection limit of 0.0005 mg/l, according to the procedures in Appendix B of Part 136.

(F) Be currently approved by EPA or the State for the analyses of trihalomethanes under § 141.30.

(ii) To receive conditional approval for vinyl chloride, the laboratory must:

(A) Analyze Performance Evaluation samples provided by EPA Envionmental Monitoring and Support Laboratory or equivalent samples provided by the tate.

(B) Achieve quantitative results on the analyses performed under (g)(11)(ii)(A) of this section that are within 40 percent of the actual amount of vinyl chloride in the Performance Evaluation sample.

(C) Achieve a method detection limit of 0.0005 mg/l, according to the procedures in Appendix B of Part 136.

(D) Receive approval or be currently approved by EPA or the State under (g)(11)(i) of this section.

(12) States have the authority to allow the use of monitoring data collected after January 1, 1983, for purposes of monitoring compliance. If the data is consistent with the other requirements in this paragraph, States may use that data to represent the initial monitoring if the system is determined by the State not to be vulnerable under the requirements of this section. In addition, the results of EPA's Ground Water Supply Survey can be used in a similar manner for systems supplied by a single well.

(13) States may increase required monitoring where necessary to detect variations within the system.

(14) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

(15) Each approved laboratory must determine the method detection limit (MDL), as defined in Appendix B to Part 136, at which it is capable of detecting VOCs. The acceptable MDL is 0.0005 mg/l. This concentration is the detection level for purposes of paragraphs (g) (5), (6), (7), and (8) of this section.

(Approved by the Office of Management and Budget under control number 2040-0090)

[40 FR 59570, Dec. 24, 1975, as amended at 44 FR 68641, Nov. 29, 1979; 45 FR 57345, Aug. 27, 1980; 47 FR 10998, Mar. 12, 1982; 52 FR 25712, July 8, 1987; 53 FR 5147, Feb. 19, 1988; 53 FR 25110, July 1, 1988]

/2/ See footnote 2 to 141.23.

/5/ Techniques of Water-Resources Investigation of the United States Geological Survey, Chapter A-3, ''Methods for Analysis of Organic Substances in Water,'' Book 5, 1971, Stock 2401-1227. Available from Superintendent of Documents, U.S. Government Printing Office., Washington, DC.

/6/ Solid Phase Extraction (SPE) Test Method Number SPE-550 is available from J.T. Baker Chemical Company, 22 Red School Lane, Phillipsburg, New Jersey 08865.

§ 141.25 ANALYTICAL METHODS FOR RADIOACTIVITY.

(a) The methods specified in Interim Radiochemical Methodology for Drinking Water, Environmental Monitoring and Support Laboratory, EPA-600/4-75-008, USEPA, Cincinnati, Ohio 45268, or those listed below, are to be used to determine compliance with §§ 141.15 and 141.16 (radioactivity) except in cases where alternative methods have been approved in accordance with 141.27.

(1) Gross Alpha and Beta -- Method 302 "Gross Alpha and Beta Radioactivity in Water" Standard Methods for the Examination of Water and Wastewater, 13th Edition, American Public Health Association, New York, NY., 1971.

(2) Total Radium -- Method 304 "Radium in Water by Precipitation" Ibid

(3) Radium-226 -- Method 305 "Radium-226 by Radon in Water" Ibid.

(4) Strontium-89,90 -- Method 303 "Total Strontium and Strontium-90 in Water" Ibid.

(5) Tritium -- Method 306 "Tritium in Water" Ibid.

(6) Cesium-134 -- ASTM D-2459 "Gamma Spectrometry in Water," 1975 Annual Book of ASTM Standards, Water and Atmospheric Analysis, Part 31, American Society for Testing and Materials, Philadelphia, PA. (1975).

(7) Uranium -- ASTM D-2907 "Microquantities of Uranium in Water by Fluorometry," Ibid.

(b) When the identification and measurement of radionuclides other than those listed in paragraph (a) of this section is required, the following references are to be used, except in cases where alternative methods have been approved in accordance with § 141.27.

(1) Procedures for Radiochemical Analysis of Nuclear Reactor Aqueous Solutions. H. L. Krieger and S. Gold, EPA-R4-73-014. USEPA, Cincinnati, Ohio, May 1973.

(2) HASL Procedure Manual, Edited by John H. Harley. HASL 300, ERDA Health and Safety Laboratory, New York, NY., 1973.

(c) For the purpose of monitoring radioactivity concentrations in drinking water, the required sensitivity of the radioanalysis is defined in terms of a detection limit. The detection limit shall be that concentration which can be counted with a precision of plus or minus 100 percent at the 95 percent confidence level (1.96 where is the standard deviation of the net counting rate of the sample).

(1) To determine compliance with 141.15(a) the detection limit shall not exceed 1 pCi/l. To determine compliance with § 141.15(b) the detection limit shall not exceed 3 pCi/l.

(2) To determine compliance with § 141.16 the detection limits shall not exceed the concentrations listed in Table B.

Table B -- Detection Limits for Man-made Beta Particle and Photon Emitters

RADIONUCLIDE	DETECTION LIMIT
Tritium	1,000 pCi/l
Strontium 89	10 pCi/l
Strontium 90	2 pCi/l
Iodine 131	1 pCi/l
Cesium 134	10 pCi/l
Gross Beta	4 pCi/l
Other Radionuclides	1/10 of the applicable limit

(d) To judge compliance with the maximum contaminant levels listed in §§ 141.15 and 141.16, averages of data shall be used and shall be rounded to the same number of significant figures as the maximum contaminant level or the substance in question.

(e) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[41 FR 28404, July 9, 1976, as amended at 45 FR 57345, Aug. 27, 1980]

§ 141.26 MONITORING FREQUENCY FOR RADIOACTIVITY IN COMMUNITY WATER SYSTEMS.

(a) Monitoring requirements for gross alpha particle activity, radium-226 and radium-228.

(1) Initial sampling to determine compliance with § 141.15 shall begin within two years of the effective date of these regulations and the analysis shall be completed within three years of the effective date of these regulations. Compliance shall be based on the analysis of an annual composite of four consecutive quarterly samples or the average of the analyses of four samples obtained at quarterly intervals.

(i) A gross alpha particle activity measurement may be substituted for the required radium-226 and radium-228 analysis Provided, That the measured gross alpha particle activity does not exceed 5 pCi/l at a confidence level of 95 percent (1.65 where is the standard deviation of the net counting rate of the sample). In localities where radium-228 may be present in drinking water, it is recommended that the State require radium-226 and/or radium-228 analyses when the gross alpha particle activity exceeds 2 pCi/l.

(ii) When the gross alpha particle activity exceeds 5 pCi/l, the same or an equivalent sample shall be analyzed for radium-226. If the concentration of radium-226 exceeds 3 pCi/l the same or an equivalent sample shall be analyzed for radium-228.

(2) For the initial analysis required by paragraph (a)(1) of this section, data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) Suppliers of water shall monitor at least once every four years following the procedure required by paragraph (a)(1) of this section. At the discretion of the State, when an annual record taken in conformance with paragraph (a)(1) of this section has established that the average annual concentration is less than half the maximum contaminant levels established

by § 141.15, analysis of a single sample may be substituted for the quarterly sampling procedure required by paragraph (a)(1) of this section.

(i) More frequent monitoring shall be conducted when ordered by the State in the vicinity of mining or other operations which may contribute alpha particle radioactivity to either surface or ground water sources of drinking water.

(ii) A supplier of water shall monitor in conformance with paragraph (a)(1) of this section within one year of the introduction of a new water source for a community water system. More frequent monitoring shall be conducted when ordered by the State in the event of possible contamination or when changes in the distribution system or treatment processing occur which may increase the concentration of radioactivity in finished water.

(iii) A community water system using two or more sources having different concentrations of radioactivity shall monitor source water, in addition to water from a free-flowing tap, when ordered by the State.

(iv) Monitoring for compliance with § 141.15 after the initial period need not include radium-228 except when required by the State, Provided, That the average annual concentration of radium-228 has been assayed at least once using the quarterly sampling procedure required by paragraph (a)(1) of this section.

(v) Suppliers of water shall conduct annual monitoring of any community water system in which the radium-226 concentration exceeds 3 pCi/l, when ordered by the State.

(4) If the average annual maximum contaminant level for gross alpha particle activity or total radium as set forth in § 141.15 is exceeded, the supplier of a community water system shall give notice to the State pursuant to § 141.31 and notify the public as required by § 141.32. Monitoring at quarterly intervals shall be continued until the annual average concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(b) Monitoring requirements for manmade radioactivity in community water systems.

(1) Within two years of the effective date of this part, systems using surface water sources and serving more than 100,000 persons and such other community water systems as are designated by the State shall be monitored for compliance with § 141.16 by analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. Compliance with § 141.16 may be assumed without further analysis if the average annual concentration of gross beta

particle activity is less than 50 pCi/l and if the average annual concentrations of tritium and strontium-90 are less than those listed in Table A, Provided, That if both radionuclides are present the sum of their annual dose equivalents to bone marrow shall not exceed 4 millirem/year.

(i) If the gross beta particle activity exceeds 50 pCi/l, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) Suppliers of water shall conduct additional monitoring, as ordered by the State, to determine the concentration of man-made radioactivity in principal watersheds designated by the State.

(iii) At the discretion of the State, suppliers of water utilizing only ground waters may be required to monitor for man-made radioactivity.

(2) For the initial analysis required by paragraph (b)(1) of this section data acquired within one year prior to the effective date of this part may be substituted at the discretion of the State.

(3) After the initial analysis required by paragraph (b)(1) of this section suppliers of water shall monitor at least every four years following the procedure given in paragraph (b)(1) of this section.

(4) Within two years of the effective date of these regulations the supplier of any community water system designated by the State as utilizing waters contaminated by effluents from nuclear facilities shall initiate quarterly monitoring for gross beta particle and iodine-131 radioactivity and annual monitoring for strontium-90 and tritium.

(i) Quarterly monitoring for gross beta particle activity shall be based on the analysis of monthly samples or the analysis of a composite of three monthly samples. The former is recommended. If the gross beta particle activity in a sample exceeds 15 pCi/l, the same or an equivalent sample shall be analyzed for strontium-89 and cesium-134. If the gross beta particle activity exceeds 50 pCi/l, an analysis of the sample must be performed to identify the major radioactive constituents present and the appropriate organ and total body doses shall be calculated to determine compliance with § 141.16.

(ii) For iodine-131, a composite of five consecutive daily samples shall be analyzed once each quarter. As ordered by the State, more frequent monitoring shall be conducted when iodine-131 is identified in the finished water.

(iii) Annual monitoring for strontium-90 and tritium shall be conducted by means of the analysis of a composite of four consecutive quarterly samples or analysis of four quarterly samples. The latter procedure is recommended.

(iv) The State may allow the substitution of environmental surveillance data taken in conjunction with a nuclear facility for direct monitoring of manmade radioactivity by the supplier of water where the State determines such data is applicable to a particular community water system.

(5) If the average annual maximum contaminant level for man-made radioactivity set forth in § 141.16 is exceeded, the operator of a community water system shall give notice to the State pursuant to 141.31 and to the public as required by § 141.32. Monitoring at monthly intervals shall be continued until the concentration no longer exceeds the maximum contaminant level or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

[41 FR 28404, July 9, 1976]

§ 141.27 ALTERNATE ANALYTICAL TECHNIQUES.

(a) With the written permission of the State, concurred in by the Administrator of the U.S. EPA, an alternate analytical technique may be employed. An alternate technique shall be accepted only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any MCL. The use of the alternate analytical technique shall not decrease the frequency of monitoring required by this part.

[45 FR 57345, Aug. 27, 1980]

§ 141.28 APPROVED LABORATORIES.

(a) For the purpose of determining compliance with §§ 141.21 through 141.27, §§ 141.41 and 141.42, samples may be considered only if they have been analyzed by a laboratory approved by the State except that measurements for turbidity, free chlorine residual, temperature and pH may be performed by any person acceptable to the State.

(b) Nothing in this part shall be construed to preclude the State or any duly designated representative of the State from taking samples or from using the results from such samples to determine compliance by a supplier of water with the applicable requirements of this part.

[45 FR 57345, Aug. 27, 1980; 47 FR 10999, Mar. 12, 1982]

S 141.29 MONITORING OF CONSECUTIVE PUBLIC WATER SYSTEMS.

When a public water system supplies water to one or more other public water systems, the State may modify the monitoring requirements imposed by this part to the extent that the interconnection of the systems jusifies treating them as a single system for monitoring purposes. Any modified monitoring shall be conducted pursuant to a schedule specified by the State and concurred in by the Administrator of the U.S. Environmental Protection Agency.

S 141.30 TOTAL TRIHALOMETHANES SAMPLING, ANALYTICAL AND OTHER REQUIREMENTS.

(a) Community water system which serve a population of 10,000 or more individuals and which add a disinfectant (oxidant) to the water in any part of the drinking water treatment process shall analyze for total trihalomethanes in accordance with this section. For systems serving 75,000 or more individuals, sampling and analyses shall begin not later than 1 year after the date of promulgation of this regulation. For systems serving 10,000 to 74.999 individuals, sampling and analyses shall begin not later than 3 years after the date of promulgation of this regulation. For the purpose of this section, the minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples. All samples taken within an established frequency shall be collected within a 24-hour period.

(b) (1) For all community water systems utilizing surface water sources in whole or in part, and for all community water systems utilizing only ground water sources that have not been determined by the State to qualify for the monitoring requirements of paragraph (c) of this section, analyses for total trihalomethanes shall be performed at quarterly intervals on at least four water samples for each treatment plant used by the system. At least 25 percent of the samples shall be taken at locations within the distribution system reflecting the maximum residence time of the water in the system. The remaining 75 percent shall be taken at representative locations in the distribution system, taking into account number of persons served, different sources of water and different treatment methods employed. The results of all analyses per quarter shall be arithmetically averaged and reported to the State within 30 days of the system's receipt of such results. Results shall also be reported to EPA until such monitoring requirements have been adopted by the State. All samples collected shall be used in the computation of the average, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in paragraph (e) of this section.

(2) Upon the written request of a community water system, the monitoring frequency required by paragraph (b)(1) of this section may be reduced by the State to a minimum of one sample analyzed for TTHMs per quarter taken at a point in the distribution system reflecting the maximum residence time of the water in the system, upon a written determination by the State that the data from at least 1 year of monitoring in accordance with paragraph (b)(1) of this section and local conditions demonstrate that total trihalomethane concentrations will be consistently below the maximum contaminant level.

(3) If at any time during which the reduced monitoring frquency prescribed under this paragraph applies, the results from any analysis exceed 0.10 mg/l of TTHMs and such results are confirmed by at least one check sample taken promptly after such results are received, or if the system makes any significant change to its source of water or treatment program, the system shall immediately begin monitoring in accordance with the requirements of paragraph (b)(1) of this section, which monitoring shall continue for at least 1 year before the frequency may be reduced again. At the option of the State, a system's monitoring frequency may and should be increased above the minimum in those cases where it is necessary to detect variations of TTHM levels within the distribution system.

(c) (1) Upon written request to the State, a community water system utilizing only ground water sources may seek to have the monitoring frequency required by paragraph (b)(1) of this section reduced to a minimum of one sample for maximum TTHM potential per year for each treatment plant used by the system taken at a point in the distribution system reflecting maximum residence time of the water in the system. The system shall submit to the State the results of at least one sample analyzed for maximum TTHM potential for each treatment plant used by the system taken at a point in the distribution system reflecting the maximum residence time of the water in the system. The system's monitoring frequency may only be reduced upon a written determination by the State that, based upon the data submitted by the system, the system has a maximum TTHM potential of less than 0.10 mg/l and that, based upon an assessment of the local conditions of the system, the system is not likely to approach or exceed the maximum contaminant level for total TTHMs. The results of all analyses shall be reported to the State within 30 days of the system's receipt of such results. Results shall also be reported to EPA until such monitoring requirements have been adopted by the State. All samples collected shall be used for determining whether the system must comply with the monitoring requirements of paragraph (b) of this section, unless the analytical results are invalidated for technical reasons. Sampling and analyses shall be conducted in accordance with the methods listed in paragraph (e) of this section.

(2) If at any time during which the reduced monitoring frequency prescribed under paragraph (c)(1) of this section applies, the results from any analysis taken by the system for maximum TTHM potential are equal to or greater than 0.10 mg/l, and such results are confirmed by at least one check sample taken promptly after such results are received, the system shall immediately begin monitoring in accordance with the requirements of paragraph (b) of this section and such monitoring shall

continue for at least one year before the frequency may be reduced again. In the event of any significant change to the system's raw water or treatment program, the system shall immediately analyze an additional sample for maximum TTHM potential taken at a point in the distribution system reflecting maximum residence time of the water in the system for the purpose of determining whether the system must comply with the monitoring requirements of paragraph (b) of this section. At the option of the State, monitoring frequencies may and should be increased above the minimum in those cases where this is necessary to detect variation of TTHM levels within the distribution system.

(d) Compliance with § 141.12(c) shall be determined based on a running annual average of quarterly samples collected by the system as prescribed in paragraph (b)(1) or (2) of this section. If the average of samples covering any 12 month period exceeds the Maximum Contaminant Level, the supplier of water shall report to the State pursuant to § 141.31 and notify the public pursuant to § 141.32. Monitoring after public notification shall be at a frequency designated by the State and shall continue until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(e) Sampling and analyses made pursuant to this section shall be conducted by one of the following EPA approved methods:

(1) "The Analysis of Trihalomethanes in Drinking Waters by the Purge and Trap Method," Method 501.1, EMSL, EPA Cincinnati, Ohio.

(2) "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction," Method 501.2, EMSL, EPA Cincinnati, Ohio.

Samples for TTHM shall be dechlorinated upon collection to prevent further production of Trihalomethanes, according to the procedures described in the above two methods. Samples for maximum TTHM potential should not be dechlorinated, and should be held for seven days at 25 C (or above) prior to analysis, according to the procedures described in the above two methods.

(f) Before a community water system makes any significant modifications to its existing treatment process for the purposes of achieving compliance with § 141.12(c), such system must submit and obtain State approval of a detailed plan setting forth its proposed modification and those safeguards that it will implement to ensure that the bacteriological quality of the drinking water served by such system will not be adversely affected by such modification. Each system shall comply with the provisions set forth in the State-approved plan. At a minimum, a State approved plan shall require the system modifying its disinfection practice to:

(1) Evaluate the water system for sanitary defects and evaluate the source water for biological quality;

(2) Evaluate its existing treatment practices and consider improvements that will minimize disinfectant demand and optimize finished water quality throughout the distribution system;

(3) Provide baseline water quality survey data of the distribution system. Such data should include the results from monitoring for coliform and fecal coliform bacteria, fecal streptococci, standard plate counts at 35 C and 20 C, phosphate, ammonia nitrogen and total organic carbon. Virus studies should be required where source waters are heavily contaminated with sewage effluent;

(4) Conduct additional monitoring to assure continued maintenance of optimal biological quality in finished water, for example, when chloramines are introduced as disinfectants or when pre-chlorination is being discontinued. Additional monitoring should also be required by the State for chlorate, chlorite and chlorine dioxide when chlorine dioxide is used. Standard plate count analyses should also be required by the State as appropriate before and after any modifications;

(5) Consider inclusion in the plan of provisions to maintain an active disinfectant residual throughout the distribution system at all times during and after the modification.

[44 FR 68641, Nov. 29, 1979, as amended at 45 FR 15545, 15547, Mar. 11, 1980]

§ 141.30 APPENDIX A - Summary of Public Comments and EPA

Responses on Proposed Amendments to the National Interim Primary Drinking Water Regulations for Control of Trihalomethanes in Drinking Water

[44 FR 68642, Nov. 29, 1979]

§ 141.30 APPENDIX B - Summary of Major Comments (for responses, see Appendix A)

[44 FR 68666, Nov. 29, 1979]

EDITORIAL NOTE: Appendices A and B appearing at 44 FR 68642 and 68666, Nov. 29, 1979, are not codified in the Code of Federal Regulations.
§ 141.30 Pt. 141, Subpt. C, App. C.

141.30 APPENDIX C -- Analysis of Trihalomethanes

Part I - The Analysis of Trihalomethanes in Drinking Water by the Purge and Trap Method

1. SCOPE

1.1 This method (1) is applicable in the determination of four trihalomethanes, i.e. chloroform, dichlorobromomethane, dibromochloromethane, and bromoform in finished drinking water, raw source water, or drinking water in any stage of treatment. The concentration of these four compounds is totaled to determine total trihalomethanes (TTHM).

1.2 For compounds other than the above-mentioned trihalomethanes, or for other sample sources, the analyst must demonstrate the usefulness of the method by collecting precision and accuracy data on actual samples as described (2).

1.3 Although the actual detection limits are highly dependent upon the gas chromatographic column and detector employed, the method can be used over a concentration range of approximately 0.5 to 1500 micrograms per liter.

1.4 Well in excess of 100 different water supplies have been analyzed using this method. Supplementary analyses using gas chromatography mass spectrometry (GC/MS) have shown that there is no evidence of interference in the determination of trihalomethanes (3). For this reason, it is not necessary to analyze the raw source water as is required with the Liquid/Liquid Extraction Method (4).

2. Summary

2.2 Trihalomethanes are extracted by an inert gas which is bubbled through the aqueous sample. The trihalomethanes, along with other organic constituents which exhibit low water solubility and a vapor pressure significantly greater than water, are efficiently transferred from the aqueous phase to the gaseous phase. These compounds are swept from the purging device and are trapped in a short column containing a suitable sorbent. After a predetermined period of time, the trapped components are thermally desorbed and backflushed onto the head of a gas chromatographic column and separated under programmed conditions. Measurement is accomplished with a halogen specific detector such as electrolytic conductivity or microcoulometric titration.

2.3 Confirmatory analyses are performed using dissimilar columns, or by mass spectrometry (5).

2.4 Aqueous standards and unknowns are extracted and analyzed under identical conditions in order to compensate for extraction losses.

2.5 The total analysis time, assuming the absence of other organohalides, is approximately 35 minutes per sample.

3. Interferences

3.1 Impurities contained in the purge gas and organic compounds outgasing from the plumbing ahead of the trap usually account for the majority of contamination problems. The presence of such inteferences are easily monitored as a part of the quality control program. Sample blanks are normally run between each set of samples. When a positive trihalomethane response is noted in the sample blank, the analyst should analyze a method blank. Method blanks are run by charging the purging device with organic-free water and analyzing in the normal manner.

If any trihalomethane is noted in the method blank in excess of 0.4 g/l. the analyst should change the purge gas source and regenerate the molecular sieve purge gas filter. Subtracting the blank values is not recommended. The use of non-TFE plastic tubing, non-TFE thread sealants, or flow controllers with rubber components should be avoided since such materials generally out-gas organic compounds which will be concentrated in the trap during the purge operation. Such out-gasing problems are common whenever new equipment is put into service: as time progresses, minor out-gasing problems generally cure themselves.

3.2 Several instances of accidental sample contamination have been noted and attributed to diffusion of volatile organics through the septum seal and into the sample during shipment and storage. The sample blank is used as a monitor for this problem.

3.3 For compounds that are not efficiently purged, such as bromoform small variations in sample volume, purge time, purge flow rate, or purge temperature can affect the analytical result. Therefore, samples and standards must be analyzed under identical conditions.

3.4 Cross-contamination can occur whenever high-level and low-level samples are sequentially analyzed. To reduce this likelihood, the purging device and sample syringe should be rinsed twice between samples with organic-free water. Whenever an unusually concentrated sample is encountered, it is highly recommended that it be followed by a sample blank analysis to ensure that sample cross contamination does not occur. For samples containing large amounts of water soluble materials, it may be necessary to wash out the purging device with a soap solution, rinse with distilled water, and then dry in a 105 C oven between analyses.

3.5 Qualitative misidentifications are a problem in using gas chromatographic analysis. Whenever samples whose qualitative nature is unknown are analyzed, the following precautionary measures should be incorporated into the analysis.

3.5.1 Perform duplicate analyses using the two recommended columns (4.2.1 and 4.2.2) which provide different retention order and retention times for the trihalomethanes and other organohalides.

3.5.2 Whenever possible, use GC/MS techniques which provide unequivocal qualitative identifications (5).

4. Apparatus

4.1 The purge and trap equipment consists of three separate pieces of apparatus: the purging device, trap, and desorber. Construction details or a purging device and an easily automated trap-desorber hybrid which has proven to be exceptionally efficient and reproducible are shown in Figures 1 through 4 and described in

4.1.1. through 4.1.3. An earlier acceptable version of the above-mentioned equipment is described in (1).

4.1.1 Purging Device -- Construction details are given in Figure 1 for an all-glass 5 ml purging device. The glass frit installed at the base of the sample chamber allows finely divided gas bubbles to pass through the sample while the sample is restrained above the frit. Gaseous volumes above the sample are kept to a minimum to eliminate dead volume effects, yet allowing sufficient space for most foams to disperse. The inlet and exit ports are constructed from heavy-walled 1/4-inch glass tubing so that leak-free removable connections can be made using ''finger-tight'' compression fittings containing Teflon ferrules. The removable foam trap is used to control samples that foam.

4.1.2 Trapping Device -- The trap (Figure 2) is a short gas chromatographic column which at <35 C retards the flow of the compounds of interest while venting the purge gas and, depending on which sorbent is used, much of the water vapor. The trap should be constructed with a low thermal mass so that it can be heated to 180 C in less than 1 minute for efficient desorption, then rapidly cooled to room temperature for recycling. Variations in the trap ID, wall thickness, sorbents, sorbent packing order, and sorbent mass could adversely affect the trapping and desorption efficiencies for compounds discussed in this text. For this reason, it is important to faithfully reproduce the trap configurations recommended in Figure 2. Traps containing Tenax only, or combinations of Tenax and other sorbents are acceptable for this analysis.

4.1.3 Desorber assembly -- Details for the desorber are shown in Figures 3, and 4. With the 6-port valve in the Purge Sorb position (Figure 3), the effluent from the purging device passes through the trap where the flow rate of the organics is retarded. The GC carrier gas also passes through the 6-port valve and is returned to the GC. With the 6-port valve in the Purge-Sorb position, the operation of the GC is in no way impaired; therefore, routine liquid injection analyses can be performed using the gas chromatograph. After the sample has been purged, the 6-port valve is turned to the desorb position (Figure 4). In this configuration the trap is coupled in series with the gas chromatographic column allowing the carrier gas to backflush the trapped materials into the analytical column. Just as the valve is actuated, the power is turned on to the resistance wire wrapped around the trap. The power is supplied by an electronic temperature controller. Using this device, the trap is rapidly heated to 180 C and then maintained at 180 C with minimal temperature overshoot. The trapped compounds are released as a "plug" to the gas chromatograph. Normally, packed columns with theoretical efficiencies near 500 plates/foot under programmed temperature conditions can accept such desorb injections without altering peak geometry. Substituting a non-controlled power supply, such as a manually-operated variable transformer, will provide nonreproductible retention times and poor quantitative data unless Injection Procedure (8.9.2) is used.

4.1.4 Several Purge and Trap Devices are now commercially available. It is recommended that the following be taken into consideration if a unit is to be purchased:

a. Be sure that the unit is completely compatible with the gas chromatograph to be used for the analysis.

b. Use a 5-ml purging device similar to that shown in Figure 1.

c. Be sure the Tenax portion of the trap meets or exceeds the dimensions shown in Figure 2.

d. With the exception of sample introduction, select a unit that has as many of the purge trap functions automated as possible.

4.2 Gas chromatograph -- The chromatograph must be temperature programmable and equipped with a halide specific detector.

4.2.1 Column I is an unusually efficient column which provides outstanding separations for a wide variety of organic compounds. Because of its ability to resolve trihalomethanes from other organochlorine compounds, column I should be used as the primary analytical column (see Table 1 for retention data using this column).

4.2.1.1 Column I parameters: Dimensions -- 8 feet longx0.1 inch ID stainless steel or glass tubing. Packing -- 1% SP-1000 on Carbopack-B (60/80) mesh. Carrier Gas -- helium at 40 ml/minute. Temperature program sequence: 45 C isothermal for 3 minutes, program at 8 C/minute to 220 C then hold for 15 minutes or until all compounds have eluted.

NOTE: It has been found that during handling, packing, and programming, active sites are exposed on the Carbopack-B packing. This results in tailing peak geometry and poor resolution of many constituents. To correct this, pack the first 5 cm of the column with 3% SP-1000 on Chromosorb-W 60/80 followed by the Carbopack-B packing. Condition the precolumn and the Carbopack columns with carrier gas flow at 220 C overnight. Pneumatic shocks and rough treatment of packed columns will cause excessive fracturing of the Carbopack. If pressure in excess of 60 psi is required to obtain 40 ml/minute carrier flow, then the column should be repacked.

4.2.1.2 Acceptable column equivalent to Column I: Dimensions -- 8 feet longx0.1 inch ID stainless steel or glass tubing. Packing -- 0.2% Carbowax 1500 on Carbopack-C (80/100) mesh. Carrier Gas -- helium at 40 ml/minute. Temperature program sequence -- 60 C isothermal for 3 minutes, program at 8 C /minute to 160 C, then hold for 2 minutes or until all compounds have eluted.

NOTE: It has been found that during handling, packing, and programming, active sites are exposed on the Carbopack-C packing. This results in poor resolution of constituents and poor peak geometry. To correct this, place a 1 ft. 0.125 in. ODx0.1 in. ID stainless steel column packed with 3% Carbowax 1500 on Chromosorb-W 60/80 mesh in series before the Carbopack-C column. Condition the precolumn and the Carbopack columns with carrier gas flow at 190 C overnight. The two columns may be retained in series for routine analyses. Trihalomethane retention times are listed in Table 1.

4.2.2 Column II provides unique organohalide-trihalomethane separations when compared to those obtained from Column I (see Figures 5 and 6). However, since the resolution between various compounds is generally not as good as those with Column I, it is recommended that Column II be used as a qualitative confirmatory column for unknown samples when GC/MS confirmation is not possible.

4.2.2.1 Column II parameters: Dimensions -- 6 feet longx0.1 inch ID stainless steel or glass. Packing -- n-octane on Porisil-C (100/120 mesh). Carrier Gas -- helium at 40 cc/minute. Temperature program sequence -- 50 C isothermal for 3 minutes, program at 6 /minute to 170 C, then hold for 4 minutes or until all compounds have eluted. Trihalomethane retention times are listed in Table 1.

5.8 Organic-free water is defined as water free of interference when employed in the purge and trap analysis.

5.8.1 Organic-free water is generated by passing tap water through a carbon filter bed containing about 1 lb. of activated carbon. Change the activated carbon bed whenever the concentration of any trihalomethane exceeds 0.4 g/l.

5.8.2 A Millipore Super-Q Water System or its equivalent may be used to generate organic-free water.

5.8.3 Organic-free water may also be prepared by boiling water for minutes. Subsequently, while maintaining the temperature at 90 C, bubble a contaminant-free inert gas through the water for one hour. While still hot, transfer the water to a narrow-mouth screw-cap bottle with a Teflon seal.

5.8.4 Test organic free water each day it is used by analyzing according to Section 8.

5.9 Standards.a

5.9.1 Bromoform -- 96% -- available from Aldrich Chemical Company.

5.9.2 Bromodichloromethane 97% -- available from Aldrich Chemical Company.

5.9.3 Chlorodibromomethane -- available from Columbia Chemical Inc., Columbia, S.C.

5.9.4 Chloroform -- 99% -- available from Aldrich Chemical Company.

5.10 **Standard Stock Solutions.**

5.10.1 Place about 9.8 ml of methyl alcohol into a ground glass stoppered 10 ml volumetric flask.

5.10.2 Allow the flask to stand unstoppered about 10 minutes or until all alcohol wetted surfaces have dried.

5.10.3 Weigh the flask to the nearest 0.1 mg.

5.10.4 Using a 100 l syringe, immediately add 2 drops of the reference standard to the flask, then reweigh. Be sure that the 2 drops fall directly into the alcohol without contacting the neck of the flask.

5.10.5 Dilute to volume, stopper, then mix by inverting the flask several times.

5.10.6 Transfer the solution to a dated and labeled 15 ml screw cap bottle with a Teflon cap liner.

Note: Because of the toxicity of trihalomethanes, it is necessary to prepare primary dilutions in a hood. It is further recommended that a NIOSH/MESA approved toxic gas respirator be used when the analyst handles high concentrations of such materials.

5.10.7 Calculate the concentration in micrograms per microliter from the net gain in weight.

5.10.8 Store the solution at 4 C.

Note: All standard solutions prepared in methyl alcohol are stable up to 4 weeks when stored under these conditions. They should be discarded after that time has elapsed.

5.11 Aqueous Calibration Standard Precautions.

5.11.1 In order to prepare accurate aqueous standard solutions, the following precautions must be observed.

a. Do not inject more than 20 l of alcoholic standards into 100 ml of organiz-free water.

b. Use of 25 l Hamilton 702N microsyringe or equivalent. (Variations in needle geometry will adversely affect the ability to deliver reproducible volumes of methanolic standards into water.)

c. Rapidly inject the alcoholic standard into the expanded area of the filled volumetric flask. Remove the needle as fast as possible after injection.

d. Mix aqueous standards by inverting the flask three times only.

e. Discard the contents contained in the neck of the flask. Fill the sample syringe from the standard solution contained in the expanded area of the flask as directed in Section 8.5.

f. Never use pipets to dilute or transfer samples or aqueous standards.

g. Aqueous standards when stored with a headspace are not stable and should be discarded after one hour.

h. Aqueous standards can be stored according to Sections 6.4 and 8.6.

5.11.2 Prepare, from the standard stock solutions, secondary dilution mixtures in methyl alcohol so that a 20 l injection into 100 ml of organic-free water will generate a calibration standard which produces a response close (+10%) to that of the sample (See 9.1).

5.11.3 Purge and analyze the aqueous calibration standards in the same manner as the samples.

5.11.4 Other calibration procedures (3) which require the delivery of less than 20 l of a methanolic standard into a 5.0 ml volume of water already contained in the sample syringe are acceptable only if the methanolic standard is delivered by the solvent flush technique (6).

5.12 Quality Check Standard (2.0 g/l)

5.12.1 From the standard stock solutions, prepare a secondary dilution in methyl alcohol containing 10 ng/ l of each trihalomethane (See Section 5.10.8 Note).

5.12.2 Daily, inject 20.0 l of this mixture into 100.0 ml of organic-free water ana analyze according to Section 8.

6. Sample Collection and Handling

6.1. The sample containers should have a total volume of at least 25ml.

6.1.1 Narrow mouth screw cap bottles with the TFE fluorocarbon face silicone septa cap liners are strongly recommended.

6.2 Sample Bottle Preparation

6.2.1 Wash all sample bottles and TFE seals in detergent. Rinse with tap water and finally with distilled water.

6.2.2 Allow the bottles and seals to air dry at room temperature, then place in a 105 C oven for one hour, then allow to cool in a area known to be free of organics.

Note: Do not heat the TFE seals for extended period of time (1 hour) because the silicone layer slowly degrades at 105 C.

6.2.3 When cool, seal the bottles using the TFE seals that will be used for sealing the samples.

6.3 Sample Stabilization -- A chemical reducing agent (Section 5.6) is added to the sample in order to arrest the formation of trihalo-methanes after sample collection (3, 7). Do not add the reducing agent to samples when data on maximum trihalomethane formation is desired. If chemical stabilization is employed, the reagent is also added to the blanks. The chemical agent (2.5 to 3 mg/40 ml) is added to the empty sample bottles just prior to shipping to the sampling site.

6.4 Sample Collection

6.4.1 Collect all samples in duplicate.

6.4.2 Fill the sample bottles in such a manner that no air bubbles pass through the sample as the bottle is filled.

6.4.3 Seal the bottles so that no air bubbles are entrapped in it.

6.4.4 Maintain the hermetic seal on the sample bottle until analysis.

6.4.5 Sampling from a water tap.

6.4.5.1 Turn on water and allow the system to flush until the temperature of the water has stabilized. Adjust the flow to about 500 ml/minute and collect duplicate samples from the flowing stream.

6.4.6 Sampling from an open body of water.

6.4.6.1 Fill a 1-quart wide-mouth bottle with sample from a representative area. Carefully fill duplicate sample bottles from the 1-quart bottle as noted in 6.4.2.

6.4.7 If a chemical reducing agent has been added to the sample bottles, fill with sample just to overflowing, seal the bottle, and shake vigorously for 1 minute.

6.4.8 Sealing practice for septum seal screw cap bottles.

6.4.8.1 Open the bottle and fill to overflowing, place on a level surface, position the TFE side of the septum seal upon the convex sample meniscus and seal the bottle by screwing the cap on tightly.

6.4.8.2 Invert the sample and lightly tap the cap on a solid surface. The absence of entrapped air indicates a successful seal. If bubbles are present, open the bottle, add a few additional drops of sample and reseal the bottle as above.

6.4.9 Blanks.

6.4.9.1 Prepare blanks in duplicate at the laboratory by filling and sealing sample bottles with organic-free water just prior to shipping the sample bottles to the sampling site.

6.4.9.2 If the sample is to be stabilized, add an identical amount of stabilization reagent to the blanks.

6.4.9.3 Ship the blanks to and from the sampling site along with the sample bottles.

6.4.9.4 Store the blanks and the samples collected at a given site (sample set) together. A sample set is defined as all the samples collected at a given site (i.e., at a water treatment plant, the duplicate raw source waters, the duplicate finished waters and the duplicate blank samples comprise the sample set).

6.5 When samples have been collected according to Section 6, no measurable loss of trihalomethanes has been detected over extended periods of storage time (3). It is recommended that all samples be analyzed within 14 days of collection.

7. Conditioning Traps

7.1 Condition newly packed traps overnight at 180 C with an inert gas flow of at least 20 ml/min.

7.1.1 Vent the trap effluent to the room, not to the analytical column.

7.2 Prior to daily use, condition traps 10 minutes while backflushing at 180 C. It may be beneficial to routinely condition traps overnight while backflushing at 180 C.

7.2.1 The trap may be vented to the analytical column; however, after conditioning, the column must be programmed prior to use.

8. Extraction and Analysis

8.1 Adjust the purge gas (nitrogen or helium) flow rate to 40 ml/min.

8.2 Attach the trap inlet to the purging device. Turn the valve to the purge-sorb position (Figure 3).

8.3 Open the syringe valve located on the purging device sample introduction needle.

8.4 Remove the plungers from two 5 ml syringes and attach a closed syringe valve to each.

8.5 Open the sample bottle and carefully pour the sample into one of the syringe barrels until it overflows. Replace the syringe plunger and compress the sample. Open the syringe valve and vent any residual air while adjusting the sample volume to 5.0 ml. Close the valve.

8.6 Fill the second syringe in an identical manner from the same sample bottle. This second syringe is reserved for a duplicate analysis, if necessary (See Sections 9.3 and 9.4).

8.7 Attach the syringe-valve assembly to the syringe valve on the purging device.

8.8 Open the syringe valve and inject the sample into the purging chamber. Close both valves. Purge the sample for 11.0 .05 minutes.

8.9 After the 11-minute purge time, attach the trap to the chromatograph (turn the valve to the desorb position) and introduce the trapped materials to the GC column by rapidly heating the trap to 180 C while backflushing the trap with an inert gas between 20 and 60 ml/min for 4 minutes.

8.9.1 If the trap can be rapidly heated to 180 C and maintained at this temperature, the GC analysis can begin as the sample is desorbed, i.e., the column is at the initial 45 C operating temperature. The equipment described in Figure 4 will perform accordingly.

8.9.2 With other types of equipment (see Section 4.1.4 and Reference 1) where the trap is not rapidly heated or is not heated in a reproducible manner, it may be necessary to transfer the contents of the trap into the analytical column at <30 C where it is once again trapped. Once the transfer is complete (4 minutes), the column is rapidly heated to the initial operating temperature for analysis.

8.9.3 If injection procedure 8.9.1 is used and the early eluting peaks in the resulting chromatogram have poor geometry or variable retention times, then Section 8.9.2 should be used.

8.10 After the extracted sample is introduced into the gas chromatograph, empty the gas purging device using the sample introduction syringe, followed by two 5-ml flushes of organic-free water. When the purging device is emptied, leave the syringe valve open allowing the purge gas to vent through the sample introduction needle.

8.11 Analyze each sample and sample blank from the sample set in an identical manner (see Section 6.4.9.4) on the same day.

8.12 Prepare calibration standards from the standard stock solutions (Section 5.10) in organic-free water that are close to the unknown in trihalomethane composition and concentration (Section 9.1). The concentrations should be such that only 20 1 or less of the secondary dilution need be added to 100 ml of organic-free water to produce a standard at the same level as the unknown.

8.13 As an alternative to Section 8.12, prepare a calibration curve for each trihalomethane containing at least 3 points, two of which must bracket the unknown.

9. Analytical Quality Control

9.1 Analyze the 2 g/l check sample daily before any samples are analyzed. Instrument status checks and lower limit of detection estimations based upon response factor calculations at five times the noise level are obtained from these data. In addition, response factor data obtained from the 2 g/l check standard can be used to estimate the concentration of the unknowns. From this information, the appropriate standard dilutions can be determined.

9.2 Analyze the sample blank to monitor for potential interferences as described in Sections 3.1, 3.2, and 3.4.

9.3 Spiked Samples.

9.3.1 For laboratories analyzing more than 10 samples a day, each 10th sample should be a laboratory generated spike which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in Section 5.11.

9.3.2 For laboratories analyzing less than 10 samples daily, each time the analysis is performed, analyze at least 1 laboratory generated spike sample which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in Section 5.11.

9.4 Randomly select and analyze 10% of all samples in duplicate.

9.4.1 Analyze all samples in duplicate which appear to deviate more than 30% from any established norm.

9.5 Maintain an up-to-date log on the accuracy and precision data collected in Sections 9.3 and 9.4. If results are significantly different than those cited in Section 11.1, the analyst should check out the entire analyses scheme to determine why the laboratory's precision and accuracy limits are greater.

9.6 Quarterly, spike an EMSL-Cincinnati trihalomethane quality control sample into organic-free water and analyze.

9.6.1 The results of the EMSL trihalomethane quality control sample should agree within 20% of the true value for each trihalomethane. If they do not then the analyst must check each step in the standard generation procedure to solve the problem (Sections 5.9, 5.10, and 5.11).

9.7 Maintain a record of the retention times for each trihalomethane using data gathered from spiked samples and standards.

9.7.1 Daily calculate the average retention time for each trihalomethane and the variance encountered for the analyses.

9.7.2 If individual trihalomethane retention time varies by more than 10% over an eight hour period or does not fall with 10% of an established norm, the system is "out of control." The source of retention data variation must be corrected before acceptable data can be generated.

10. Calculations

10.1 Locate each trihalomethane in the sample chromatogram by comparing the retention time of the suspect peak to the data gathered in 9.7.1. The retention time of the suspect peak must fall within the limits established in 9.7.1 for single column identification.

10.2 Calculate the concentration of the samples by comparing the peak height or peak areas of the samples to the standard peak height (8.12). Round off the data to the nearest g/l or two significant figures.

10.3 Report the results obtained from the lower limit of detection estimates along with the data for the samples.

10.4 Calculate the total trihalomethane concentration (TTHM) by summing the 4 individual trihalomethane concentrations in g/l. TTHM (g/l)=(Conc. $CHCl_3$)+(Conc. $CHBrCl_2$)+(Conc. $CHBr_2Cl$)+(Conc. $CHBr$).

10.5 Calculate the limit of detection (LOD) for each trihalomethane not detected using the following criteria:

$$LOD\ (ug/l) = [(A \times ATT) / (B \times ATT)] \times (2\ ug/l)$$

where

B=peak height (mm) of 2 g/1 quality check standard

A=5 times the noise level in (mm) at the exact retention time of the trihalomethane or the baseline displacement in (mm) from the theoretical zero at the exact retention time of the trihalomethane.

ATT=Attenuation factor.

11. Accuracy and Precision

11.1 One liter of organic-free water was spiked with the trihalomethanes and used to fill septum seal vials which were stored under ambient conditions. The spiked samples were randomly analyzed over a 2-week period of time. The single laboratory data listed in Table II reflect the errors due to the analytical procedure and storage.

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Table I -- Retention Data for Trihalomethanes

	RETENTION TIME MINUTES	RETENTION TIME MINUTES	RETENTION TIME MINUTES
Trihalomethane	Column I, 1% sp1000 CARBOPACK B	Accept.Alter. to Column 1, 0.4% Carbowax Carbopack	Column II n-octane Porasil-C
Chloroform	10.7	8.2	12.2
Bromodichloro methane	13.7	10.8	14.7
Chlorodibromomethane (Dibromochloromethane)	16.5	13.2	16.6
Bromoform	19.2	15.7	19.2

Table II -- Single Laboratory Accuracy and Precision for Trihalomethanes

Spike ug/l	No. Samples	Mean ug/l	Precision Standard Deviation	Accuracy % Recovery
CHLOROFORM				
1.2	12	1.2	0.14	100
12.0	8	11.0	0.16	92
119.0	11	105.0	7.90	88
BROMODI-CHLORO-METHANE				
1.6	12	1.5	0.05	94
16.0	8	15.0	0.39	94
160.0	11	145.0	10.2	91

Spike ug/l	No. Samples	Mean ug/l	Precision Standard Deviation	Accuracy % Recovery
CHLORO-DIBROMO-METHANE				
2.0	12	1.9	0.09	95
20.0	8	19.0	0.70	95
196.0	11	185.0	10.6	94
BROMOFORM				
2.3	12	2.3	0.16	100
23.0	8	23.0	1.38	100
231.0	11	223.0	16.3	97

As a precautionary measure, all standards must be checked for purity by boiling point determinations or GC/MS assays (5)

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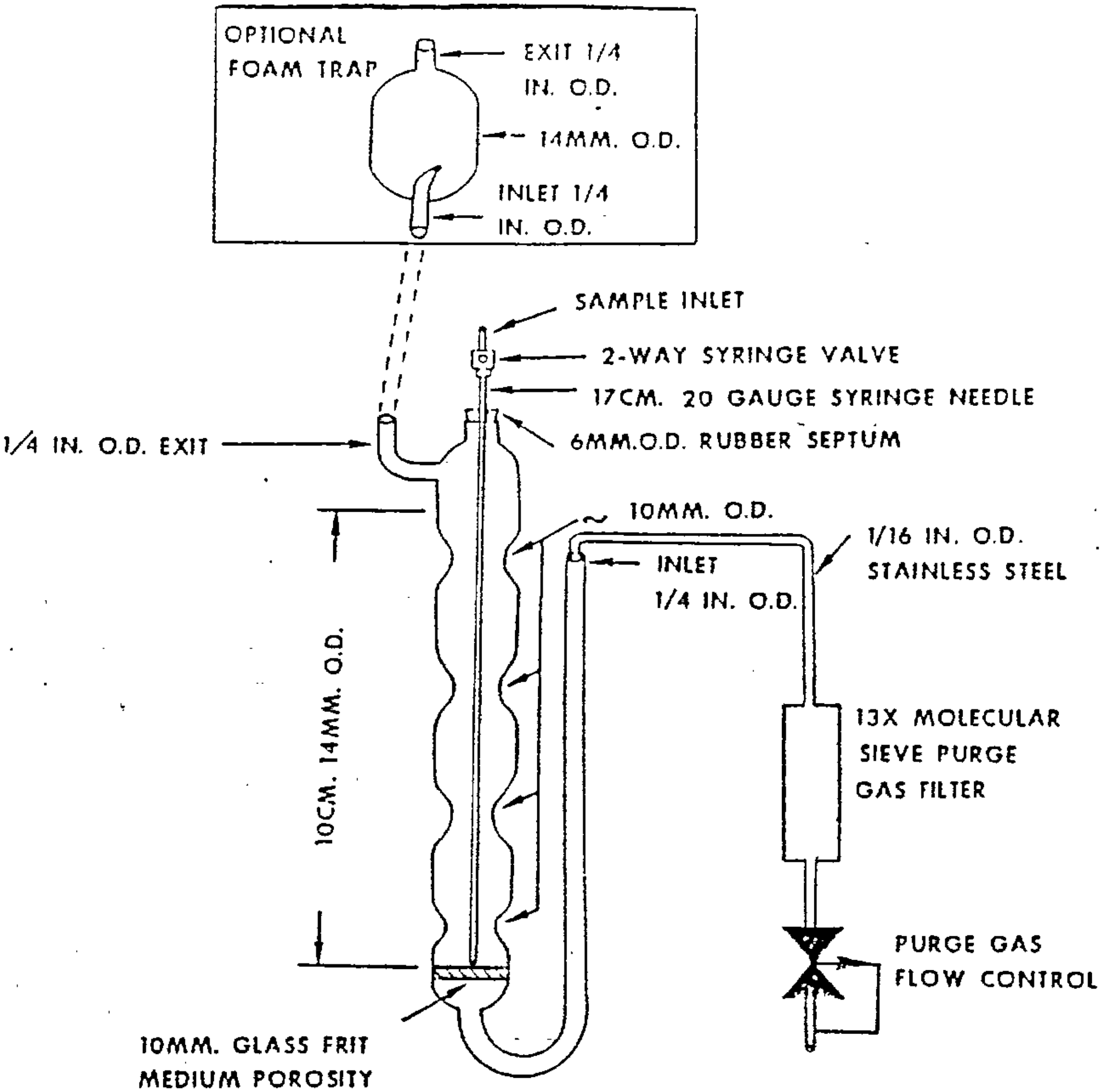


FIGURE 1. PURGING DEVICE

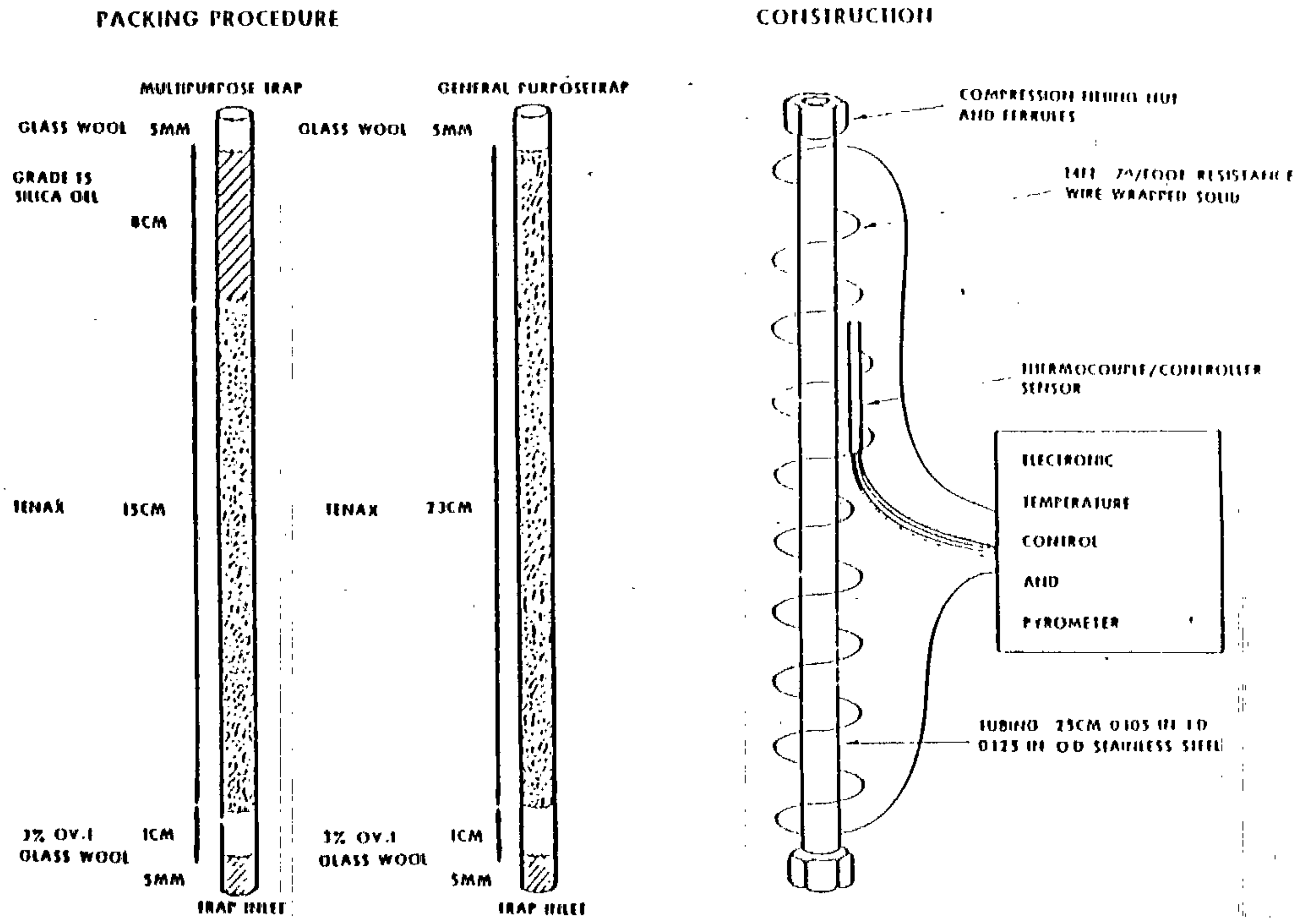
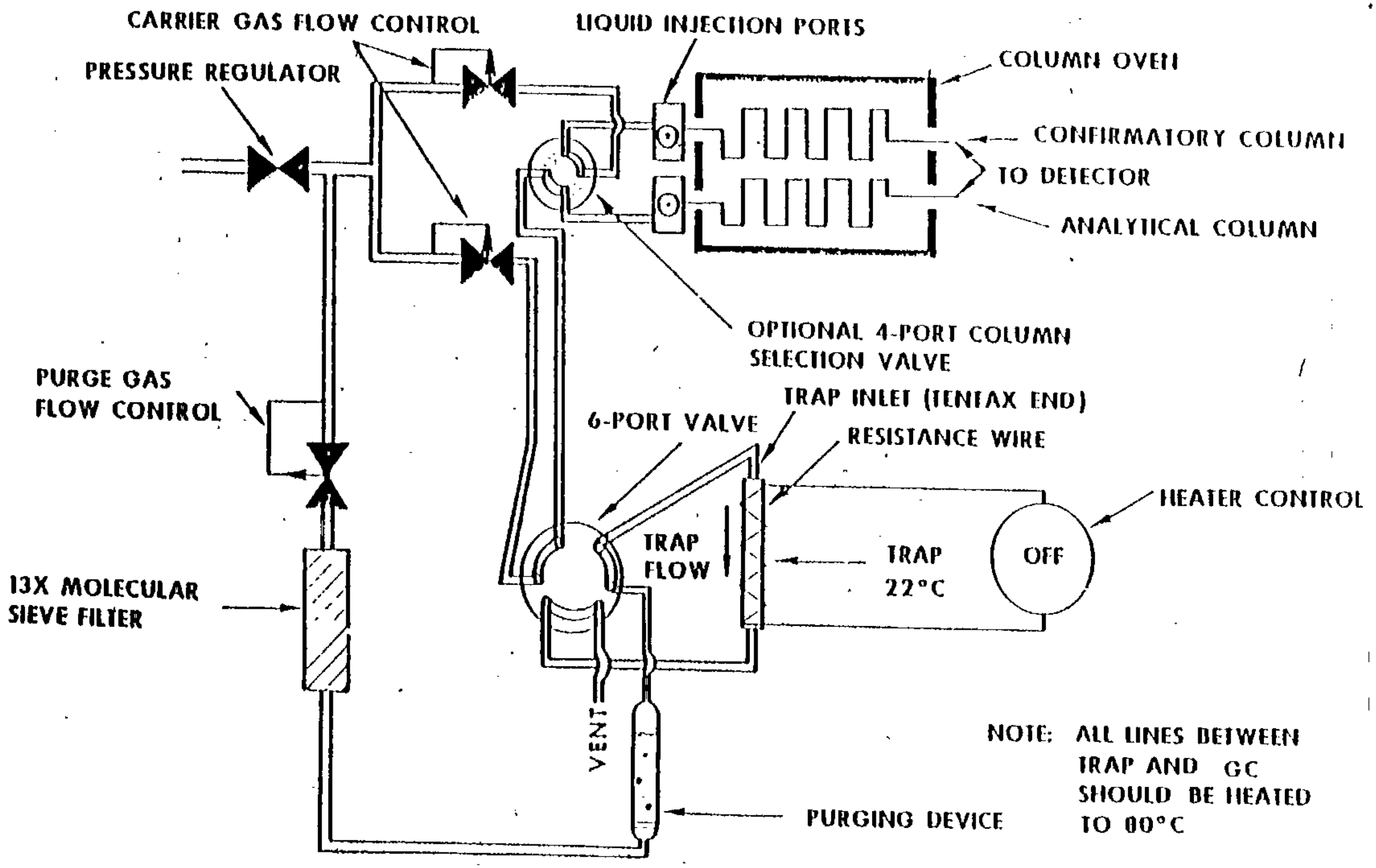
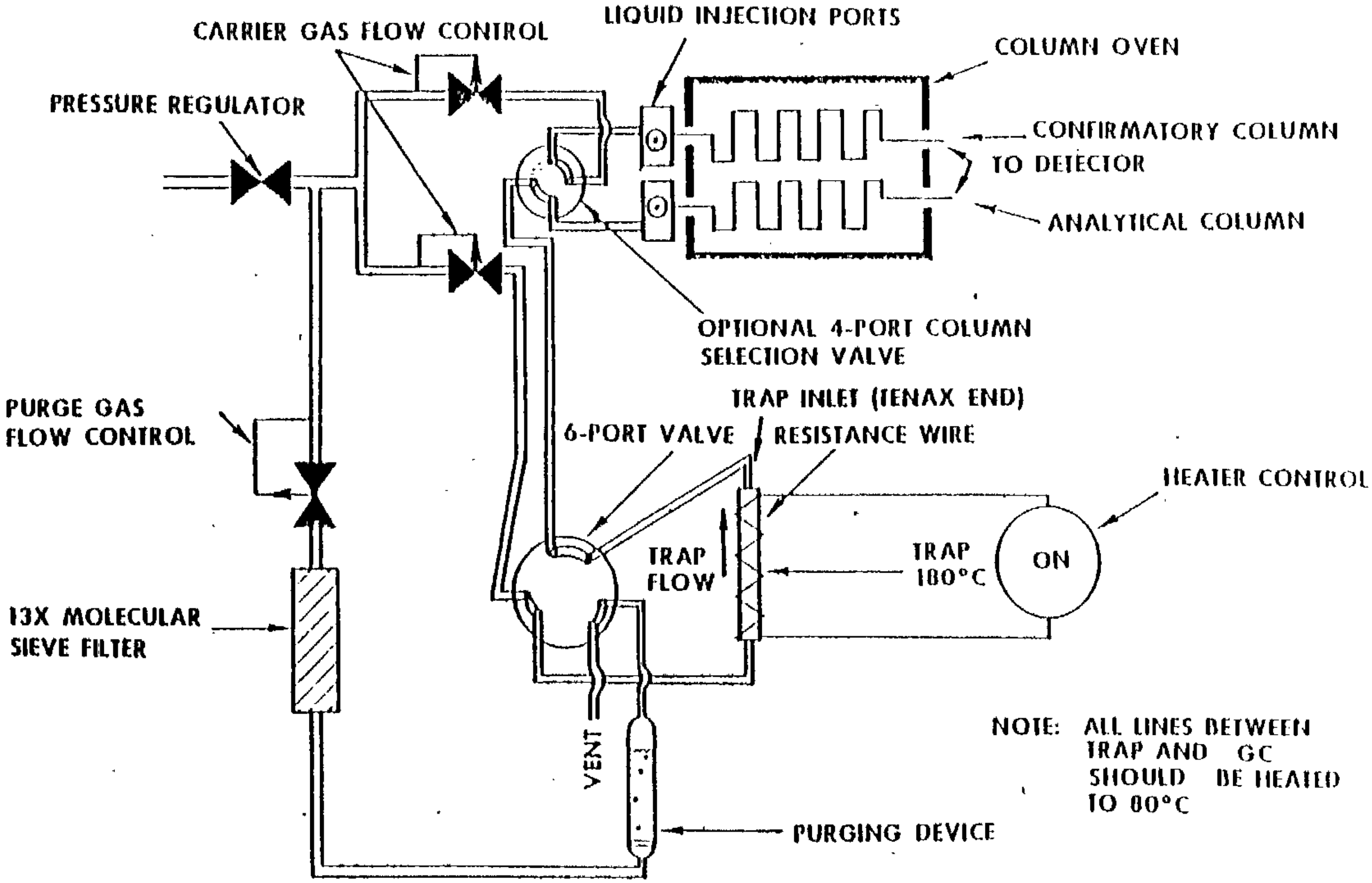


FIGURE 2 TRAP



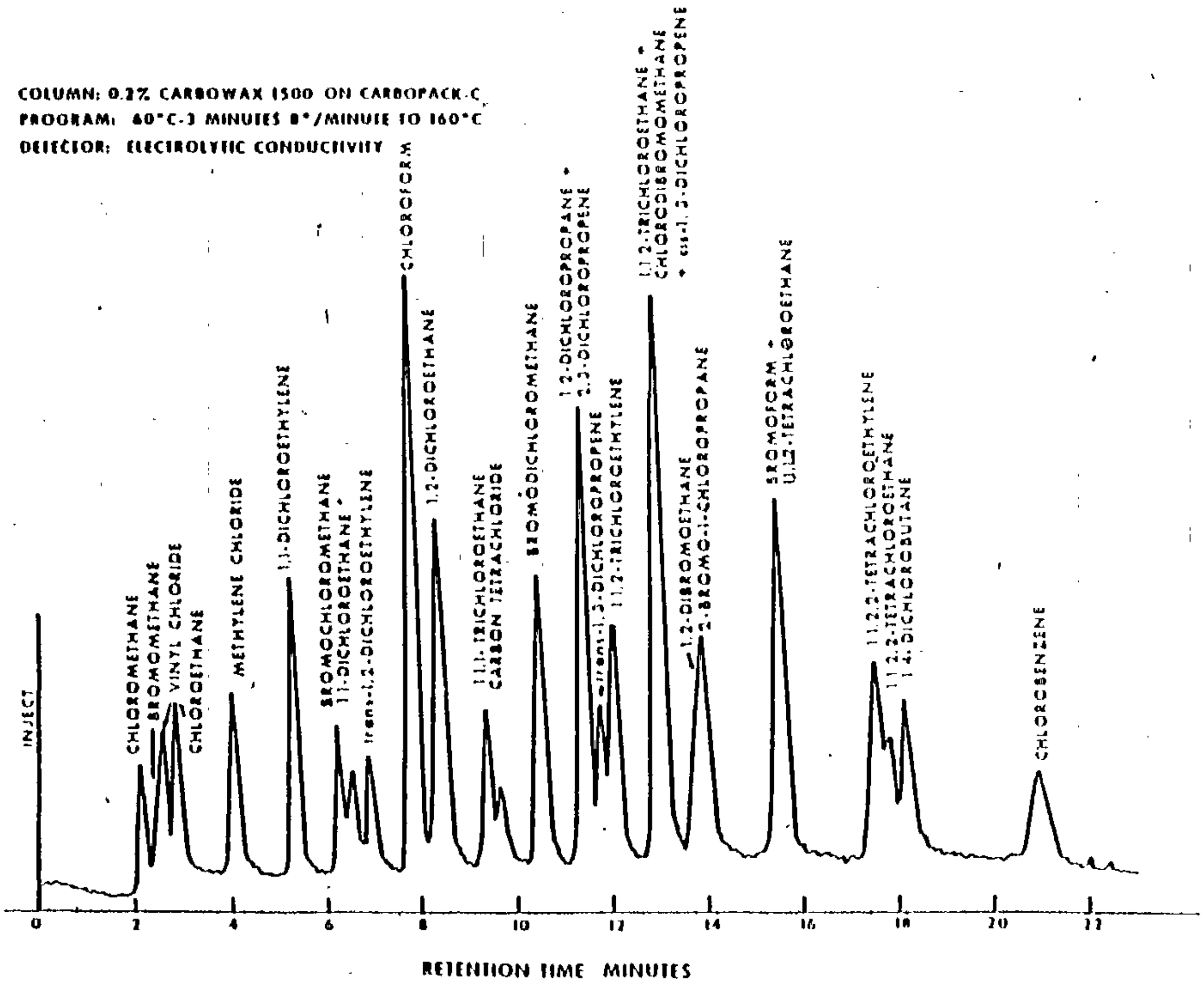
NOTE: ALL LINES BETWEEN
TRAP AND GC
SHOULD BE HEATED
TO 80°C

FIGURE 3 PURGE-TRAP SYSTEM (PURGE-SORB MODE)



NOTE: ALL LINES BETWEEN TRAP AND GC SHOULD BE HEATED TO 80°C

FIGURE 4 PURGE-TRAP SYSTEM (DESORB MODE)



COLUMN: 0.2% CARBOWAX 1500 ON CARBOPACK-C
PROGRAM: 40°C-3 MINUTES 8°/MINUTE TO 160°C
DETECTOR: ELECTROLYTIC CONDUCTIVITY

FIGURE 5 CHROMATOGRAM OF ORGANOHALIDES

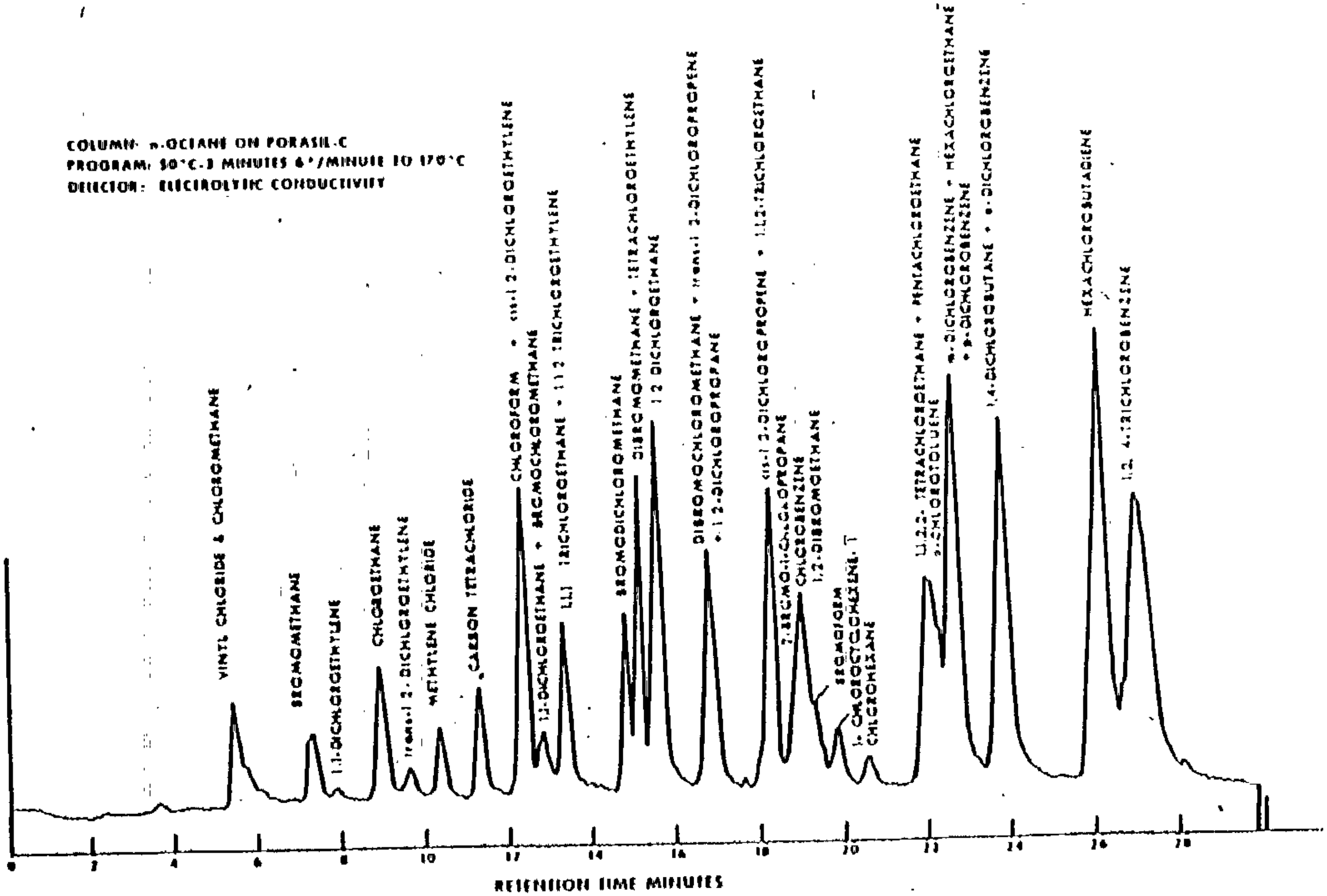


FIGURE 6 CHROMATOGRAM OF ORGANOHALIDES

BILLING CODE 6560-01-C

Part II -- Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction

1. Scope

1.1 This method (1,2) is applicable only to the determination of four trihalomethanes, i.e., chloroform, bromodichloromethane, chlorodibromomethane, and bromoform in finished drinking water, drinking water during intermediate stages of treatment, and the raw source water.

1.2 For compounds other than the above-mentioned trihalomethanes, or for other sample sources, the analyst must demonstrate the usefulness of the method by collecting precision and accuracy data on actual samples as described in (3) and provide qualitative confirmation of results by Gas Chromatography/Mass Spectrometry (GC/MS) (4).

1.3 Qualitative analyses using GC/MS or the purge and trap method (5) must be performed to characterize each raw source water if peaks appear as interferences in the raw source analysis.

1.4 The method has been shown to be useful for the trihalomethanes over a concentration range from approximately 0.5 to 200 g/l. Actual detection limits are highly dependent upon the characteristics of the gas chromatographic system used.

2. Summary

2.1 Ten milliliters of sample are extracted one time with 2 ml of solvent. Three 1 of the extract are then injected into a gas chromatograph equipped with a linearized electron capture detector for separation and analysis.

2.2 The extraction and analysis time is 10 to 50 minutes per sample depending upon the analytical conditions chosen. (See Table 1 and Figures 1, 2, and 3.)

2.3 Confirmatory evidence is obtained using dissimilar columns and temperature programming. When component concentrations are sufficiently high (50 g/l), halogen specific detectors may be employed for improved specificity.

2.4 Unequivocal confirmatory analyses at high levels (50 g/l) can be performed using GC/MS in place of the electron capture detector. At levels below 50 g/l, unequivocal confirmation can only be performed by the purge and trap technique using GC/MS (4, 5).

2.5 Standards dosed into organic free water and the samples are extracted and analyzed in an identical manner in order to compensate for possible extraction losses.

2.6 The concentration of each trihalomethane is summed and reported as total trihalomethanes in g/l.

3. Interferences

3.1 Impurities contained in the extracting solvent usually account for the majority of the analytical problems. Solvent blanks should be analyzed before a new bottle of solvent is used to extract samples. Indirect daily checks on the extracting solvent are obtained by monitoring the sample blanks (6.4.10). Whenever an interference is noted in the sample blank, the analyst should reanalyze the extracting solvent. The extraction solvent should be discarded whenever a high level (10 g/l) of interfering compounds are traced to it. Low level interferences generally can be removed by distillation or column chromatography (6); however, it is generally more economical to obtain a new source of solvent or select one of the approved alternative solvents listed in Section 5.1. Interference free solvent is defined as a solvent containing less than 0.4 g/l individual trihalomethane interference. Protect interference-free solvents by storing in a non-laboratory area known to be free of organochlorine solvents. Subtracting blank values is not recommended.

3.2 Several instances of accidental sample contamination have been attributed to diffusion of volatile organics through the septum seal on the sample bottle during shipment and storage. The sample blank (6.4.10) is used to monitor for this problem.

3.3 This liquid/liquid extraction technique efficiently extracts a wide boiling range of non-polar organic compounds and, in addition, extracts the polar organic components of the sample with varying efficiencies. In order to perform the trihalomethane analysis as rapidly as possible with sensitivities in the low g/l range, it is necessary to use the semi-specific electron capture detector and chromatographic columns which have relatively poor resolving power. Because of these concessions, the probability of experiencing chromatographic interferences is high. Trihalomethanes are primarily products of the chlorination process and generally do not appear in the raw source water. The absence of peaks in the raw source water analysis with retention times similar to the trihalomethanes is generally adequate evidence of an interference-free finished drinking water analysis. Because of these possible interferences, in addition to each finished drinking water analysis, a representative raw source water (6.4.5) must be analyzed. When potential interferences are noted in the raw source water analysis, the alternate chromatographic columns must be used to reanalyze the sample set. If interferences are still noted, qualitative identifications should be performed according to Sections 2.3 and 2.4. If the peaks are confirmed to be other than trihalomethanes and add significantly to the total trihalomethane value in the finished drinking water analysis, then the sample set must be analyzed by the purge and trap method (5).

4. Apparatus

4.1 Extraction vessel -- A 15 ml total volume glass vessel with a

Teflon lined screw-cap is required to efficiently extract the samples. 4.1.1 For samples that do not form emulsions 10 ml screw-cap flasks with a Teflon faced septum (total volume is ml) are recommended. Flasks and caps -- Pierce -- 13310 or equivalent. Septa -- Teflon silicone -- Pierce 12718 or equivalent.

4.1.2 For samples that form emulsions (turbid source water) 15 ml screw cap centrifuge tubes with a Teflon cap liner are recommended. Centrifuge tube -- Corning 8062-15 or equivalent.

4.2 Sampling containers -- 40 ml screw cap sealed with Teflon faced silicone septa. Vials and caps -- Pierce 13075 or equivalent. Septa -- Pierce 12722 or equivalent.

4.3 Micro syringes -- 10, 100 1.

4.45 Micro syringe -- 25 1 with a 2-inch by 0.006-inch needle -- Hamilton 702N or equivalent.

4.5 Syringes -- 10 ml glass hypodermic with luerlok tip (2 each).

4.6 Syringe valve -- 2-way with luer ends (2 each) -- Hamilton 86570 -- IPM1 or equivalent.

4.7 Pipette -- 2.0 ml transfer.

4.8 Glass stoppered volumetric flasks -- 10 and 100 ml.

4.9 Gas chromatograph with linearized electron capture detector. (Recommended option -- temperature programmable. See Section 4.12.)

4.10 Column A -- 4 mm ID x 2m long glass packed with 3% SP-1000 on Supelcoport (100/120 mesh) operated at 50 C with 60 ml/min flow. (See Figure 1 for a sample chromatogram and Table 1 for retention data.)

4.11 Column B -- 2 mm ID x 2m long glass packed with 10% squalane on Chromosorb WAW (80/100 mesh) operated at 67 C with 25 ml/min flow. This column is recommended as the primary analytical column. Trichloroethylene, a common raw source water contaminate, coelutes with bromodichloromethane. (See Figure 2 for a sample chromatogram and Table 1 for retention data.)

4.12 Column C -- 2 mm ID x 3m long glass packed with 6% OV-11/4% SP-2100 on Supelcoport (100/120 mesh) temperature program 45 C for 12 minutes, then program at 1 /minute to 70 C with a 25 ml/min flow. (See Figure 3 for a sample chromatogram and Table I for retention data.)

4.13 Standard storage containers -- 15 ml amber screw-cap septum bottles with Teflon faced silicone septa. Bottles and caps -- Pierce 19830 or equivalent. Septa -- Pierce 12716 or equivalent.

5. Reagents

5.1 Extraction solvent -- (See 3.1). Recommended -- Pentanea.

Alternative -- hexane, methylcyclohexane or 2,2,4-trimethylpentane.

5.2 Methyl alcohol -- ACS Reagent Grade.

5.3 Free and combined chlorine reducing agents -- Sodium thiosulfate ACS Reagent Grade -- sodium sulfite ACS Reagent Grade.

5.4 Activated carbon -- Filtrasorb -- 200, available from Calgon Corporation, Pittsburgh, PA, or equivalent.

5.5 Standards.b

5.5.1 Bromoform 96% -- available from Aldrich Chemical Company.

5.5.2 Bromodichloromethane 97% -- available from Aldrich Chemical Company.

5.5.3 Chlorodibromomethane -- available from Columbia Chemical, Incorporated, Columbia, S.C.

5.5.4 Chloroform 99% -- available from Aldrich Chemical Company.

5.6 Organic-free water -- Organic-free water is defined as water free of interference when employed in the procedure described herein.

5.6.1 Organic-free water is generated by passing tap water through a carbon filter bed containing carbon. Change the activated carbon whenever the concentration of any trihalomethane exceeds 0.4 g/l.

5.6.2 A Millipore Super-Q Water System or its equivalent may be used to generate organic-free deionized water.

5.6.3 Organic-free water may also be prepared by boiling water for 15 minutes. Subsequently, while maintaining the temperature at 90 C, bubble a contaminant free inert gas through the water at 100 ml/minute for one hour. While still hot, transfer the water to a narrow mouth screw cap bottle with a Teflon seal.

5.6.4 Test organic free water each day it is used by analyzing it according to Section 7.

5.7 Standard stock solutions.

5.7.1 Fill a 10.0 ml ground glass stoppered volumetric flask with approximately 9.8 ml of methyl alcohol.

5.7.2 Allow the flask to stand unstoppered about 10 minutes or until all alcohol wetted surfaces dry.

5.7.3 Weigh the unstoppered flask to the nearest 0.1 mg.

5.7.4 Using a 100 1 syringe, immediately add 2 to 3 drops of the reference standard to the flask, then reweigh. Be sure that the reference standard falls directly into the alcohol without contacting the neck of the flask.

5.7.5 Dilute to volume, stopper, then mix by inverting the flask several times.

5.7.6 Transfer the standard solution to a dated and labeled 15 ml screw-cap bottle with a Teflon cap liner.

Note: Because of the toxicity of trihalomethanes, it is necessary to prepare primary dilutions in a hood. It is further recommended that a NIOSH/MESA-approved toxic gas respirator be used when the analyst handles high concentrations of such materials.

5.7.7 Calculate the concentration in micrograms per microliter from the net gain in weight.

5.7.8 Store the solution at 4 C.

Note: All standard solutions prepared in methyl alcohol are stable up to 4 weeks when stored under these conditions. They should be discarded after that time has elapsed.

5.8 Aqueous calibration standard precautions.

5.8.1 In order to prepare accurate aqueous standard solutions, the following precautions must be observed:

a. Do not inject more than 20 1 of alcoholic standards into 100 ml of organic-free water.

b. Use a 25 1 Hamilton 702N microsyringe or equivalent. (Variations in needle geometry will adversely affect the ability to deliver reproducible volumes of methanolic standards into water.)

c. Rapidly inject the aloholic standard into the expanded area of the filled volumetric flask. Remove the needle as fast as possible after injection.

d. Mix aqueous standards by inverting the flask three times only.

e. Discard the contents contained in the neck of the flask. Fill the sample syringe from the standard solution contained in the expanded area of the flask as directed in Section 7.

f. Never use pipets to dilute or transfer samples and aqueous standards.

g. Aqueous standards, when stored with a headspace, are not stable and should be discarded after one hour. Aqueous standards can be stored according to Sections 6.4.9 and 7.2.

5.9 Calibration standards.

5.9.1 Prepare, from the standard stock solutions, a multicomponent secondary dilution mixture in methyl alcohol so that a 20 l injection into 100 ml of organic-free water will generate a calibration standard which produces a response close (25%) to that of the unknown. (See 8.1.)

5.9.2 Alternative calibration procedure.

5.9.2.1 Construct a calibration curve for each trihalomethane containing a minimum of 3 different concentrations. Two of the concentrations must bracket each unknown.

5.9.3 Extract and analyze the aqueous calibration standards in the same manner as the unknowns.

5.9.4 Other calibration procedures (7) which require the delivery of less than 20 l of methanolic standards to 10.0 ml volumes of water contained in the sample syringe are acceptable only if the methanolic standard is delivered by the solvent flush technique (8).

5.10 Quality Check Standard Mixture.

5.10.1 Prepare, from the standard stock solutions, a secondary dilution mixture in methyl alcohol that contains 10.0 ng/ l of each compound. (See 5.7.6 and 5.7.8.)

5.10.2 Daily, prepare and analyze a 2.0 g/l aqueous dilution from this mixture by dosing 20.0 l into 100 ml of organic-free water (See Section 8.1).

6. Sample Collection and Handling.

6.1 The sample containers should have a total volume of at least 25 ml.

6.1.1 Narrow-mouth screw-cap bottles with the TFE fluorocarbon faced silicone septa cap liners are strongly recommended.

6.2 Glassware Preparation.

6.2.1 Wash all sample bottles, TFE seals, and extraction flasks in detergent. Rinse with tap water and finally with distilled water.

6.2.2 Allow the bottles and seals to air dry, then place in an 105 C oven for 1 hour, then allow to cool in an area known to be free of organics.

Note: Do not heat the TFE seals for extended periods of time (1 hour) because the silicone layer slowly degrades at 105 C.

6.2.3 When cool, seal the bottles using the TFE seals that will be used for sealing the samples.

6.3 Sample stabilization -- A chemical reducing agent (Section 5.3) is added to all samples in order to arrest the formation of additional trihalomethanes after sample collection (7,9) and to eliminate the possibility of free chlorine reacting with impurities in the extraction solvent to form interfering organohalides. DO NOT ADD

THE REDUCING AGENT TO SAMPLES AT COLLECTION TIME WHEN DATA FOR MAXIMUM TRIHALOMETHANE FORMATION IS DESIRED. If chemical stabilization is employed, then the reagent is also added to the blanks. The chemical agent (2.5 to 3 mg/40 ml) is added in crystalline form to the empty sample bottle just prior to shipping to the sampling site. If chemical stabilization is not employed at sampling time then the reducing agent is added just before extraction.

6.4 Sample Collection.

6.4.1 Collect all samples in duplicate.

6.4.2 Fill the sample bottles in such a manner that no air bubbles pass through the sample as the bottle is filled.

6.4.3 Seal the bottle so that no air bubbles are entrapped in it.
6.4.4 Maintain the hermetic seal on the sample bottle until analysis.

6.4.5 The raw source water sample history should resemble the finished drinking water. The average retention time of the finished drinking water within the water plant should be taken into account when sampling the raw source water.

6.4.6 Sampling from a water tap.
6.4.6.1 Turn on the water and allow the system to flush until the temperature of the water has stabilized. Adjust the flow to about 500 ml/ minute and collect duplicate samples from the flowing stream.

6.4.7 Sampling from an open body of water.

6.4.7.1 Fill a 1-quart wide-mouth bottle with sample from a representative area. Carefully fill duplicate sample bottles from the 1-quart bottle as in 6.4.

6.4.8 If a chemical reducing agent has been added to the sample bottles, fill with sample just to overflowing, seal the bottle, and shake vigorously for 1 minute.

6.4.9 Sealing practice for septum seal screw cap bottles.
6.4.9.1 Open the bottle and fill to overflowing. Place on a level surface. Position the TFE side of the septum seal upon the convex sample meniscus and seal the bottle by screwing the cap on tightly.

6.4.9.2 Invert the sample and lightly tap the cap on a solid surface. The absence of entrapped air indicates a successful seal. If bubbles are present, open the bottle, add a few additional drops of sample, then reseal bottle as above.

6.4.10 Sample blanks.

6.4.10.1 Prepare blanks in duplicate at the laboratory by filling and sealing sample bottles with organic-free water just prior to shipping the sample bottles to the sampling site.

6.4.10.2 If the sample is to be stabilized, add an identical amount of reducing agent to the blanks.

6.4.10.3 Ship the blanks to and from the sampling site along with the sample bottles.

6.4.10.4 Store the blanks and the samples, collected at a given site (sample set), together in a protected area known to be free from contamination. A sample set is defined as all the samples collected at a given site (i.e., at a water treatment plant, duplicate raw source water, duplicate finished water and the duplicate sample blanks comprise the sample set).

6.5 When samples are collected and stored under these conditions, no measurable loss of trihalomethanes has been detected over extended periods of time (7). It is recommended that the samples be analyzed within 14 days of collection.

7. Extraction and Analysis.

7.1 Remove the plungers from two 10-ml syringes and attach a closed syringe valve to each.

7.2 Open the sample bottlec (or standard) and carefully pour the sample into one of the syringe barrels until it overflows. Replace the plunger and compress the sample. Open the syringe valve and vent any residue air while adjusting the sample volume to 10.0 ml. Close the valve.

7.3 Fill the second syringe in an identical manner from the same sample bottle. This syringe is reserved for a replicate analysis (see 8.3 and 8.4).

7.4 Pipette 2.0 ml of extraction solvent into a clean extraction flask.

7.5 Carefully inject the contents of the syringe into the extraction flask.

7.6 Seal with a Teflon faced septum.

7.7 Shake vigorously for 1 minute.

7.8 Let stand until the phases separate (60 seconds).

7.8.1 If the phases do not separate on standing then centrifugation can be used to facilitate separation.

7.9 **Analyze the sample** by injecting 3.0 l (solvent flush technique. (8)) of the upper (organic) phase into the gas chromatograph.

8. Analytical Quality Control.

8.1 A 2 g/l quality check standard (See 5.10) should be extracted and analyzed each day before any samples are analyzed. Instrument status checks and lower limit of detection estimations based upon response factor calculations at 5 times the noise level are obtained from these data. In addition, the data obtained from the quality check standard can be used to estimate the concentration of the unknowns. From this information the appropriate standards can be determined.

8.2 Analyze the sample blank and the raw source water to monitor for potential interferences as described in Sections 3.1, 3.2, and 3.3.

8.3 Spiked samples.

8.3.1 For those laboratories analyzing more than 10 samples a day, each 10th sample analyzed should be a laboratory-generated spike which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in Section 5.9.

8.3.2 In those laboratories analyzing less than 10 samples daily, each time the analysis is performed, analyze at least one laboratory generated spike sample which closely duplicates the average finished drinking water in trihalomethane composition and concentration. Prepare the spiked sample in organic-free water as described in section 5.9.

8.3.3 Maintain an up-to-date log on the accuracy and precision data collected in Sections 8.3 and 8.4. If results are significantly different than those cited in Section 10.1, the analyst should check out the entire analysis scheme to determine why the laboratory's precision and accuracy limits are greater.

8.4 Randomly select and analyze 10% of all samples in duplicate.

8.5 Analyze all samples in duplicate which appear to deviate more than 30% from any established norm.

8.6 Quarterly, spike an EMSL-Cincinnati trihalomethane quality control sample into organic-free water and analyze.

8.6.1 The results of the EMSL trihalomethane quality control sample should agree within 20% of the true value for each trihalomethane. If they do not, the analyst must check each step in the standard generation procedure to solve the problem.

8.7 It is important that the analyst be aware of the linear response characteristics of the electron capture system that is utilized. Calibration curves should be generated and rechecked quarterly for each trihalomethane over the concentration range encountered in the samples in order to confirm the linear response range of the system. Quantitative data cannot be calculated from non-linear responses. Whenever non-linear responses are noted, the analyst must dilute the sample for reanalysis.

8.8 Maintain a record of the retention times for each trihalomethane using data gathered from spiked samples and standards.

8.8.1 Daily calculate the average retention time for each trihalomethane and the variance encountered for the analyses.

8.8.2 If individual trihalomethane retention time varies by more than

10% over an eight hour period or does not fall within 10% of an established norm. the system is "out of control." The source of retention data variation must be corrected before acceptable data can be generated.

9. Calculations.

9.1 Locate each trihalomethane in the sample chromatogram by comparing the retention time of the suspect peak to the data gathered in 8.8.1. The retention time of the suspect peak must fall within the limits established in 8.8.1 for a single column identification.

9.2 Calculate the concentration of each trihalomethane by comparing the peak heights or peak areas of the samples to those of the standards. Round off the data to the nearest g/l or two significant figures. Concentration, g/l=sample peak height/standard peak height standard concentration, g/l.

9.3 Calculate the total trihalomethane concentration (TTHM) bysumming the 4 individual trihalomethane concentrations in g/l: TTHM (g/l)=(conc. $CHCl_3$)+(conc. $CHBrCl_2$)+(conc. $CHBr_2Cl$)+(conc. $CHBr_3$)

9.4 Calculate the limit of detection (LOD) for each trihalomethane not detected using the following criteria:

LOD (ug/l) = [(A x ATT) / (B x ATT)] x (2 ug/l)

Where:

B=peak height (mm) of 2 g/l quality check standard

A=5 times the noise level in mm at the exact retention time of the trihalomethane or the base line displacement in mm from theoretical zero at the exact retention time for the trihalomethane.

ATT=attenuation factor.

9.5 Report the results obtained from the lower limit of detection estimates along with the data for the samples.

10. Precision and Accuracy

10.1 Single lab precision and accuracy. The data in Table II were generated by spiking organic-free water with trihalomethanes as described in 5.9. The mixtures were analyzed by the analyst as true unknowns.

Table 1 -- Retention Times for Trihalomethanes

TRIHALOMETHANE	RETENTION TIME MINUTES A	 B	 C
Chloroform	1.0	1.3	4.9
Bromodichloromethane	1.5	2.5*	11.9
Chlorodibromomethane (Dibromochloromethane)	2.6	5.6	23.1
bromoform	5.5	10.9	39.4

* On this column, trichloroethylene, a common raw source water contaminate, coelutes with bromodichloromethane.

Table II -- Single Laboratory Accuracy and Precision

COMPOUND	DOSE LEVEL ug/l	NO. SAMPLES	MEAN ug/l	PRECISION RELATIVE STAND.DEV. PERCENT	AC'RACY PERCENT RECOV.
CHCl 3	9.1	5	10.0	11.0	110
CHCl 3	69.0	3	73.0	5.3	106
CHBrCl 2	1.2	5	1.3	9.8	108
CHBrCl 2	12.0	2	15.0	1.4	125
CHBr2Cl	2.7	5	2.0	17.0	74
CHBr2Cl	17.0	3	16.0	9.9	94
CHBr2	2.9	5	2.2	10.0	76
CHBr2	14.0	3	16.0	12.0	114

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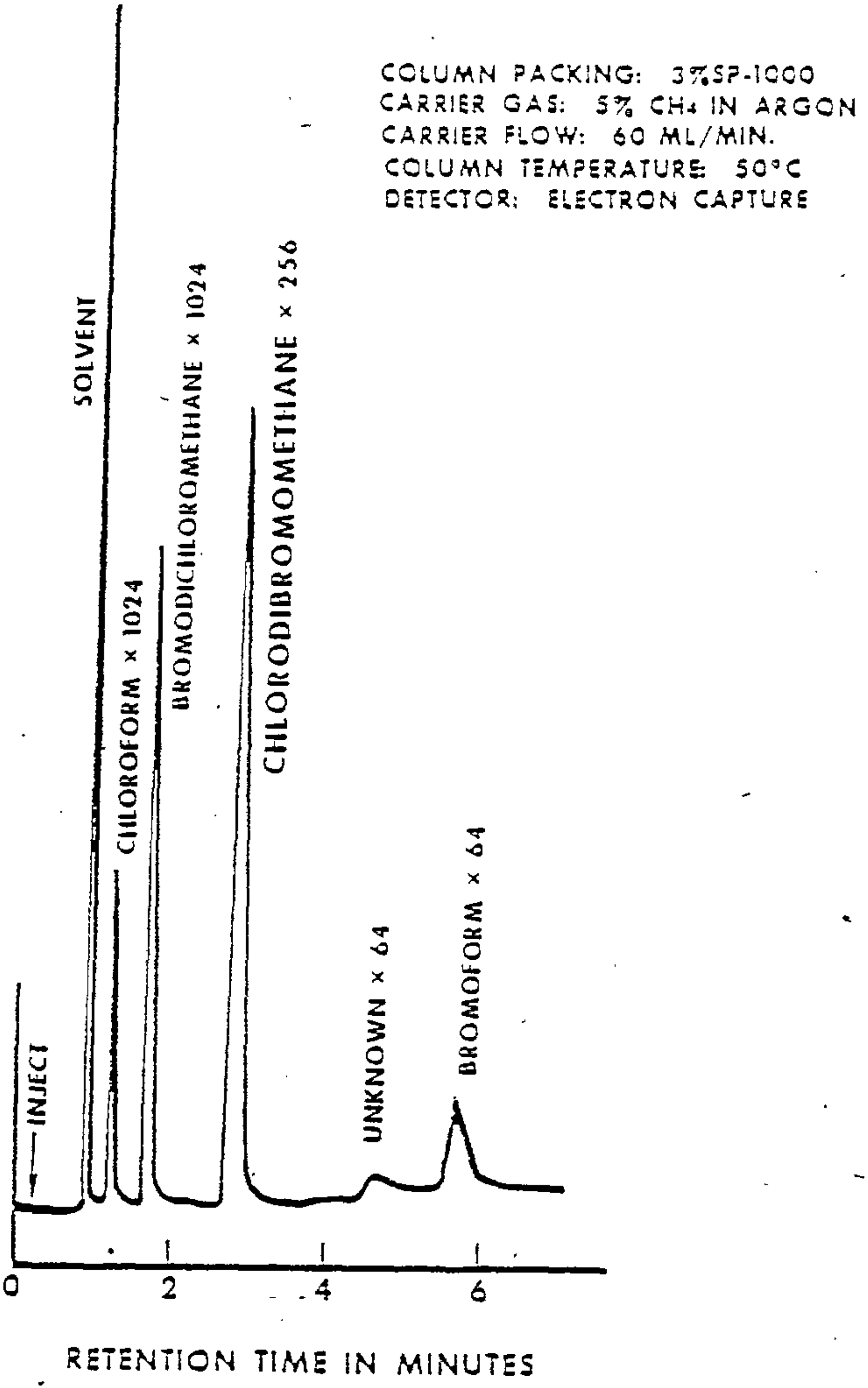
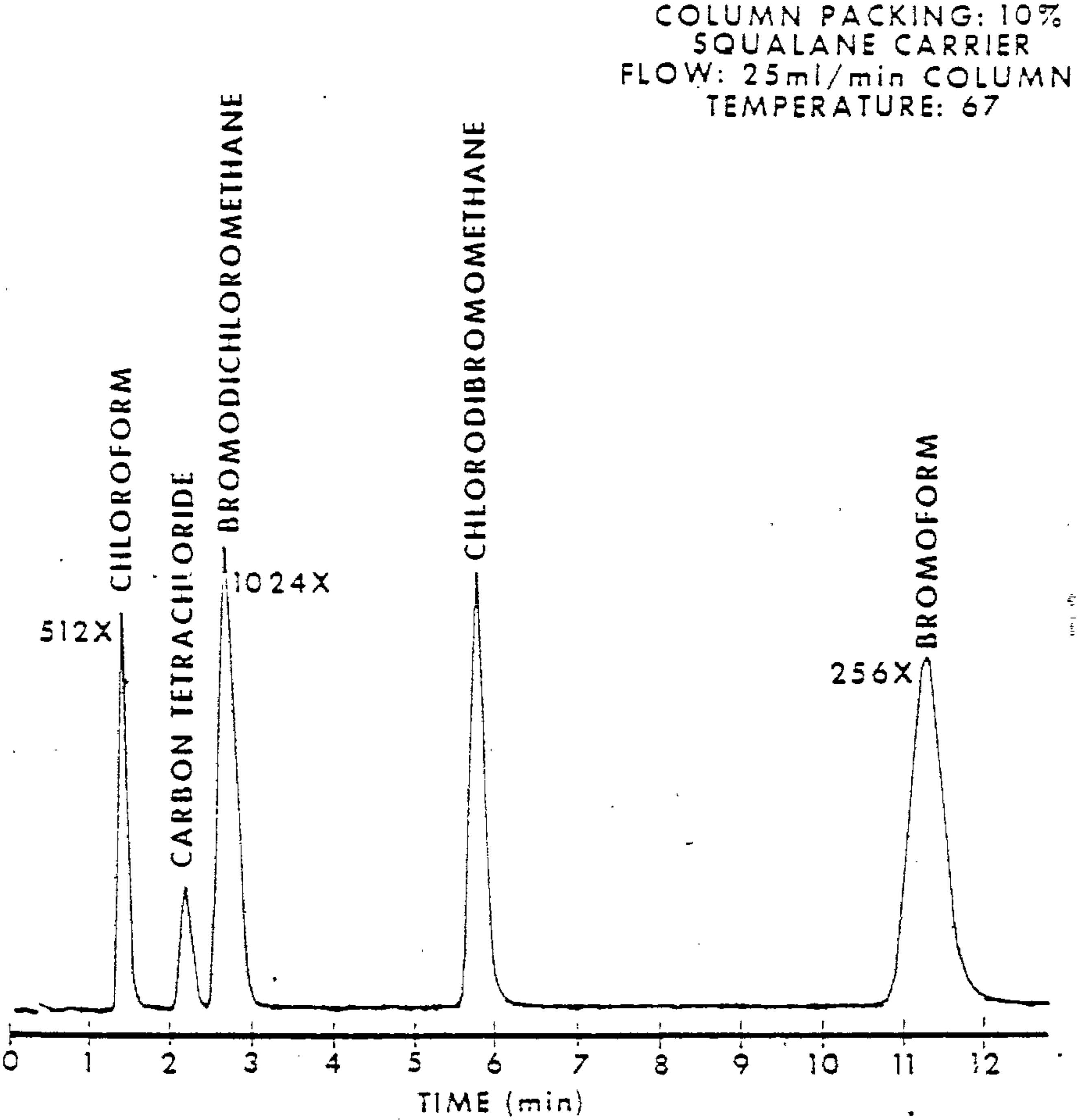


FIGURE 1. FINISHED WATER EXTRACT



COLUMN PACKING: 10%
SQUALANE CARRIER
FLOW: 25ml/min COLUMN
TEMPERATURE: 67

FIGURE 2. EXTRACT OF STANDARD

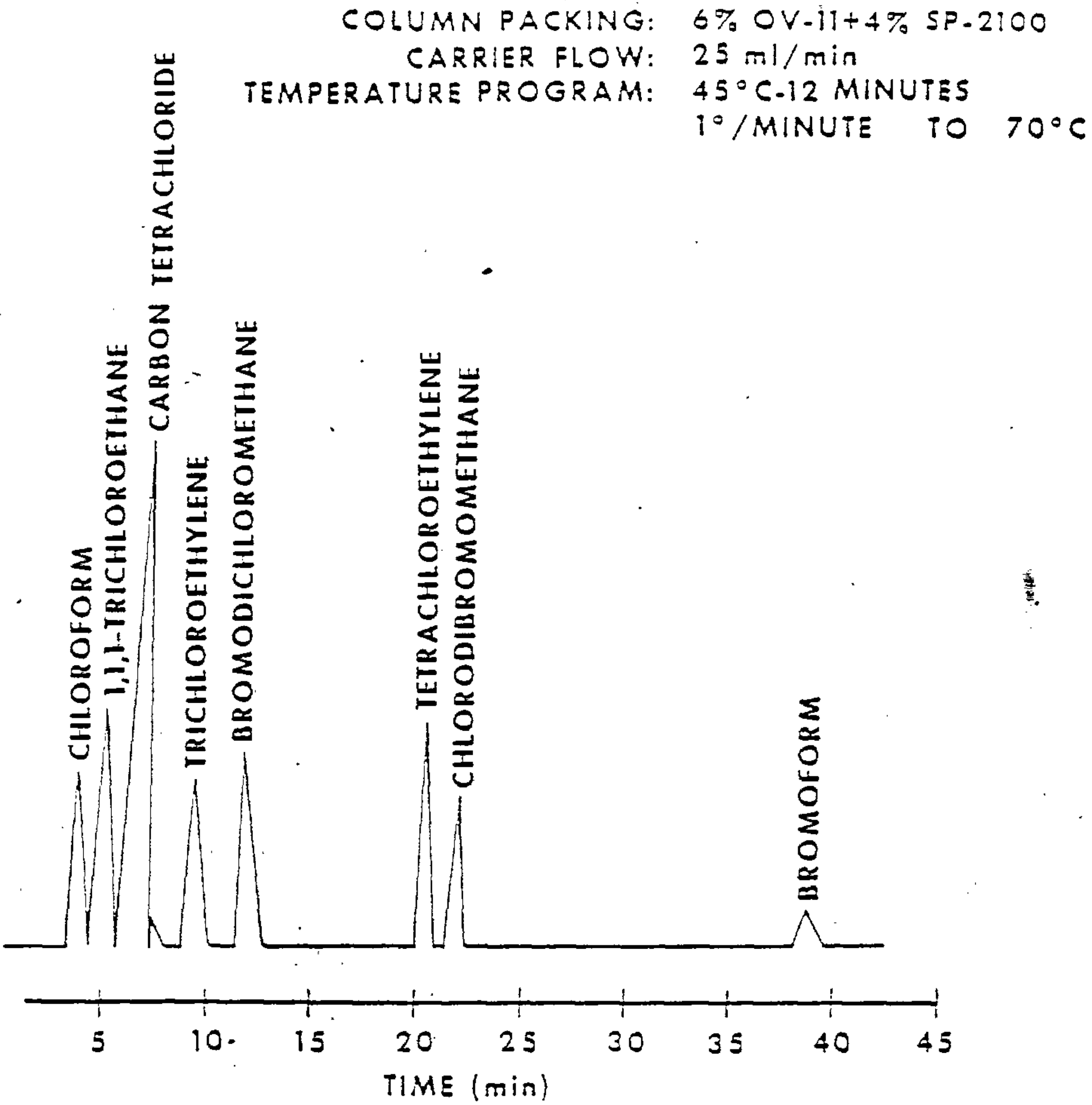


FIGURE 3. EXTRACT OF STANDARD

Part III -- Determination of Maximum Total Trihalomethane Potential (MTP)

The water sample used for this determination is taken from a point in the distribution system that reflects maximum residence time. Procedures for sample collection and handling are given in EMSL Methods 501.1 and 501.2. No reducing agent is added to "quench" the chemical reaction producing THMs at the time of sample collection. The intent is to permit the level of THM precursors to be depleted and the concentration of the THMs to be maximized for the supply being tested.

Four experimental parameters affecting maximum THM production are pH, temperature, reaction time and the presence of a disinfectant residual. These parameters are dealt with as follows:

Measure the disinfectant residual at the selected sampling point. Proceed only if a measurable disinfectant residual is present. Collect triplicate 40 ml water samples at the pH prevailing at the time of sampling, and prepare a method blank according to the EMSL methods. Seal and store these samples together for 7 days at 25 C or above. After this time period, open one of the sample containers and check for disinfectant residual. Absence of a disinfectant residual invalidates the sample for further analyses. Once a disinfectant residual has been demonstrated, open another of the sealed samples and determine total THM concentration using either of the EMSL analytical methods.
(44 FR 68672, Nov. 29, 1979)

a. Pentane has been selected as the best solvent for this analysis because it elutes, on all of the columns, well before any of the trihalomethanes. High altitudes or laboratory temperatures in excess of 75 F may make the use of this solvent impractical. For these reasons, alternative solvents are acceptable: however, the analyst may experience baseline variances in the elution areas of the trihalomethanes due to coelution of these solvents. The degree of difficulty appears to be dependent upon the design and condition of the electron capture detector. Such problems should be insignificant when concentrations of the coeluting trihalomethane are in excess of 5 g/l.

b. As a precautionary measure, all standards must be checked for purity by boiling point determinations or GC/MS assays.

c. If for any reason the chemical reducing agent has not been added to the sample, then it must be added just prior to analyses at the rate of 2.5 to 3 mg/40 ml or by adding 1 mg directly to the sample in the extraction flask.

Subpart D -- Reporting, Public Notification and Recordkeeping

§141.31 Reporting requirements.

(a) Except where a shorter period is specified in this part, the supplier of water shall report to the State the results of any test measurement or analysis required by this part within (1) the first ten days following the month in which the result is received, or (2) the first ten days following the end of the required monitoring period as stipulated by the State, whichever of these is shortest.

(b) The supplier of water shall report to the State within 48 hours the failure to comply with any primary drinking water regulation (including failure to comply with monitoring requirements) set forth in this part.

(c) The supplier of water is not required to report analytical results to the State in cases where a State laboratory performs the analysis and reports the results to the State office which would normally receive such notification from the supplier.

(d) The water supply system, within ten days of completion of each public notification required pursuant to 141.32, shall submit to the State a representative copy of each type of notice distributed, published, posted, and/or made available to the persons served by the system and/or to the media.

(e) The water supply system shall submit to the State within the time stated in the request copies of any records required to be maintained under 141.33 hereof or copies of any documents then in existence which the State or the Administrator is entitled to inspect pursuant to the authority of section 1445 of the Safe Drinking Water Act or the equivalent provisions of State law.

(40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57345, Aug. 27, 1980)

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Public notification.

The requirements in this section are effective April 28, 1989. The requirements of 141.36 apply until April 28, 1989.

(a) Maximum contaminant level (MCL), treatment technique, and variance and exemption schedule violations. The owner or operator of a public water system which fails to comply with an applicable MCL or treatment technique established by this part or which fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, shall notify persons served by the system as follows:

(1) Except as provided in paragraph (a)(3) of this section, the owner or operator of a public water system must give notice:

(i) By publication in a daily newspaper of general circulation in the area served by the system as soon as possible, but in no case later than 14 days after the violation or failure. If the area served by a public water system is not served by a daily newspaper of general circulation, notice shall instead be given by publication in a weekly newspaper of general circulation serving the area: and

(ii) By mail delivery (by direct mail or with the water bill), or by hand delivery, not later than 45 days after the violation or failure. The State may waive mail or hand delivery if it determines that the owner or operator of the public water system in violation has corrected the violation or failure within the 45-day period. The State must make the waiver in writing and within the 45-day period: and

(iii) For violations of the MCLs of contaminants that may pose an acute risk to human health, by furnishing a copy of the notice to the radio and television stations serving the area served by the public water system as soon as possible but in no case later than 72 hours after the violation. The following violations are acute violations:

(A) Any violations specified by the State as posing an acute risk to human health.

(B) Violation of the MCL for nitrate as defined in 141.11(b) and determined according to 141.23(d).

(C) (Reserved)

(D) Occurrence of a waterborne disease outbreak, as defined in §141.2, in an unfiltered system subject to the requirements of Subpart H of this Part, after December 30, 1991 (see §141.71(b)(4)).

(2) Except as provided in paragraph (a)(3) of this section, following the initial notice given under paragraph (a)(1) of this section, the owner or operator of the public water system must give notice at least once every three months by mail delivery (by direct mail or with the water bill) or by hand delivery, for as long as the violation or failure exists.

(3)(i) In lieu of the requirements of paragraph (a)(1)(i) of this section, the owner or operator of a community water system in an area that is not served by a daily or weekly newspaper of general circulation must give notice within 14 days after the violation or failure by hand delivery or by continuous posting in conspicuous places within the area served by the system. Posting must continue for as long as the violation or failure exists. Notice by hand delivery must be repeated at least every three months for as long as the violation or failure exists.

(ii) In lieu of the requirements of paragraphs (a) (1) and (2) of this section, the owner or operator of a non-community water system may give notice within 14 days after the violation or failure by hand delivery or by continuous posting in conspicuous places within the area served by the system. Posting must continue for as long as the violation or failure exists. Notice by hand delivery must be repeated at least every three months for as long as the violation or failure exists.

(b) Other violations, variances, exemptions. The owner or operator of a public water system which fails to perform monitoring required by section 1445(a) of the Act (including monitoring required by the National Primary Drinking Water Regulations (NPDWRs) of this part), fails to comply with a testing procedure established by this part, is subject to a variance granted under section 1415(a)(1)(A) or 1415(a)(2) of the Act, or is subject to an exemption under section 1416 of the Act, shall notify persons served by the system as follows:

(1) Except as provided in paragraph (b)(3) or (b)(4) of this

section, the owner or operator of a public water system must give notice within three months of the violation or granting of a variance or exemption by publication in a daily newspaper of general circulation in the area served by the system. If the area served by a public water system is not served by a daily newspaper of general circulation, notice shall instead be given by publication in a weekly newspaper of general circulation serving the area.

(2) Except as provided in paragraph (b)(3) or (b)(4) of this section, following the initial notice given under paragraph (b)(1) of this section, the owner or operator of the public water system must give notice at least once every three months by mail delivery (by direct mail or with the water bill) or by hand delivery, for as long as the violation exists. Repeat notice of the existence of a variance or exemption must be given every three months for as long as the variance or exemption remains in effect.

(3)(i) In lieu of the requirements of paragraphs (b)(1) and (b)(2) of this section, the owner or operator of a community water system in an area that is not served by a daily or weekly newspaper of general circulation must give notice, within three months of the violation or granting of the variance or exemption, by hand delivery or by continuous posting in conspicuous places with the area served by the system. Posting must continue for as long as the violation exists or a variance or exemption remains in effects. Notice by hand delivery must be repeated at least every three months for as long as the violation exists or a variance or exemption remains in effect.

(ii) In lieu of the requirements of paragraphs (b)(1) and (b)(2) of this section, the owner or operator of a non-community water system may give notice, within three months of the violation or the granting of the variance or exemption, by hand delivery or by continuous posting in conspicuous places within the area served by the system. Posting must continue for as long as the violation exists, or a variance or exemption remains in effect. Notice by hand delivery must be repeated at least every three months for as long as the violation exists or a variance or exemption remains in effect.

(4) In lieu of the requirements of paragraphs (b)(1), (b)(2), and (b)(3) of this section, the owner or operator of a public water system, at the discretion of the State, may provide less frequent notice for minor monitoring violations as defined by the State, if EPA has approved the State's application for a program revision under 142.16. Notice of such violations must be given no less frequently than annually.

(c) Notice to new billing units. The owner or operator of a community water system must give a copy of the most recent public notice for any outstanding violation of any maximum contaminant level, or any treatment technique requirement, or any variance or exemption schedule to all new billing units or new hookups prior to or at the time service begins.

(d) General content of public notice. Each notice required by this section must provide a clear and readily understandable explanation of the violation, any potential adverse health effects, the population at risk, the steps that the public water system is taking to correct such violation, the necessity for seeking alternative water supplies, if any, and any preventive measures the consumer should take until the violation is corrected. Each notice shall be conspicuous and shall not contain unduly technical language, unduly small print, or similar problems that frustrate the purpose of the notice. Each notice shall include the telephone number of the owner, operator, or designee of the public water system as a source of additional information concerning the notice. Where appropriate, the notice shall be multi-lingual.

(e) Mandatory health effects language. When providing the information on potential adverse health effects required by paragraph (d) of this section in notices of violations of maximum contaminant levels or treatment technique requirements, or notices of the granting or the continued existence of exemptions or variances, or notices of failure to comply with a variance or exemption schedule, the owner or operator of a public water system shall include the language specified below for each contaminant. (If language for a particular contaminant is not specified below at the time notice is required, this paragraph does not apply.)

(1) Trichloroethylene. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that trichloroethylene is a health concern at certain levels of exposure. This chemical is a common metal cleaning and dry cleaning fluid. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set forth the enforceable drinking water standard for trichloroethylene at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(2) Carbon tetrachloride. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that carbon tetrachloride is a health concern at certain levels of exposure. This chemical was once a popular household cleaning fluid. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of of time. EPA has set the enforceable drinking water standard for carbon tetrachloride at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(3) 1,2-Dichloroethane. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that 1,2-dichloroethane is a health concern at certain levels of exposure. This chemical is used as a cleaning fluid for fats, oils, waxes, and resins. It generally gets into drinking water from improper waste disposal. This chemical has been shown to cause cancer in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals that cause cancer in laboratory animals also may increase the risk of cancer in

humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for 1,2-dichloroethane at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(4) Vinyl chloride. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that vinyl chlorideis a health concern at certain levels of exposure. This chemical is used in industry and is found in drinking water as a result of the breakdown of related solvents. The solvents are used as cleaners and degreasers of metals and generally get into drinking water by improper waste disposal. This chemical has been associated with significantly increased risks of cancer among certain industrial workers who were exposed to relatively large amounts of this chemical during their working careers. This chemical has also been shown to cause cancer in laboratory animals when the animals are exposed at high levels over their lifetimes. Chemicals that cause increased risk of cancer among exposed industrial workers and in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for vinyl chloride at 0.002 part per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(5) Benzene. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that benzene is a health concern at certain levels of exposure. This chemical is used as a solvent and degreaser of metals. It is also a major component of gasoline. Drinking water contamination generally results from leaking undergound gasoline and petroleum tanks or improper waste disposal. This chemical has been associated with significantly increased risks of leukemia among certain industrial workers who were exposed to relatively large amounts of this chemical during their working careers. This chemical has also been shown to cause cancer in laboratory animals when the animals are exposed at high levels over their lifetimes. Chemicals that cause increased risk of cancer among exposed industrial workers and in laboratory animals also may increase the risk of cancer in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for benzene at 0.005 parts per million (ppm) to reduce the risk of cancer or other adverse health effects which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(6) 1,1-Dichloroethylene. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that 1,1-dichloroethylene is a health concern at certain levels of exposure. This chemical is used in industry and is found in drinking water as a result of the breakdown of related solvents. The solvents are used as cleaners and degreasers of metals and generally get into drinking water by improper waste disposal. This chemical has been shown to cause liver and kidney damage in laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Chemicals which cause adverse effects in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for 1,1-dichloroethylene at 0.007 parts per million (ppm) to reduce the risk of

these adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(7) Para-dichlorobenzene. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that para-dichlorobenzene is a health concern at certain levels of exposure. This chemical is a component of deodorizers, moth balls, and pesticides. It generally gets into drinking water by improper waste disposal. This chemical has been shown to cause liver and kidney damage in laboratory animals such as rats and mice when the animals are exposed to high levels over their lifetimes. Chemicals which cause adverse effects in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for para-dichlorobenzene at 0.075 parts per million (ppm) to reduce the risk of these adverse health effects which have been observed in laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(8) 1,1,1-Trichloroethane. The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the 1,1,1-trichloroethane is a health concern at certain levels of exposure. This chemical is used as a cleaner and degreaser of metals. It generally gets into drinking water by improper waste disposal. This chemical has been shown to damage the liver, nervous system, and circulatory system of laboratory animals such as rats and mice when the animals are exposed at high levels over their lifetimes. Some industrial workers who were exposed to relatively large amounts of this chemical during their working careers also suffered damage to the liver, nervous system, and circulatory system. Chemicals which cause adverse effects among exposed industrial workers and in laboratory animals also may cause adverse health effects in humans who are exposed at lower levels over long periods of time. EPA has set the enforceable drinking water standard for 1,1,1-trichloroethane at 0.2 parts per million (ppm) to protect against the risk of these adverse health effects which have been observed in humans and laboratory animals. Drinking water which meets this standard is associated with little to none of this risk and should be considered safe.

(9) Fluoride.

(Note. -- EPA is not specifying language that must be included in a public notice for a violation of the fluoride maximum contaminant level in this section because 143.5 of this part includes the necessary information. See paragraph (f) of this section.)

(10) Microbiological contaminants (for use when there is a violation of the treatment technique requirements for filtration and disinfection in Subpart H of this part). The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that the presence of microbiological contaminants are a health concern at certain levels of exposure. If water is inadequately treated, microbiological contaminants in that water may cause disease. Disease symptoms may include diarrhea, cramps, nausea, and possibly jaundice, and

any associated headaches and fatigue. These symptoms, however, are not just associated with disease causing organisms in drinking water, but also may be caused by a number of factors other than your drinking water. EPA has set enforceable requirements for treating drinking water to reduce the risk of these adverse health effects. Treatment such as filtering and disinfecting the water removes or destroys microbiological contaminants. Drinking water which is treated to meet EPA requirements is associated with little to none of this risk and should be considered safe.

(f) Public notices for fluoride. Notice of violations of the maximum contaminant level for fluoride, notices of variances and exemptions from the maximum contaminant level for fluoride, and notices of failure to comply with variance and exemption schedules for the maximum contaminant level for fluoride shall consist of the public notice prescribed in 143.5(b), plus a description of any steps which the system is taking to come into compliance.

(g) Public notification by the State. The State may give notice to the public required by this section on behalf of the owner or operator of the public water system if the State complies with the requirements of this section. However, the owner or operator of the public water system remains legally responsible for ensuring that the requirements of this section are met.

(52 FR 41546, Oct. 28, 1987)

Effective Date Note: At 52 FR 41546, Oct. 28, 1987, 141.32 was added, effective April 28, 1989. The old 141.32 was redesignated as 141.36.

§141.33 Record maintenance.

Any owner or operator of a public water system subject to the provisions of this part shall retain on its premises or at a convenient location near its premises the following records:

(a) Records of bacteriological analyses made pursuant to this part shall be kept for not less than 5 years. Records of chemical analyses made pursuant to this part shall be kept for not less than 10 years. Actual laboratory reports may be kept, or data may be transferred to tabular summaries, provided that the following information is included:

(1) The date, place, and time of sampling, and the name of the person who collected the sample;

(2) Identification of the sample as to whether it was a routine distribution system sample, check sample, raw or process water sample or other special purpose sample;

(3) Date of analysis;

(4) Laboratory and person responsible for performing analysis;

(5) The analytical technique/method used; and

(6) The results of the analysis.

(b) Records of action taken by the system to correct violations of primary drinking water regulations shall be kept for a period not less than 3 years after the last action taken with respect to the particular violation involved.

(c) Copies of any written reports, summaries or communications relating to sanitary surveys of the system conducted by the system itself, by a private consultant, or by any local, State or Federal agency, shall be kept for a period not less than 10 years after completion of the sanitary survey involved.

(d) Records concerning a variance or exemption granted to the system shall be kept for a period ending not less than 5 years following the expiration of such variance or exemption.

§ 141.34 Public notice requirements pertaining to lead.

(a) Applicability of public notice requirement. (1) Except as provided in paragraph (a)(2) of this section, by June 19, 1988, the owner or operator of each community water system and each non-transient, non-community water system shall issue notice to persons served by the system that may be affected by lead contamination of their drinking water. The State may require subsequent notices. The owner or operator shall provide notice under this section even if there is no violation of the national primary drinking water regulation for lead.

(2) Notice under paragraph (a)(1) of this section is not required if the system demonstrates to the State that the water system, including the residential and non-residential portions connected to the water system, are lead free. For the purposes of this paragraph, the term "lead free" when used with respect to solders and flux refers to solders and flux containing not more than 0.2 percent lead, and when used with respect to pipes and pipe fittings refers to pipes and pipe fittings containing not more than 8.0 percent lead.

(b) Manner of notice. Notice shall be given to persons served by the system either by (1) three newspaper notices (one for each of three consecutive months and the first no later than June 19, 1988); or (2) once by mail notice with the water bill or in a separate mailing by June 19, 1988; or (3) once by hand delivery by June 19, 1988. For non-transient non-community water systems, notice may be given by continuous posting. If posting is used, the notice shall be posted in a conspicuous place in the area served by the system and start no later than June 19, 1988, and continue for three months.

(c) General content of notice. (1) Notices issued under this section shall provide a clear and readily understandable explanation of the potential sources of lead in drinking water, potential adverse health effects, reasonably available methods of mitigating known or potential lead content in drinking water, any steps the water system is taking to mitigate lead content in drinking water, and the necessity for seeking alternative water supplies, if any. Use of the mandatory language in paragraph (d) of this section in the notice will be sufficient to explain potential adverse health effects. (2) Each notice shall also include specific advice on how to determine if materials containing lead have been used in homes or the water distribution system and how to minimize exposure to water likely to contain high levels of lead. Each notice shall be conspicuous and shall not contain unduly technical language, unduly small print, or similar problems that frustrate the purpose of the notice. Each notice shall contain the telephone number of the owner, operator, or designee of the public water system as a source of additional information regarding the notice. Where appropriate, the notice shall be multilingual.

(Note (Optional Information): Each notice should advise persons served by the system to use only the cold water faucet for drinking and for use in cooking or preparing baby formula, and to run the water until it gets as cold as it is going to get before each use. If there has recenlty been major water use in the household, such as showering or bathing, flushing toilets, or doing laundry with cold water, flushing the pipes should take 5 to 30 seconds; if not, flushing the pipes could take as long as several minutes. Each notice should also advise persons served by the system to check to see if lead pipes, solder, or flux have been used in plumbing that provides tap water and to ensure that new plumbing and plumbing repairs use lead-free materials. The only way to be sure of the amount of lead in the household water is to have the water tested by a competent laboratory. Testing is especially important to apartment dwellers because flushing may not be effective in high-rise buildings that have lead-soldered central piping. As appropriate, the notice should provide information on testing.)

(d) Mandatory health effects information. When providing the information in public notices required under paragraph (c) of this section on the potential adverse health effects of lead in drinking water, the owner or operator of the water system shall include the following specific language in the notice:

"The United States Environmental Protection Agency (EPA) sets drinking water standards and has determined that lead is a health concern at certain levels of exposure. There is currently a standard of 0.050 parts per million (ppm). Based on new health information, EPA is likely to lower this standard significantly.

"Part of the purpose of this notice is to inform you of the potential adverse health effects of lead. This is being done even though your water may not be in violation of the current standard.

"EPA and others are concerned about lead in drinking water. Too much lead in the human body can cause serious damage to the brain, kidneys, nervous system, and red blood cells. The greatest risk, even with short-term exposure, is to young children and pregnant women.

"Lead levels in your drinking water are likely to be highest:

-if your home or water system has lead pipes, or

-if your home has copper pipes with lead solder, and

-if the home is less than five years old, or

-if you have soft or acidic water, or

-if water sits in the pipes for several hours."

(e) Notice by the State. The State may give notice to the public required by this section on behalf of the owner or operator of the water system if the State meets the requirements of paragraph (b) and the notice contains all the information specified in paragraphs (c) and (d) of this section. However, the owner or operator of the water system remains legally responsible for ensuring that the requirements of this section are met.

(f) Enforcement by the State. All States shall enforce the requirements of this section by June 19, 1988, as required by section 1417(b)(2) of the Act. If the Administrator determines that a State is not enforcing these requirements, the Administrator may withhold up to five percent of the State program grant fund under section 1443(a) of the Act.

(52 FR 41549, Oct. 28, 1987)

§ 141.35 Reporting and public notification for certain unregulated contaminants.

(a) The requirements of this section only apply to the contaminants listed in § 141.40.

(b) The owner or operator of a community water system or non-transient, non-community water system who is required to monitor under § 141.40 shall send a copy of the results of such monitoring within 30 days of receipt and any public notice under paragraph (d) of this section to the State.

(c) The State, or the community water system or non-transient, non-community water system if the State has not adopted regulations equivalent to § 141.40, shall furnish the following information to the Administrator for each sample analyzed under § 141.40:

(1) Results of all analytical methods, including negatives;

(2) Name and address of the system that supplied the sample;

(3) Contaminant(s);

(4) Analytical method(s) used;

(5) Date of sample;

(6) Date of analysis.

(d) The owner or operator shall notify persons served by the system of the availability of the results of sampling conducted under 141.40 by including a notice in the first set of water bills issued by the system after the receipt of the results or written notice within three months. The notice shall identify a person and supply the telephone number to contact for information on the monitoring results. For surface water systems, public notification is required only after the first quarter's monitoring and must include a statement that additional monitoring will be conducted for three more quarters with the results available upon request.

(52 FR 25714, July 8, 1987; 53 FR 25110, July 1, 1988) Effective Date Note: At 52 FR 25714, July 8, 1987 as corrected at 53 FR 25110, July 1, 1988, 141.35 was added to Subpart D. The document provided that the information collection requirements in 141.35 "are effective January 1, 1988, if the information collection request is cleared by the Office of Management and Budget (OMB) and an OMB clearance number is assigned prior to that date. If not, the requirements will be effective when OMB clears the request and a notice is published."

§ 141.36 Public notification.

The requirements in this section apply until April 28, 1989. After April 28, 1989 the requirements of 141.32 will apply.

(a) If a community water system or non-transient non-community water systems fails to comply with an applicable maximum contaminant level established in Subpart B or G, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable maximum contaminant level, fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, or fails to perform any monitoring pursuant to section 1445(a) of the Act, the supplier of water shall notify persons served by the water system of the failure or grant by inclusion of a notice in the first set of water bills of the system issued after the failure or grant and in any event by written notice within three months. Such notice shall be repeated at least once every three months so long as the system's failure continues or the variance or exemption remains in effect. If the system issues water bills less frequently than quarterly, or does not issue water bills, the notice shall be made by or supplemented by another form of direct mail.

(b) If a community water system has failed to comply with an applicable maximum contaminant level, the supplier of water shall notify the public of such failure, in addition to the notification required by paragraph (a) of this section, as follows:

(1) By publication on not less than three consecutive days in a newspaper or newspapers of general circulation in the area served by the system. Such notice shall be completed within fourteen days after the supplier of water learns of the failure.

(2) By furnishing a copy of the notice to the radio and television stations serving the area served by the system. Such notice shall be furnished within seven days after the supplier of water learns of the failure.

(3) Except that the requirements of this paragraph (b) may be waived by the State if it determines that the violation has been corrected promptly after discovery, the cause of the violation has been eliminated, and there is no longer a risk to public health.

(c) If the area served by a community water system is not served by a daily newspaper of general circulation, notification by newspaper required by paragraph (b) of this section shall instead be given by publication on three consecutive weeks in a weekly newspaper of general circulation serving the area. If no weekly or daily newspaper of general circulation serves the area, notice shall be given by posting the notice in post offices within the area served by the system.

(d) If a non-community water system fails to comply with an applicable MCL established in Subpart B of this part, fails to comply with an applicable testing procedure established in Subpart C of this part, is granted a variance or an exemption from an applicable MCL, fails to comply with the requirements of any schedule prescribed pursuant to a variance or exemption, or fails to perform any monitoring requirement pursuant to section 1445(a) of the Act, the supplier of water shall give notices by continuous posting of such failure or granting of a variance or exemption to the persons served by the system as long as the failure or granting of a variance or exemption continues. The form and manner for such notices shall be prescribed by the State and shall ensure that the public using the system is adequately informed of the failure or granting of the variance or exemption.

(e) Notices given pursuant to this section shall be written in a manner reasonably designed to inform fully the users of the system. The notice shall be conspicuous and shall not use unduly technical language, unduly small print or other methods which would frustrate the purpose of the notice. The notice shall disclose all material facts regarding the subject including the nature of the problem and, when appropriate, a clear statement that a primary drinking water regulation has been violated and any preventive measures that should be taken by the public. Where appropriate, or where designated by the State, bilingual notice shall be given. Notices may include a balanced explanation of the significance or seriousness to the public health of the subject of the notice, a fair explanation of steps taken by the system to correct any problem and the results of any additional sampling.

(f) Notice to the public required by this section may be given by
the State on behalf of the supplier of water.

(g) In any instance in which notification by mail is required by paragraph (a) of this section but notification by newspaper or to radio or television stations is not required by paragraph (b) of this section, the State may order the supplier of water to provide notification by newspaper and to radio and television stations when circumstances make more immediate or broader notice appropriate to protect the public health.

(40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57345, Aug. 27, 1980; 51 FR 11411, Apr. 2, 1986; 52 FR 25714, July 8, 1987. Redesignated and amended at 52 FR 41546, Oct. 28, 1987)

Effective Date Note 1: At 52 FR 25714, July 8, 1987, § 141.32 was amended by revising the first phrase of paragraph (a), effective January 9, 1989. The text remaining in effect until January 9, 1989 appears below.

§ 141.32 Public notification.

(a) If a community water system fails to comply with an applicable
maximum contaminant level established in Subparts B or G. * * *

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Effective Date Note 2: At 52 FR 41546, Oct. 28, 1987, 141.32 was redesignated as § 141.36 and introductory text was added, effective to April 28, 1989.

Subpart E -- Special Regulations, Including Monitoring Regulations and Prohibition on Lead Use

§ 141.40 Special monitoring for organic chemicals.

(a) All community and non-transient, non-community water systems shall monitor for the contaminants listed in paragraph (e) in this section by date specified in Table 1:

Table 1. -- Monitoring Schedule by System Size

Number of Persons Served	Monitoring to begin no later than:
Over 10,000	1-1-88
3,300 to 10,000	1-1-89
Less than 3,000	1-1-91

(b) Surface water systems shall sample at points in the distribution system representative of each water source or at entry points to the distribution system after any application of treatment. The minimum number of samples is one year of quarterly samples per water source.

(c) Ground water systems shall sample at points of entry to the distribution system representative of each well after any application of treatment. The minimum number of samples is one sample per entry point to the distribution system.

(d) The State may require confirmation samples for positive or negative results.

(e) Community water systems and non-transient, non-community water systems shall monitor for the following contaminants except as provided in paragraph (f) of this section:

(1) Chloroform
(2) Bromodichloromethane
(3) Chlorodibromomethane
(4) Bromoform
(5) trans-1,2-Dichloroethylene
(6) Chlorobenzene
(7) m-Dichlorobenzene
(8) Dichloromethane
(9) cis-1,2-Dichloroethylene
(10) o-Dichlorobenzene
(11) Dibromomethane
(12) 1,1-Dichloropropene
(13) Tetrachloroethylene
(14) Toluene
(15) p-Xylene
(16) o-Xylene
(17) m-Xylene

(18) 1,1-Dichloroethane
(19) 1,2-Dichloropropane
(20) 1,1,2,2-Tetrachloroethane
(21) Ethylbenzene
(22) 1,3-Dichloropropane
(23) Styrene
(24) Chloromethane
(25) Bromomethane
(26) 1,2,3-Trichloropropane
(27) 1,1,1,2-Tetrachloroethane
(28) Chloroethane
(29) 1,1,2-Trichloroethane
(30) 2,2-Dichloropropane
(31) o-Chlorotoluene
(32) p-Chlorotoluene
(33) Bromobenzene
(34) 1,3-Dichloropropene
(35) Ethylene dibromide (EDB)
(36) 1,2-Dibromo-3-chloropropane (DBCP)

(f) Community water systems and non-transient non-community water systems must monitor for EDB and DBCP only if the State determines they are vulnerable to contamination by either or both of these substances. For the purpose of this paragraph, a vulnerable system is defined as a system which is potentially contaminated by EDB and DBCP, including surface water systems where these two compounds are applied, manufactured, stored, disposed of, or shipped upstream, and for ground-water systems in areas where the compounds are applied, manufactured, stored, disposed of, or shipped in the ground-water recharge basin, or for ground-water systems that are in proximity to underground storage tanks that contain leaded gasoline.

(g) Analysis under this section shall be conducted using the recommended EPA methods as follows, or their equivalent as determined by EPA: 502.1, "Volatile Halogenated Organic Compounds in Water by Purge and Trap Gas Chromatography," 503.1, "Volatile Aromatic and Unsaturated Organic Compounds in Water by Purge and Trap Gas Chromatography," 524.1, ''Volatile Organic Compounds in Water by Purge and Trap Gas Chromatography/Mass Spectrometry," 524.2, "Volatile Organic Compounds in Water by Purge and Trap Capillary Column Gas Chromatography/Mass Spectrometry, or 502.2, "Volatile Organic Compounds in Water by Purge and Trap Gas Chromatography with Photoionization and Electrolytic Conductivity Detectors in Series." These methods are contained in "Methods for the Determination of Organic Compounds in Finished Drinking Water and Raw Source Water," September 1986, available from Environmental Monitoring and Support Laboratory (EMSL), EPA, Cincinnati, Ohio 45268. Analysis of 1,2-dibromo-3-chloropropane (DBCP) and 1,2-dibromoethane (EDB) shall be conducted by Method 504, "Measurement of 1,2,-Dibromoethane (EDB) and 1,2-Dibromo-3-chloropropane (DBCP) in Drinking Water by Microextraction and Gas Chromatography," September

1986, available from EMSL. Cincinnati, Ohio 45268 or the State.

(h) Analysis under this section shall only be conducted by laboratories approved under § 141.24(g)(11). In addition to the requirements of § 141.24(g)(11), each laboratory analyzing for EDB and DBCP must achieve a method detection limit for EDB and DBCP of 0.00002 mg/l, according to the procedures in Appendix B of Part 136.

(i) Public water systems may use monitoring data collected any time after January 1, 1983 to meet the requirements for unregulated monitoring, provided that the monitoring program was consistent with the requirements of this section. In addition, the results of EPA's Ground Water Supply Survey may be used in a similar manner for systems supplied by a single well.

(j) Monitoring for the following compounds is required at the discretion of the State:

(1) 1,2,4-Trimethylbenzene
(2) 1,2,4-Trichlorobenzene
(3) 1,2,3-Trichlorobenzene
(4) n-Propylbenzene
(5) n-Butylbenzene
(6) Naphthalene
(7) Hexachlorobutadiene
(8) 1,3,5-Trimethylbenzene
(9) p-Isopropyltoluene
(10) Isopropylbenzene
(11) Tert-butylbenzene
(12) Sec-butylbenzene
(13) Fluorotrichloromethane
(14) Dichlorodifluoromethane
(15) Bromochloromethane

(k) Instead of performing the monitoring required by this section, a community water system or non-transient non-community water system serving fewer than 150 service connections may send a letter to the State stating that the system is available for sampling. This letter must be sent to the State no later than January 1, 1991. The system shall not send such samples to the State, unless requested to do so by the State.

(l) All community and non-transient, non-community water systems shall repeat the monitoring required in § 141.40 no less frequently than every five years from the dates specified in 141.40(a).

(m) States or public water systems may composite up to five samples when monitoring for substances in § 141.40 (e) and (j) of this section.

(52 FR 25715, July 8, 1987; 53 FR 25111, July 1, 1988)

Effective Date Note: At 52 FR 25715, July 8, 1987, as corrected at 53 FR 25110, July 1, 1988, 141.40 was revised. The document provided that the information collection requirements in 141.40 "are effective January 1, 1988, if the information collection request is cleared by the Office of Management and Budget (OMB) and an OMB clearance number is assigned prior to that date. If not, the requirements will be effective when OMB clears the request and a notice is published." The text in effect until OMB clearance is obtained is shown below.

141.40 Special monitoring for organic chemicals.

(a) The Administrator may designate, by publication in the Federal Register, public water systems which are required to take water samples, provide information, and in appropriate cases analyze water samples for the purpose of providing information on contamination of drinking water sources and of treated water by organic chemicals. 1

(b) The Administrator shall provide to each public system designated pursuant to paragraph (a) of this section a written schedule for the sampling of source water or treated water by the system, with written instructions for the sampling methods and for handling of samples. The schedule may designate the locations or types of locations to be sampled.

(c) In cases where the public water system has a laboratory capable of analyzing samples for constituents specified by the Administrator, the Administrator may require analyses to be made by the public water system for submission to EPA. If the Administrator requires the analyses to be made by the public water system, he shall provide the system with written instructions as to the analytical procedures to be followed, or with references to technical documents describing the analytical procedures.

(d) Public water systems designated by the Administrator pursuant to paragraph (a) of this section shall provide to the Administrator, upon request, information to be used in the evaluation of analytical results, including records of previous monitoring and analyses, information on possible sources of contamination and treatment techniques used by the system.

(40 FR 59588, Dec. 24, 1975)

1.A list of designated public water systems was published at 41 FR 5281, January 5, 1976.

§ 141.41 Special monitoring for sodium.

(a) Suppliers of water for community public water systems shall collect and analyze one sample per plant at the entry point of the distribution system for the determination of sodium concentration levels; samples must be collected and analyzed annually for systems utilizing surface water sources in whole or in part, and at least every three years for systems utilizing solely ground water sources. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples. The supplier of water may be required by the State to collect and analyze water samples for sodium more frequently in locations where the sodium content is variable.

(b) The supplier of water shall report to EPA and/or the State the results of the analyses for sodium within the first 10 days of the month following the month in which the sample results were received or within the first 10 days following the end of the required monitoring period as stipulated by the State, whichever of these is first. If more than annual sampling is required the supplier shall report the average sodium concentration within 10 days of the month following the month in which the analytical results of the last sample used for the annual average was received. The supplier of water shall not be required to report the results to EPA where the State has adopted this regulation and results are reported to the State. The supplier shall report the results to EPA where the State has not adopted this regulation.

(c) The supplier of water shall notify appropriate local and State public health officials of the sodium levels by written notice by direct mail within three months. A copy of each notice required to be provided by this paragraph shall be sent to EPA and/or the State within 10 days of its issuance. The supplier of water is not required to notify appropriate local and State public health officials of the sodium levels where the State provides such notices in lieu of the supplier.

(d) Analyses for sodium shall be performed by the flame photometric method in accordance with the procedures described in "Standard Methods for the Examination of Water and Wastewater," 14th Edition, pp. 250-253; or by Method 273.1, Atomic Absorption -- Direct Aspiration or Method 273.2, Atomic Absorption -- Graphite Furnace, in "Methods for Chemical Analysis of Water and Waste," EMSL, Cincinnati, EPA, 1979; or by Method D1428-64(a) in Annual Book of ASTM Standards, Part 31, Water.

(45 FR 57345, Aug. 27, 1980)

§ 141.42 Special monitoring for corrosivity characteristics.

(a) Suppliers of water for community public water systems shall collect samples from a representative entry point to the water distribution system for the purpose of analysis to determine the corrosivity characteristics of the water.

(1) The supplier shall collect two samples per plant for analysis for each plant using surface water sources wholly or in part or more if required by the State; one during mid-winter and one during mid-summer. The supplier of the water shall collect one sample per plant for analysis for each plant using ground water sources or more if required by the State. The minimum number of samples required to be taken by the system shall be based on the number of treatment plants used by the system, except that multiple wells drawing raw water from a single aquifer may, with the State approval, be considered one treatment plant for determining the minimum number of samples.

(2) Determination of the corrosivity characteristics of the water shall include measurement of pH, calcium hardness, alkalinity, temperature, total dissolved solids (total filterable residue), and calculation of the Langelier Index in accordance with paragraph (c) of this section. The determination of corrosivity characteristics shall only include one round of sampling (two samples per plant for surface water and one sample per plant for ground water sources). However, States may require more frequent monitoring as appropriate. In addition, States have the discretion to require monitoring for additional parameters which may indicate corrosivity characteristics, such as sulfates and chlorides. In certain cases, the Aggressive Index, as described in paragraph (c), can be used instead of the Langelier Index; the supplier shall request in writing to the State and the State will make this determination.

(b) The supplier of water shall report to EPA and/or the State the results of the analyses for the corrosivity characteristics within the first 10 days of the month following the month in which the sample results were received. If more frequent sampling is required by the State, the supplier can accumulate the data and shall report each value within 10 days of the month following the month in which the analytical results of the last sample was received. The supplier of water shall not be required to report the results to EPA where the State has adopted this regulation and results are reported to the State.

(c) Analyses conducted to determine the corrosivity of the water shall be made in accordance to the following methods:

(1) Langelier Index -- "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 203, pp. 61-63.

(2) Aggressive Index -- "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, Colorado.

(3) Total Filtrable Residue -- "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 208B, pp. 92-93: or "Methods for Chemical Analysis of Water and Wastes," Method 160.1.

(4) Temperature -- "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 212, pp. 125-126.

(5) Calcium -- EDTA titrimetric method "Standard Methods for the Examination of Water and Wastewater," 14th Edition. Method 306C, pp. 189-191: or "Annual Book of ASTM Standards," Method D-1126-67B: ''Methods for Chemical Analysis of Water and Wastes," Method 215.2.

(6) Alkalinity -- Methyl Orange end point pH 4.5. "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 403, pp. 278-281: or "Annual Book of ASTM Standards," Method D1067-70B: or "Methods for Chemical Analysis of Water and Wastes," Method 310.1.

(7) pH -- "Standard Methods for the Examination of Water and Wastewater," 14th Edition, Method 424, pp. 460-465; or "Methods for Chemical Analysis of Water and Wastes," Method 150.1: or "Annual Book of ASTM Standards," Method D-1293-78A or B.

(8) Chloride -- Potentiometric Method. "Standard Methods for the Examination of Water and Wastewater," 14th Edition, p. 306.

(9) Sulfate -- Turbidimetric Method. "Methods for Chemical Analysis of Water and Wastes," pp. 277-278, EPA, Office of Technology Transfer, Washington, DC, 20460, 1974, or "Standard Methods for the Examination of Water and Wastewater," 14th Edition, pp. 496-498.

(d) Community water supply systems shall identify whether the following construction materials are present in their distribution system and report to the State:

Lead from piping, solder, caulking, interior lining of distribution mains, alloys and home plumbing.

Copper from piping and alloys, service lines, and home plumbing.

Galvanized piping, service lines, and home plumbing.

Ferrous piping materials such as cast iron and steel.

Asbestos cement pipe.

In addition. States may require identification and reporting of other materials of construction present in distribution systems that may contribute contaminants to the drinking water, such as:

Vinyl lined asbestos cement pipe.

Coal tar lined pipes and tanks.

(45 FR 57346, Aug. 27, 1980; 47 FR 10999. Mar. 12, 1982)

§ 141.43 Prohibition on use of lead pipes, solder, and flux.

(a) In general -- (1) Prohibition. Any pipe, solder, or flux, which is used after June 19, 1986, in the installation or repair of:

(i) Any public water system, or

(ii) Any plumbing in a residential or nonresidential facility providing water for human consumption which is connected to a public water system shall be lead free as defined by paragraph (d) of this section.

This paragraph (a)(1) shall not apply to leaded joints necessary for the repair of cast iron pipes.

(2) Each public water system shall identify and provide notice to persons that may be affected by lead contamination of their drinking water where such contamination results from either or both of the following:

(i) The lead content in the construction materials of the public water distribution system.

(ii) Corrosivity of the water supply sufficient to cause leaching of lead. Notice shall be provided notwithstanding the absence of a violation of any national drinking water standard. The manner and form of notice are specified in 141.34 of this part.

(b) State enforcement -- (1) Enforcement of prohibition. The requirements of paragraph (a)(1) of this section shall be enforced in all States effective June 19, 1988. States shall enforce such requirements through State or local plumbing codes, or such other means of enforcement as the State may determine to be appropriate.

(2) Enforcement of public notice requirements. The requirements of paragraph (a)(2) of this section, shall apply in all States effective June 19, 1988.

(c) Penalties. If the Administrator determines that a State is not enforcing the requirements of paragraph (a) of this section, as required pursuant to paragraph (b) of this section, the Administrator may withhold up to 5 percent of Federal funds available to that State for State program grants under section 1443(a) of the Act.

(d) Definition of lead free. For purposes of this section, the term "lead free"

(1) When used with respect to solders and flux refers to solders and flux containing not more than 0.2 percent lead, and

(2) When used with respect to pipes and pipe fittings refers to pipes and pipe fittings containing not more than 8.0 percent lead.

(52 FR 20674, June 2, 1987)

141.50 Subpart F -- Maximum Contaminant Level Goals

Maximum contaminant level goals for organic contaminants

(a) MCLGs are zero for the following contaminants:
(1) Benzene
(2) Vinyl chloride
(3) Carbon tetrachloride
(4) 1,2-dichloroethane
(5) Trichloroethylene

(b) MCLGs for the following contaminants are as indicated:

CONTAMINANT	MCLG in mg/l
1,1-Dichloroethylene	0.007
1,1,1-Trichloroethane	0.20

para-Dichlorobenzene	0.075

50 FR 46901, Nov. 13, 1985, as amended at 52 FR 20674, June 2, 1987; 52 FR 25716, July 8, 1987)

Effective Date Note: At 52 FR 25716, July 8, 1987, 141.50 was amended by revising paragraph (b), effective January 9, 1989.

§ 141.51 Maximum contaminant level goals for inorganic contaminants.

(a) (RESERVED)

(b) MCLGs for the following contaminants are as indicated:

(1) Fluoride: 4.0 mg/l
(2) (RESERVED)

(50 FR 47155, Nov. 14, 1985, as amended at 52 FR 20674, June 2, 1987)

Subpart G --- National Revised Primary Drinking Water Regulations: Maximum Contaminant Levels

§141.52 Maximum contaminant level goals for microbiological contaminants.

MCLGs for the following contaminants are as indicated:

Contaminant	MCLG
(1) Giardia lamblia	zero
(2) Viruses	zero
(3) Legionella	zero

§ 141.60 Effective dates.

(a) The effective date for 141.61 is January 9, 1989.
(b) The effective date for 141.62(b)(1) is October 2, 1987.

(52 FR 25716, July 8, 1987; 53 FR 25111, July 1, 1988) Effective Date
Note: At 52 FR 25716, July 8, 1987, as corrected at 53 FR 25111, July 1, 1988, § 141.60 was revised, effective January 9, 1989. For the convenience of the user, the superseded text is set forth as follows.
141.60 Effective dates.

(a) (Reserved)
(b) Effective dates for 141.62
(1) (Reserved)
(2) The effective date for 141.62(b)(1) is October 2, 1987.

(51 FR 11411, Apr. 2, 1986)

§ 141.61 Maximum contaminant levels for organic contaminants.

(a) The following maximum contaminant levels for organic contaminants apply to community water systems and non-transient non-community water systems.

CAS No.	CONTAMINANT	MCL in mg/l
71-43-2	Benzene	0.005
75-01-4	Vinyl chloride	0.002
56-23-5	Carbon tetrachloride	0.005
107-06-2	1,2-Dichloroethane	0.005
79-01-6	Trichloroethylene	0.005
75-35-4	1,1,-Dichloroethylene	0.007
71-55-6	1,1,1-Trichloroethane	0.20
106-46-7	para-Dichlorobenzene	0.075

(b) The Administrator, pursuant to section 1412 of the Act, hereby identifies the following as the best technology, treatment techniques, or other means available for achieving compliance with the maximum contaminant levels for synthetic organic chemicals (141.61(a)): central treatment using packed tower aeration; central treatment using granular activated carbon for all these chemicals except vinyl chloride.

(52 FR 25716, July 8, 1987; 53 FR 25111, July 1, 1988)

Effective Date Note: At 52 FR 25716, July 8, 1987, as corrected at 53 FR 25111, 141.61 was added, effective January 9, 1989.

§ 141.62 Maximum contaminant levels for inorganic contaminants.

(a) (Reserved)

(b) The following maximum contaminant levels for inorganic contaminants apply to community water systems.

(1) Fluoride 4.0 mg/l

(2) (RESERVED)

(51 FR 11411, Apr. 2, 1986)

Subpart H -- FILTRATION AND DISINFECTION

§141.70 General requirements.

(a) The requirements of this Subpart H constitute national primary drinking water regulations. These regulations establish criteria under which filtration is required as a treatment technique for public water systems supplied by a surface water source and public water systems supplied by a ground water source under the direct influence of surface water. In addition, these regulations establish treatment technique requirements in lieu of maximum contaminant levels for the following contaminants: Giardia lamblia, viruses, heterotrophic plate count bacteria, Legionella, and turbidity. Each public water system with a surface water source or a ground water source under the direct influence of surface water must provide treatment of that source water that complies with these treatment technique requirements. The treatment technique requirements consist of installing and properly operating water treatment processes which reliably achieve:

(1) at least 99.9 percent (3-log) removal and/or inactivation of Giardia lamblia cysts between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer; and

(2) at least 99.99 percent (4-log) removal and/or inactivation of viruses between a point where the raw water is not subject to recontamination by surface water runoff and a point downstream before or at the first customer.

(b) A public water system using a surface water source or a ground water source under the direct influence of surface water is considered to be in compliance with the requirements of paragraph (a) of this section if:

(1) it meets the requirements for avoiding filtration in §141.71 and the disinfection requirements in §141.72(a): or

(2) it meets the filtration requirements in §141.73 and the disinfection requirements in §141.72(b).

(c) Each public water system using a surface water source or a ground water source under the direct influence of surface water must be operated by qualified personnel who meet the requirements specified by the State.

§141.71 Criteria for avoiding filtration.

A public water system that uses a surface water source must meet all of the conditions of paragraphs (a) and (b) of this section, and is subject to paragraph (c) of this section, beginning December 30, 1991, unless the State has determined, in writing pursuant to section 1412(b)(7)(C)(iii), that filtration is required. A public water system that uses a ground water source under the direct influence of surface water must meet all of the conditions of paragraphs (a) and (b) of this section and is subject to paragraph (c) of this section, beginning 18 months after the State determines that it is under the direct influence of surface water, or December 30, 1991, whichever is later, unless the State has determined, in writing pursuant to section 1412(b)(7)(C)(iii), that filtration is required. If the State determines in writing pursuant to section 1412(b)(7)(C)(iii) before December 30, 1991 that filtration is required, the system must have installed filtration and meet the criteria for filtered systems specified in §§141.72(b) and 141.73 by June 29, 1993. Within 18 months of the failure of a system using surface water or a ground water source under the direct influence of surface water to meet any one of the requirements of paragraphs (a) and (b) of this section or after June 29, 1993, whichever is later, the system must have installed filtration and meet the criteria for filtered systems specified in §§141.72(b) and 141.73.

(a) Source water quality conditions. (1) The fecal coliform concentration must be equal to or less than 20/100 1, or the total coliform concentration must be equal to or less than 100/100 ml (measured as specified in §141.74(a)(1) and (2) and (b)(1)), in representative samples of the source water immediately prior to the first or only point of disinfectant application in at least 90 percent of the measurements made for the six previous months that the system served water to the public on an ongoing basis. If a system measures both fecal and total coliforms, the fecal coliform criterion, but not the total coliform criterion, in this paragraph must be met.

(2) The turbidity level cannot exceed 5 NTU (measured as specified in §141.74(a)(4) and (b)(2)) in representative samples of the source water immediately prior to the first or only point of disinfectant application unless: (i) the State determines that any such event was caused by circumstances that were unusual and unpredictable; and (ii) as a result of any such event, there have not been more than two events in the past 12 months the system served water to the public, or more than five events in the past 120 months the system served water to the public, in which the turbidity level exceeded 5 NTU. An "event" is a series of

consecutive days during which at least one turbidity measurement each day exceeds 5 NTU.

(b) Site-specific conditions. (1)(i) The public water system must meet the requirements of §141.72(a)(1) at least

11 of the 12 previous months that the system served water to the public, on an ongoing basis, unless the system fails to meet the requirements during 2 of the 12 previous months that the system served water to the public, and the State determines that at least one of these failures was caused by circumstances that were unusual and unpredictable.

(ii) The public water system must meet the requirements of §141.72(a)(2) at all times the system serves water to the public.

(iii) The public water system must meet the requirements of §141.72(a)(3) at all times the system serves water to the public unless the State determines that any such failure was caused by circumstances that were unusual and unpredictable.

(iv) The public water system must meet the requirements of §141.72(a)(4) on an ongoing basis unless the State determines that failure to meet these requirements was not caused by a deficiency in treatment of the source water.

(2) The public water system must maintain a watershed control program which minimizes the potential for contamination by Giardia lamblia cysts and viruses in the source water. The State must determine whether the watershed control program is adequate to meet this goal. The adequacy of a program to limit potential contamination by Giardia lamblia cysts and viruses must be based on: the comprehensiveness of the watershed review; the effectiveness of the system's program to monitor and control detrimental activities occurring in the watershed;

and the extent to which the water system has maximized land ownership and/or controlled land use within the watershed. At a minimum, the watershed control program must:

(i) characterize the watershed hydrology and land ownership; (ii) identify watershed characteristics and activities which may have an adverse effect on source water quality; and

(iii) monitor the occurrence of activities which may have an adverse effect on source water quality.

The public water system must demonstrate through ownership and/or written agreements with landowners within the watershed that it can control all human activities which may have an adverse impact on the microbiological quality of the source water. The public water system must submit an annual report to the State that identifies any special concerns about the watershed and how they are being handled; describes activities in the watershed that affect water quality; and projects what adverse activities are expected to occur in the future and describes how the public water system expects to address them. For systems using a ground water source under the direct influence of surface water, an approved wellhead protection program developed under section 1428 of the Safe Drinking Water Act may be used, if the State deems it appropriate, to meet these requirements.

(3) The public water system must be subject to an annual on-site inspection to assess the watershed control program and disinfection treatment process. Either the State or a

party approved by the State must conduct the on-site inspection. The inspection must be conducted by competent individuals such as sanitary and civil engineers, sanitarians, or technicians who have experience and knowledge about the operation and maintenance of a public water system, and who have a sound understanding of public health principles and waterborne diseases. A report of the on-site inspection summarizing all findings must be prepared every year. The on-site inspection must indicate to the State's satisfaction that the watershed control program and disinfection treatment process are adequately designed and maintained. The on-site inspection must include:

(i) a review of the effectiveness of the watershed control program;

(ii) a review of the physical condition of the source intake and how well it is protected;

(iii) a review of the system's equipment maintenance program to ensure there is low probability for failure of the disinfection process;

(iv) an inspection of the disinfection equipment for physical deterioration;

(v) a review of operating procedures;

(vi) a review of data records to ensure that all required tests are being conducted and recorded and disinfection is effectively practiced; and

(vii) identification of any improvements which are needed in the equipment, system maintenance and operation, or data collection.

(4) The public water system must not have been identified as a source of a waterborne disease outbreak, or if it has been so identified, the system must have been modified sufficiently to prevent another such occurrence, as determined by the State.

(5) The public water system must comply with the maximum contaminant level (MCL) for total coliforms in §141.63 at least 11 months of the 12 previous months that the system served water to the public, on an ongoing basis, unless the State determines that failure to meet this requirement was not caused by a deficiency in treatment of the source water.

(6) The public water system must comply with the requirements for trihalomethanes in §§141.12 and 141.30.

(c) *Treatment technique violations.* (1) A system that (i)4 fails to meet any one of the criteria in paragraphs (a) and (b) of this section and/or which the State has determined that filtration is required, in writing pursuant to section 1412(b)(7)(C)(iii), and (ii) fails to install filtration by the date specified in the introductory paragraph of this section is in violation of a treatment technique requirement.

(2) A system that has not installed filtration is in violation of a treatment technique requirement if:

(i) The turbidity level (measured as specified in §141.74(a)(4) and (b)(2)) in a representative sample of the source water immediately prior to the first or only point of disinfection application exceeds 5 NTU; or

(ii) The system is identified as a source of a waterborne disease outbreak.

§141.72 Disinfection.

A public water system that uses a surface water source and does not provide filtration treatment must provide the disinfection treatment specified in paragraph (a) of this section beginning December 30, 1991, unless the State determines that filtration is required in writing pursuant to section 1412 (b)(7)(C)(iii). A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must provide disinfection treatment specified in paragraph (a) of this section beginning December 30, 1991 or 18 months after the State determines that the ground water source is under the influence of surface water, whichever is later, unless the State has determined that filtration is required in writing pursuant to section 1412(b)(7)(C)(iii). If the State has determined that filtration is required, the system must comply with any interim disinfection requirements the State deems necessary before filtration is installed. A system that uses a surface water source that provides filtration treatment must provide the disinfection treatment specified in paragraph (b) of this section beginning June 29, 1993, or beginning when filtration is installed, whichever is later. A system that uses a ground water source under the direct influence of surface water and provides filtration treatment must provide disinfection treatment as specified in paragraph (b) of this section by June 29, 1993, or beginning when filtration is installed, whichever is later. Failure to meet any requirement of this section after the applicable date specified in this introductory paragraph is a treatment technique violation.

(a) Disinfection requirements for public water systems that do not provide filtration. Each public water system that does not provide filtration treatment must provide disinfection treatment as follow

(1) The disinfection treatment must be sufficient to ensure at least 99.9 percent (3-log) inactivation of Giardia lamblia cysts and

99.99 percent (4-log) inactivation of viruses, every day the system serves water to the public, except any one day each month. Each day a system serves water to the public, the public water system must calculate the CT value(s) from the system's treatment parameters, using the procedure specified in §141.74(b)(3), and determine whether this value(s) is sufficient to achieve the specified inactivation rates for Giardia lamblia cysts and viruses. If a system uses a disinfectant other than chlorine, the system may demonstrate to the State, through the use of a State-approved protocol for on-site disinfection challenge studies or other information satisfactory to the State, that $CT_{99.9}$ values other than those specified in Tables 2.1 and 3.1 in §141.74(b)(3) or other operational parameters are adequate to demonstrate that the system is achieving minimum inactivation rates required by paragraph (a)(1) of this section.

(2) The disinfection system must have either (i) redundant components, including an auxiliary power supply with automatic start-up and alarm to ensure that disinfectant application is maintained continuously while water is being delivered to the distribution system, or (ii) automatic shut-off of delivery of water to the distribution system whenever there is less than 0.2 mg/l of residual disinfectant concentration in the water. If the State determines that automatic shut-off would cause unreasonable risk to health or interfere with fire protection, the system must comply with paragraph (a)(2)(i) of this section.

(3) The residual disinfectant concentration in the water entering the distribution system, measured as specified in §141.74(a)(5) and (b)(5), cannot be less than 0.2 mg/l for more than 4 hours.

(4)(i) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in §141.74(a)(5) and (b)(6), cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in §141.74(a)(3), is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula cannot exceed 5 percent in one month, for any two consecutive months.

$$V = \frac{c + d + e}{a + b} \times 100$$

where:

a = number of instances where the residual disinfectant concentration is measured;

b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d = number of instances where residual disinfectant concentration is measured but not detected and where the HPC is >500/ml; and

e = number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml.

(ii) If the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by §141.74(a)(3) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (a)(4)(i) of this section do not apply to that system.

(b) Disinfection requirements for public water systems which provide filtration. Each public water system that provides filtration treatment must provide disinfection treatment as follows.

(1) The disinfection treatment must be sufficient to ensure that the total treatment processes of that system achieve at least 99.9 percent (3-log) inactivation and/or removal of Giardia lamblia cysts and at least 99.99 percent (4-log) inactivation and/or removal of viruses, as determined by the State.

(2) The residual disinfectant concentration in the water entering the distribution system, measured as specified in §141.74(a)(5) and (c)(2), cannot be less than 0.2 mg/l for more than 4 hours.

(3)(i) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, or chlorine dioxide, as specified in §141.74(a)(5) and (c)(3), cannot be undetectable in more than 5 percent of the samples each month, for any two consecutive months that the system serves water to the public. Water in the distribution system with a heterotrophic bacteria concentration less than or equal to 500/ml, measured as heterotrophic plate count (HPC) as specified in §141.74(a)(3), is deemed to have a detectable disinfectant residual for purposes of determining compliance with this requirement. Thus, the value "V" in the following formula cannot exceed 5 percent in one month, for any two consecutive months.

$$v = \frac{c + d + e}{a + b} \times 100$$

where:

a = number of instances where the residual disinfectant concentration is measured;

b = number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

c = number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

d = number of instances where no residual disinfectant concentration is detected and where the HPC is >500/ml; and

e = number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml.

(ii) If the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified in §141.74(a)(3) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (b)(3)(i) of this section do not apply.

§141.73 Filtration.

A public water system that uses a surface water source or a ground water source under the direct influence of surface water, and does not meet all of the criteria in §141.71(a) and (b) for avoiding filtration, must provide treatment consisting of both disinfection, as specified in §141.72(b), and filtration treatment which complies with the requirements of paragraph (a), (b), (c), (d), or (e) of this section by June 29, 1993, or within 18 months of the failure to meet any one of the criteria for avoiding filtration in §141.71(a) and (b), whichever is later. Failure to meet any requirement of this section after the date specified in this introductory paragraph is a treatment technique violation.

(a) Conventional filtration treatment or direct filtration. (1) For systems using conventional filtration or direct filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 0.5 NTU in at least 95 percent of the measurements taken each month, measured as specified in §141.74(a)(4) and (c)(1), except that if the State determines that the system is capable of achieving at least 99.9 percent removal and/or inactivation of Giardia lamblia cysts at some turbidity level higher than 0.5 NTU in at least 95 percent of the measurements taken each month, the State may substitute this higher turbidity limit for that system. However, in no case may the State approve a turbidity limit that allows more than 1 NTU in more than 5 percent of the samples taken each month, measured as specified in §141.74(a)(4) and (c)(1).

(2) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in §141.74(a)(4) and (c)(1).

(b) Slow sand filtration. (1) For systems using slow sand filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in §141.74(a)(4) and (c)(1), except that if the State determines there is no significant interference with disinfection at a higher turbidity level, the State may substitute this higher turbidity limit for that system.

(2) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in §141.74(a)(4) and (c).

(c) Diatomaceous earth filtration. (1) For systems using diatomaceous earth filtration, the turbidity level of representative samples of a system's filtered water must be less than or equal to 1 NTU in at least 95 percent of the measurements taken each month, measured as specified in §141.74(a)(4) and (c)(1).

(2) The turbidity level of representative samples of a system's filtered water must at no time exceed 5 NTU, measured as specified in §141.74(a)(4) and (c)(1).

(d) Other filtration technologies. A public water system may use a filtration technology not listed in paragraphs (a)-(c) of this section if it demonstrates to the State, using pilot plant studies or other means, that the alternative filtration technology, in combination with disinfection treatment that meets the requirements of §141.72(b), consistently achieves 99.9 percent removal and/or inactivation of Giardia lamblia cysts and 99.99 percent removal and/or inactivation of viruses. For a system that makes this demonstration, the requirements of paragraph (b) of this section apply. §141.74 Analytical and monitoring requirements.

(a) Analytical requirements. Only the analytical method(s) specified in this paragraph, or otherwise approved by EPA, may be used to demonstrate compliance with the requirements of §§141.71, 141.72, and 141.73. Measurements for pH, temperature, turbidity, and residual disinfectant concentrations must be conducted by a party approved by the State. Measurements for total coliforms, fecal coliforms, and HPC must be conducted by a laboratory certified by the State or EPA to do such analysis. Until laboratory certification criteria are developed for the analysis of HPC and fecal coliforms, any laboratory certified for total coliform analysis by EPA is deemed certified for HPC and fecal coliform analysis. The following procedures shall be performed in accordance with the publications listed in the following section. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR Part 51. Copies of the methods published in Standard Methods for the Examination of Water and Wastewater may be obtained from the American Public Health Association et al., 1015 Fifteenth Street, N.W., Washington, D.C. 20005; copies of the Minimal Medium ONPG-MUG Method as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and Esherichia coli from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method" (Edberg et al.), may be obtained from the American Water Works Association Research Foundation, 6666 West Quincy Avenue, Denver, Colorado, 80235; and copies of the Indigo Method as set forth in the article "Determination of Ozone in Water by the Indigo Method" (Bader and Hoigne), may be obtained from Ozone Science & Engineering, Pergamon Press Ltd., Fairview Park, Elmsford, New York 10523. Copies may be inspected at the U.S. Environmental Protection Agency, Room EB15, 401 M Street, S.W., Washington, D.C. 20460 or at the Office of the Federal Register, 1100 L Street, N.W., Room 8401, Washington, D.C.

(1) Fecal coliform concentration - Method 908C (Fecal Coliform MPN Procedures), pp. 878-880, Method 908D (Estimation of Bacterial Density), pp. 880-882, or Method 909C (Fecal Coliform Membrane Filter Procedure),

pp. 896-898, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition.

(2) Total coliform concentration - Method 908A (Standard Total Coliform Multiple - Tube (MPN) Tests), pp. 872-876, Method 908B (Application of Tests to Routine Examinations), pp. 876-878, Method 908D (Estimation of Bacterial Density), pp. 880-882, Method 909A (Standard Total Coliform Membrane Filter Procedure), pp. 887-894, or Method 909B (Delayed - Incubation Total Coliform Procedure), pp. 894-896, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition; Minimal Medium ONPG-MUG Test, as set forth in the article "National Field Evaluation of a Defined Substrate Method for the Simultaneous Enumeration of Total Coliforms and Escherichia coli from Drinking Water: Comparison with the Standard Multiple Tube Fermentation Method" (Edberg et al.), Applied and Environmental Microbiology, Volume 54, pp. 1595-1601, June 1988. (Note: the Minimal Medium ONPG-MUG Test is sometimes referred to as the Autoanalysis Colilert System). Systems may use a five-tube test or a ten-tube test.

(3) Heterotrophic Plate Count - Method 907A (Pour Plate Method), pp. 864-866, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition.

(4) Turbidity - Method 214A (Nephelometric Method Nephelometric Turbidity Units), pp. 134-136, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition.

(5) Residual disinfectant concentration - Residual disinfectant concentrations for free chlorine and combined chlorine (chloramines) must be measured by Method 408C (Amperometric Titration Method), pp. 303-306, Method 408D (DPD Ferrous Titrimetric Method), pp. 306-309, Method 408E (DPD Colorimetric Method), pp. 309-310, or Method 408F (Leuco Crystal Violet Method), pp. 310-313, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition. Residual disinfectant concentrations for free chlorine and combined chlorine may also be measured by using DPD colorimetric test kits if approved by the State. Residual disinfectant concentrations for ozone must be measured by the Indigo Method as set forth in Bader, H., Hoigne, J., "Determination of Ozone in Water by the Indigo Method: A Submitted Standard Method"; Ozone Science and Engineering, Vol. 4, pp. 169-176, Pergamon Press Ltd., 1982, or automated methods which are calibrated in reference to the results obtained by the Indigo Method on a regular basis, if approved by the State. (Note: This method will be published in the 17th edition of Standard Methods for the Examination of Water and Wastewater, American Public Health Association et al.; the Iodometric Method in the 16th edition may not be used.) Residual disinfectant concentrations for chlorine dioxide must be measured by Method 410B (Amperometric Method) or Method 410C (DPD Method), pp. 323-324, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition.

(6) Temperature - Method 212 (Temperature), pp. 126-127, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association et al., 16th edition.

(7) pH - Method 423 (pH Value), pp. 429-437, as set forth in Standard Methods for the Examination of Water and Wastewater, 1985, American Public Health Association, 16th edition.

(b) Monitoring requirements for systems that do not provide filtration. A public water system that uses a surface water source and does not provide filtration treatment must begin monitoring, as specified in this paragraph (b), beginning December 31, 1990, unless the State has determined that filtration is required in writing pursuant to section 1412(b)(7)(C)(iii), in which case the State may specify alternative monitoring requirements, as appropriate, until filtration is in place. A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must begin monitoring as specified in this paragraph (b) beginning December 31, 1990 or 6 months after the State determines that the ground water source is under the direct influence of surface water, whichever is later, unless the State has determined that filtration is required in writing pursuant to section 1412(b)(7)(C)(iii), in which case the State may specify alternative monitoring requirements, as appropriate, until filtration is in place.

(1) Fecal coliform or total coliform density measurements as required by §141.71(a)(1) must be performed on representative source water samples immediately prior to the first or only point of disinfectant application. The system must sample for fecal or total coliforms at the following minimum frequency each week the system serves water to the public:

System size (persons served)	Samples/week[1]
<500	1
501-3,300	2
3,301-10,000	3
10,001-25,000	4
>25,000	5

[1] Must be taken on separate days.

Also, one fecal or total coliform density measurement must be made every day the system serves water to the public and the turbidity of the source water exceeds 1 NTU (these samples count towards the weekly coliform sampling requirement) unless the State determines that the system, for logistical reasons outside the system's control, cannot have the sample analyzed within 30 hours of collection.

(2) Turbidity measurements as required by §141.71(a)(2) must be performed on representative grab samples of source water immediately prior to the first or only point of disinfectant application every four hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the State.

(3) The total inactivation ratio for each day that the system is in operation **must be determined** based on the $CT_{99.9}$ values in Tables 1.1 - 1.6, 2.1, and 3.1 of this section, as appropriate. The parameters necessary to **determine** the total inactivation ratio must be monitored as follows:

(i) The temperature of the disinfected water must be measured at least once per day at each residual disinfectant concentration sampling point.

(ii) If the system uses chlorine, the pH of the disinfected water must be measured at least once per day at each chlorine residual disinfectant concentration sampling point.

(iii) The disinfectant contact time(s) ("T") must be determined for each day during peak hourly flow.

(iv) The residual disinfectant concentration(s) ("C") of the water before or at the first customer must be measured each day during peak hourly flow.

(v) If a system uses a disinfectant other than chlorine, the system may demonstrate to the State, through the use of a State-approved protocol for on-site disinfection challenge studies or other information satisfactory to the State, that $CT_{99.9}$ values other than those specified in Tables 2.1 and 3.1 in this section other operational parameters are adequate to demonstrate that the system is achieving the minimum inactivation rates required by §141.72(a)(1).

TABLE 1.1

CT VALUES ($CT_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 0.5°C OR LOWER*

Residual (mg/l)	pH ≤ 6.0	6.5	7.0	7.5	8.0	8.5	< 9.0
≤ 0.4	137	163	195	237	277	329	390
0.6	141	168	200	239	286	342	407
0.8	145	172	205	246	295	354	422
1.0	148	176	210	253	304	365	437
1.2	152	180	215	259	313	376	451
1.4	155	184	221	266	321	387	464
1.6	157	189	226	273	329	397	477
1.8	162	193	231	279	338	407	489
2.0	165	197	236	286	346	417	500
2.2	169	201	242	297	353	426	511
2.4	172	205	247	298	361	435	522
2.6	175	209	252	304	368	444	533
2.8	178	213	257	310	375	452	543
3.0	181	217	261	316	382	460	552

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature and at the higher pH.

TABLE 1.2

CT VALUES (CT $_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 5.0°C*

Free Residual (mg/l)	pH						
	< 6.0	6.5	7.0	7.5	8.0	8.5	< 9.0
< 0.4	97	117	139	166	198	236	279
0.6	100	120	143	171	204	244	291
0.8	103	122	146	175	210	252	301
1.0	105	125	149	179	216	260	312
1.2	107	127	152	183	221	267	320
1.4	109	130	155	187	227	274	329
1.6	111	132	158	192	232	281	337
1.8	114	135	162	196	238	287	345
2.0	116	138	165	200	243	294	353
2.2	118	140	169	204	248	300	361
2.4	120	143	172	209	253	306	368
2.6	122	146	175	213	258	312	375
2.8	124	148	178	217	263	318	382
3.0	126	151	182	221	268	324	389

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT $_{99.9}$ value at the lower temperature, and at the higher pH.

TABLE 1.3

CT VALUES ($CT_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 10°C*

Free Residual (mg/l)	pH						
	< 6.0	6.5	7.0	7.5	8.0	8.5	< 9.0
< 0.4	73	88	104	125	149	177	209
0.6	75	90	107	128	153	183	218
0.8	78	92	110	131	158	189	226
1.0	79	94	112	134	162	195	234
1.2	80	95	114	137	166	200	240
1.4	82	98	116	140	170	206	247
1.6	83	99	119	144	174	211	253
1.8	86	101	122	147	179	215	259
2.0	87	104	124	150	182	221	265
2.2	89	105	127	153	186	225	271
2.4	90	107	129	157	190	230	276
2.6	92	110	131	160	194	234	281
2.8	93	111	134	163	197	239	287
3.0	95	113	137	166	201	243	292

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature, and at the higher pH.

TABLE 1.4

CT VALUES ($CT_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 15°C*

Free Residual (mg/l)	pH						
	≤ 6.0	6.5	7.0	7.5	8.0	8.5	≤ 9.0
≤ 0.4	49	59	70	83	99	118	140
0.6	50	60	72	86	102	122	146
0.8	52	61	73	88	105	126	151
1.0	53	63	75	90	108	130	156
1.2	54	64	76	92	111	134	160
1.4	55	65	78	94	114	137	165
1.6	56	66	79	96	116	141	169
1.8	57	68	81	98	119	144	173
2.0	58	69	83	100	122	147	177
2.2	59	70	85	102	124	150	181
2.4	60	72	86	105	127	153	184
2.6	61	73	88	107	129	156	188
2.8	62	74	89	109	132	159	191
3.0	63	76	91	111	134	162	195

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature, and at the higher pH.

TABLE 1.5

CT VALUES (CT$_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 20°C*

Free Residual (mg/l)	pH						
	< 6.0	6.5	7.0	7.5	8.0	8.5	< 9.0
≤ 0.4	36	44	52	62	74	89	105
0.6	38	45	54	64	77	92	109
0.8	39	46	55	66	79	95	113
1.0	39	47	56	67	81	98	117
1.2	40	48	57	69	83	100	120
1.4	41	49	58	70	85	103	123
1.6	42	50	59	72	87	105	126
1.8	43	51	61	74	89	108	129
2.0	44	52	62	75	91	110	132
2.2	44	53	63	77	93	113	135
2.4	45	54	65	78	95	115	138
2.6	46	55	66	80	97	117	141
2.8	47	56	67	81	99	119	143
3.0	47	57	68	83	101	122	146

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT$_{99.9}$ value at the lower temperature, and at the higher pH.

TABLE 1.6

CT VALUES (CT$_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY FREE CHLORINE AT 25°C* AND HIGHER

Free Residual (mg/l)	pH						
	< 6.0	6.5	7.0	7.5	8.0	8.5	< 9.0
< 0.4	24	29	35	42	50	59	70
0.6	25	30	36	43	51	61	73
0.8	26	31	37	44	53	63	75
1.0	26	31	37	45	54	65	78
1.2	27	32	38	46	55	67	80
1.4	27	33	39	47	57	69	82
1.6	28	33	40	48	58	70	84
1.8	29	34	41	49	60	72	86
2.0	29	35	41	50	61	74	88
2.2	30	35	42	51	62	75	90
2.4	30	36	43	52	63	77	92
2.6	31	37	44	53	65	78	94
2.8	31	37	45	54	66	80	96
3.0	32	38	46	55	67	81	97

*These CT values achieve greater than a 99.99 percent inactivation of viruses. CT values between the indicated pH values may be determined by linear interpolation. CT values between the indicated temperatures of different tables may be determined by linear interpolation. If no interpolation is used, use the CT$_{99.9}$ value at the lower temperature, and at the higher pH.

TABLE 2.1

CT VALUES ($CT_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY CHLORINE DIOXIDE AND OZONE*

	Temperature					
	< 1°C	5°C	10°C	15°C	20°C	> 25°C
Chlorine dioxide	63	26	23	19	15	11
Ozone	2.9	1.9	1.4	0.95	0.72	0.48

*These CT values achieve greater than 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature for determining $CT_{99.9}$ values between indicated temperatures.

TABLE 3.1

CT VALUES ($CT_{99.9}$) FOR 99.9 PERCENT INACTIVATION OF GIARDIA LAMBLIA CYSTS BY CHLORAMINES*

Temperature					
< 1°C	5°C	10°C	15°C	20°C	> 25°C
3,800	2,200	1,850	1,500	1,100	750

*These values are for pH values of 6 to 9. These CT values may be assumed to achieve greater than 99.99 percent inactivation of viruses only if chlorine is added and mixed in the water prior to the addition of ammonia. If this condition is not met, the system must demonstrate, based on on-site studies or other information, as approved by the State, that the system is achieving at least 99.99 percent inactivation of viruses. CT values between the indicated temperatures may be determined by linear interpolation. If no interpolation is used, use the $CT_{99.9}$ value at the lower temperature for determining $CT_{99.9}$ values between indicated temperatures.

(4) The total inactivation ratio must be calculated as follows:

(i) If the system uses only one point of disinfectant application, the system may determine the total inactivation ratio based on either of the following two methods:

(A) One inactivation ratio ($CTcalc/CT_{99.9}$) is determined before or at the first customer during peak hourly flow and if the $CTcalc/CT_{99.9} >$ 1.0, the 99.9 percent Giardia lamblia inactivation requirement has been achieved; or

(B) Successive $CTcalc/CT_{99.9}$ values, representing sequential inactivation ratios, are determined between the point of disinfectant application and a point before or at the first customer during peak hourly flow. Under this alternative, the following method must be used to calculate the total inactivation ratio:

(1) Determine $\frac{CTcalc}{CT_{99.9}}$ for each sequence.

(2) Add the $\frac{CTcalc}{CT_{99.9}}$ values together $\left(\left(\frac{CTcalc}{CT_{99.9}}\right)\right)$

(3) If $\frac{(CTcalc)}{(CT_{99.9})}$ > 1.0, the 99.9 percent Giardia lamblia inactivation requirement has been achieved.

(ii) If the system uses more than one point of disinfectant application before or at the first customer, the system must determine the CT value of each disinfection sequence immediately prior to the next point of disinfectant application during peak hourly flow. The $CTcalc/CT_{99.9}$ value of each sequence and $\frac{CTcalc}{CT_{99.9}}$ must be calculated using the method in paragraph (b)(4)(i)(B) of this section to determine if the system is in compliance with §142.72(a).

(iii) Although not required, the total percent inactivation for a system with one or more points of residual disinfectant concentration monitoring may be calculated by solving the following equation:

$$\% \text{ inactivation} = 100 - \frac{100}{10^{z}}$$

$$\text{where } z = 3 \times \frac{(CTcalc)}{(CT_{99.9})}$$

(5) The residual disinfectant concentration of the water entering the distribution system must be monitored continuously, and the lowest value must be recorded each day, except that if there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment, and systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies prescribed below:

System size by population	Samples/day*
< 500	1
501-1,000	2
1,001-2,500	3
2,501-3,300	4

* The day's samples cannot be taken at the same time. The sampling intervals are subject to State review and approval.

If at any time the residual disinfectant concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system must take a grab sample every 4 hours until the residual concentration is equal to or greater than 0.2 mg/l.

(6)(i) The residual disinfectant concentration must be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled, as specified in §141.21, except that the State may allow a public water system which uses both a surface water source or a ground water source under direct influence of surface water, and a ground water source, to take disinfectant residual samples at points other than the total coliform sampling points if the State determines that such points are more representative of treated (disinfected) water quality within the distribution system. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in paragraph (a)(3) of this section, may be measured in lieu of residual disinfectant concentration.

(ii) If the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by paragraph (a)(3) of this section and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (b)(6)(i) of this section do not apply to that system.

(c) *Monitoring requirements for systems using filtration treatment.* A public water system that uses a surface water source or a ground water source under the influence of surface water and provides filtration treatment must monitor in accordance with this paragraph (c) beginning June 29, 1993, or when filtration is installed, whichever is later.

(1) Turbidity measurements as required by §141.73 must be performed on representative samples of the system's filtered water every four hours (or more frequently) that the system serves water to the public. A public water system may substitute continuous turbidity monitoring for

grab sample monitoring if it validates the continuous measurement for accuracy on a regular basis using a protocol approved by the State. For any systems using slow sand filtration or filtration treatment other than conventional treatment, direct filtration, or diatomaceous earth filtration, the State may reduce the sampling frequency to once per day if it determines that less frequent monitoring is sufficient to indicate effective filtration performance. For systems serving 500 or fewer persons, the State may reduce the turbidity sampling frequency to once per day, regardless of the type of filtration treatment used, if the State determines that less frequent monitoring is sufficient to indicate effective filtration performance.

(2) The residual disinfectant concentration of the water entering the distribution system must be monitored continuously, and the lowest value must be recorded each day, except that if there is a failure in the continuous monitoring equipment, grab sampling every 4 hours may be conducted in lieu of continuous monitoring, but for no more than 5 working days following the failure of the equipment, and systems serving 3,300 or fewer persons may take grab samples in lieu of providing continuous monitoring on an ongoing basis at the frequencies each day prescribed below:

System size by population	Samples/day*
< 500	1
501-1,000	2
1,001-2,500	3
2,501-3,300	4

* The day's samples cannot be taken at the same time. The sampling intervals are subject to State review and approval.

If at any time the residual disinfectant concentration falls below 0.2 mg/l in a system using grab sampling in lieu of continuous monitoring, the system must take a grab sample every 4 hours until the residual disinfectant concentration is equal to or greater than 0.2 mg/l.

(3)(i) The residual disinfectant concentration must be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled, as specified in §141.21, except that the State may allow a public water system which uses both a surface water source or a ground water source under direct influence of surface water, and a ground water source to take disinfectant residual samples at points other than the total coliform sampling points if the State determines that such points are more representative of treated (disinfected) water quality within the distribution system. Heterotrophic bacteria, measured as heterotrophic plate count (HPC) as specified in paragraph (a)(3) of this section, may be measured in lieu of residual disinfectant concentration.

(ii) If the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by paragraph (a)(3) of this section and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (c)(3)(i) of this section do not apply to that system.

§141.75 Reporting and recordkeeping requirements.

(a) A public water system that uses a surface water source and does not provide filtration treatment must report monthly to the State the information specified in this paragraph (a) beginning December 31, 1990, unless the State has determined that filtration is required in writing pursuant to section 1412(b)(7)(C)(iii), in which case the State may specify alternative reporting requirements, as appropriate, until filtration is in place. A public water system that uses a ground water source under the direct influence of surface water and does not provide filtration treatment must report monthly to the State the information specified in this paragraph (a) beginning December 31, 1990 or 6 months after the State determines that the ground water source is under the direct influence of surface water, whichever is later, unless the State has determined that filtration is required in writing pursuant to section 1412(b)(7)(C)(iii), in which case the State may specify alternative reporting requirements, as appropriate, until filtration is in place.

(1) Source water quality information must be reported to the State within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(i) The cumulative number of months for which results are reported.

(ii) The number of fecal and/or total coliform samples, whichever are analyzed during the month (if a system monitors for both, only fecal coliforms must be reported), the dates of sample collection, and the dates when the turbidity level exceeded 1 NTU.

(iii) The number of samples during the month that had equal to or less than 20/100 ml fecal coliforms and/or equal to or less than 100/100 ml total coliforms, whichever are analyzed.

(iv) The cumulative number of fecal or total coliform samples, whichever are analyzed, during the previous six months the system served water to the public.

(v) The cumulative number of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than

100/100 ml total coliforms, whichever are analyzed, during the previous six months the system served water to the public.

(vi) The percentage of samples that had equal to or less than 20/100 ml fecal coliforms or equal to or less than 100/100 ml total coliforms, whichever are analyzed, during the previous six months the system served water to the public.

(vii) The maximum turbidity level measured during the month, the date(s) of occurrence for any measurement(s) which exceeded 5 NTU, and the date(s) the occurrence(s) was reported to the State.

(viii) For the first 12 months of recordkeeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after one year of recordkeeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 12 months the system served water to the public.

(ix) For the first 120 months of recordkeeping, the dates and cumulative number of events during which the turbidity exceeded 5 NTU, and after 10 years of recordkeeping for turbidity measurements, the dates and cumulative number of events during which the turbidity exceeded 5 NTU in the previous 120 months the system served water to the public.

(2) Disinfection information specified in §141.74(b) must be reported to the State within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(i) For each day, the lowest measurement of residual disinfectant concentration in mg/l in water entering the distribution system.

(ii) The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/l and when the State was notified of the occurrence.

(iii) The daily residual disinfectant concentration(s) (in mg/l) and disinfectant contact time(s) (in minutes) used for calculating the CT value(s).

(iv) If chlorine is used, the daily measurement(s) of pH of disinfected water following each point of chlorine disinfection.

(v) The daily measurement(s) of water temperature in °C following each point of disinfection.

(vi) The daily CTcalc and CTcalc/$CT_{99.9}$ values for each disinfectant measurement or sequence and the sum of all CTcalc/$CT_{99.9}$ values ((CTcalc/$CT_{99.9}$)) before or at the first customer.

(vii) The daily determination of whether disinfection achieves adequate *Giardia* cyst and virus inactivation, i.e., whether (CTcalc/$CT_{99.9}$) is at least 1.0 or, where disinfectants other than chlorine are used, other indicator conditions that the State determines are appropriate, are met.

(viii) The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to §141.72:

(A) number of instances where the residual disinfectant concentration is measured;

(B) number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

(C) number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

(D) number of instances where no residual disinfectant concentration is detected and where HPC is >500/ml;

(E) number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml;

(F) for the current and previous month the system served water to the public, the value of "V" in the following formula:

$$v = \frac{c + d + e}{a + b} \times 100$$

where

a = the value in paragraph (a)(2)(viii)(A) of this section, b = the value in paragraph (a)(2)(viii)(B) of this section, c = the value in paragraph (a)(2)(viii)(C) of this section, d = the value in paragraph (a)(2)(viii)(D) of this section, and e = the value in paragraph (a)(2)(viii)(E) of this section. (G) if the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory under the requisite time and temperature conditions specified by §141.74(a)(3) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (a)(2)(viii)(A)-(F) of this section do not apply to that system.

(ix) A system need not report the data listed in paragraphs (a)(2)(i), and (iii)-(vi) of this section if all data listed in paragraphs (a)(2)(i)-(viii) of this section remain on file at the system, and the State determines that:

(A) the system has submitted to the State all the information required by paragraphs (a)(2)(i)-(viii) of this section for at least 12 months; and

(B) the State has determined that the system is not required to provide filtration treatment.

(3) No later than ten days after the end of each Federal fiscal year (September 30), each system must provide to the State a report which summarizes its compliance with all watershed control program requirements specified in §141.71(b)(2).

(4) No later than ten days after the end of each Federal fiscal year (September 30), each system must provide to the State a report on the on-site inspection conducted during that year pursuant to §141.71(b)(3), unless the on-site inspection was conducted by the State. If the inspection was conducted by the State, the State must provide a copy of its report to the public water system.

(5) (i) Each system, upon discovering that a waterborne disease outbreak potentially attributable to that water system has occurred, must report that occurrence to the State as soon as possible, but no later than by the end of the next business day.

(ii) If at any time the turbidity exceeds 5 NTU, the system must inform the State as soon as possible, but no later than the end of the next business day.

(iii) If at any time the residual falls below 0.2 mg/l in the water entering the distribution system, the system must notify the State as soon as possible, but no later than by the end of the next business day. The system also must notify the State by the end of the next business day whether or not the residual was restored to at least 0.2 mg/l within 4 hours.

(b) A public water system that uses a surface water source or a ground water source under the direct influence of surface water and provides filtration treatment must report monthly to the State the information specified in this paragraph (b) beginning June 29, 1993, or when filtration is installed, whichever is later.

(1) Turbidity measurements as required by §141.74(c)(1) must be reported within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(i) The total number of filtered water turbidity measurements taken during the month.

(ii) The number and percentage of filtered water turbidity measurements taken during the month which are less than or equal to the turbidity limits specified in §141.73 for the filtration technology being used.

(iii) The date and value of any turbidity measurements taken during the month which exceed 5 NTU.

(2) Disinfection information specified in §141.74(c) must be reported to the State within 10 days after the end of each month the system serves water to the public. Information that must be reported includes:

(i) For each day, the lowest measurement of residual disinfectant concentration in mg/l in water entering the distribution system.

(ii) The date and duration of each period when the residual disinfectant concentration in water entering the distribution system fell below 0.2 mg/l and when the State was notified of the occurrence.

(iii) The following information on the samples taken in the distribution system in conjunction with total coliform monitoring pursuant to §141.72:

(A) number of instances where the residual disinfectant concentration is measured;

(B) number of instances where the residual disinfectant concentration is not measured but heterotrophic bacteria plate count (HPC) is measured;

(C) number of instances where the residual disinfectant concentration is measured but not detected and no HPC is measured;

(D) number of instances where no residual disinfectant concentration is detected and where HPC is >500/ml;

(E) number of instances where the residual disinfectant concentration is not measured and HPC is >500/ml;

(F) for the current and previous month the system serves water to the public, the value of "V" in the following formula:

$$V = \frac{c + d + e}{a + b} \times 100$$

where

a = the value in paragraph (b)(2)(iii)(A) of this section, b = the value in paragraph (b)(2)(iii)(B) of this section, c = the value in paragraph (b)(2)(iii)(C) of this section, d = the value in paragraph (b)(2)(iii)(D) of this section, and e = the value in paragraph (b)(2)(iii)(E) of this section. (G) if the State determines, based on site-specific considerations, that a system has no means for having a sample transported and analyzed for HPC by a certified laboratory within the requisite time and temperature conditions specified by §141.74(a)(3) and that the system is providing adequate disinfection in the distribution system, the requirements of paragraph (b)(2)(iii)(A)-(F) of this section do not apply.

(iv) A system need not report the data listed in paragraph (b)(2)(i) of this section if all data listed in paragraphs (b)(2)(i)-(iii) of this section remain on file at the system and the State determines that the system has submitted all the information required by paragraphs (b)(2)(i)-(iii) of this section for at least 12 months.

(3) (i) Each system, upon discovering that a waterborne disease outbreak potentially attributable to that water system has occurred, must report that occurrence to the State as soon as possible, but no later than by the end of the next business day.

(ii) If at any time the turbidity exceeds 5 NTU, the system must inform the State as soon as possible, but no later than the end of the next business day.

(iii) If at any time the residual falls below 0.2 mg/l in the water entering the distribution system, the system must notify the State as soon as possible, but no later than by the end of the next business day. The system also must notify the State by the end of the next business day whether or not the residual was restored to at least 0.2 mg/l within 4 hours.

Subpart I -- (RESERVED)

Subpart J -- Use of Non-Centralized Treatment Devices

Source: 52 FR 25716, July 8, 1987, unless otherwise noted.

Effective Date Note: At 52 FR 25716, July 8, 1987, Subpart J (141.100 and 141.101) was added, effective January 9, 1989.

141.100 Criteria and procedures for public water systems using point-of-entry devices.

(a) Public water systems may use point-of-entry devices to comply with maximum contaminant levels only if they meet the requirements of this section.

(b) It is the responsibility of the public water system to operate and maintain the point-of-entry treatment system.

(c) The public water system must develop and obtain State approval for a monitoring plan before point-of-entry devices are installed for compliance. Under the plan approved by the State, point-of-entry devices must provide health protection equivalent to central water treatment. "Equivalent" means that the water would meet all national primary drinking water regulations and would be of acceptable quality similar to water distributed by a well-operated central treatment plant. In addition to the VOCs, monitoring must include physical measurements and observations such as total flow treated and mechanical condition of the treatment equipment.

(d) Effective technology must be properly applied under a plan approved by the State and the microbiological safety of the water must be maintained.

(1) The State must require adequate certification of performance, field testing, and, if not included in the certification process, a rigorous engineering design review of the point-of-entry devices.

(2) The design and application of the point-of-entry devices must consider the tendency for increase in heterotrophic bacteria concentrations in water treated with activated carbon. It may be necessary to use frequent backwashing, post-contactor disinfection, and Heterotrophic Plate Count monitoring to ensure that the microbiological safety of the water is not compromised.

(e) All consumers shall be protected. Every building connected to the system must have a point-of-entry device installed, maintained, and adequately monitored. The State must be assured that every building is subject to treatment and monitoring, and that the rights and responsibilities of the public water system customer convey with title upon sale of property.

(52 FR 25716, July 8, 1987; 53 FR 25111, July 1, 1988)

§ 141.101 Use of other non-centralized treatment devices.

Public water systems shall not use bottled water or point-of-use devices to achieve compliance with an MCL. Bottled water or point-of-use devices may be used on a temporary basis to avoid an unreasonable risk to health.