

AL-TR-1991-0075

AD-A242 509



DTIC
ELECTE
NOV 18 1991
S C D



2

ARMSTRONG
LABORATORY

**A BEE GUIDE TO COMPLYING WITH THE
SAFE DRINKING WATER ACT**

John G. Garland III, Major, USAF, BSC
Anita M. Acker, Second Lieutenant, USAF, BSC

OCCUPATIONAL AND ENVIRONMENTAL
HEALTH DIRECTORATE
Brooks Air Force Base, TX 78235-5000

August 1991

Final Report

Approved for public release; distribution is unlimited.

91-15691



91 1115 007

AIR FORCE SYSTEMS COMMAND
BROOKS AIR FORCE BASE, TEXAS 78235-5000

NOTICES

When Government drawings, specifications, or other data are used for any purpose other than in connection with a definitely Government-related procurement, the United States Government incurs no responsibility or any obligation whatsoever. The fact that the Government may have formulated or in any way supplied the said drawings, specifications, or other data, is not to be regarded by implication, or otherwise in any manner construed, as licensing the holder or any other person or corporation; or as conveying any rights or permission to manufacture, use, or sell any patented invention that may in any way be related thereto.

The mention of trade names or commercial products in this publication is for illustration purposes and does not constitute endorsement or recommendation for use by the United States Air Force.

The Office of Public Affairs has reviewed this report, and it is releasable to the National Technical Information Service, where it will be available to the general public, including foreign nationals.

This report has been reviewed and is approved for publication.

Government agencies and their contractors registered with Defense Technical Information Center (DTIC) should direct requests for copies to: DTIC, Cameron Station, Alexandria VA 22304-6145.

Non-Government agencies may purchase copies of this report from: National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield VA 22161.



JOHN G. GARLAND III, Maj, USAF, BSC
Chief, Environmental Engineering
Branch



EDWARD F. MAHER, Lt Col, USAF, BSC
Chief, Bioenvironmental
Engineering Division

REPORT DOCUMENTATION PAGE			Form Approved OMB No 0704-0188	
Public reporting burden for this collection of information is estimated to average 1 hour per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden, to Washington Headquarters Services, Directorate for Information Operations and Reports, 1215 Jefferson Davis Highway, Suite 1204, Arlington, VA 22202-4302 and to the Office of Management and Budget, Paperwork Reduction Project (0704-0188), Washington, DC 20503.				
1. AGENCY USE ONLY (Leave blank)		2. REPORT DATE August 1991	3. REPORT TYPE AND DATES COVERED Final	
4. TITLE AND SUBTITLE A BEE Guide to Complying with the Safe Drinking Water Act			5. FUNDING NUMBERS	
6. AUTHOR(S) John G. Garland III Anita M. Acker				
7. PERFORMING ORGANIZATION NAME(S) AND ADDRESS(ES) Armstrong Laboratory Occupational and Environmental Health Directorate Brooks Air Force Base, TX 78235-5000			8. PERFORMING ORGANIZATION REPORT NUMBER AL-TR-1991-0075	
9. SPONSORING / MONITORING AGENCY NAME(S) AND ADDRESS(ES)			10. SPONSORING / MONITORING AGENCY REPORT NUMBER	
11. SUPPLEMENTARY NOTES				
12a. DISTRIBUTION / AVAILABILITY STATEMENT Approved for public release; distribution is unlimited.			12b. DISTRIBUTION CODE	
13. ABSTRACT (Maximum 200 words) Armstrong Laboratory prepared this report to provide current information on the Safe Drinking Water Act and recent amendments. The report describes the evolution of the Safe Drinking Water Act and the responsibilities of base personnel involved in compliance with the Act. It also describes the monitoring requirements, analytical requirements, best available technology for controlling contaminants, and public notification requirements for regulated contaminants. The appendixes include proposed contaminants and state water quality agencies. Trying to comply with the Act can be confusing since changes seem to be occurring daily. Resources available to help answer questions about drinking water compliance include: EPA Drinking Water hotline at 1-800-426-4791, your state drinking water services, and Armstrong Laboratory, Water Quality Function at DSN 240-3305.				
14. SUBJECT TERMS Safe Drinking Water Act			15. NUMBER OF PAGES 98	
			16. PRICE CODE	
17. SECURITY CLASSIFICATION OF REPORT Unclassified	18. SECURITY CLASSIFICATION OF THIS PAGE Unclassified	19. SECURITY CLASSIFICATION OF ABSTRACT Unclassified	20. LIMITATION OF ABSTRACT UL	

TABLE OF CONTENTS

	Paragraph	Page
Chapter 1--INTRODUCTION		
Scope.....	1-1	1
Primary Enforcement Responsibility.....	1-2	1
Water Systems Not Covered by the SDWA..	1-3	2
Use of this Report.....	1-4	2
Updating of this Report.....	1-5	2
Chapter 2--BACKGROUND ON DRINKING WATER REGULATIONS		
History.....	2-1	3
SDWA Scope.....	2-2	3
1986 Amendments.....	2-3	4
Lead Contamination Control Act.....	2-4	4
Some Important Definitions in the Law..	2-5	5
EPA Standardized Monitoring Requirements.....	2-6	6
Chapter 3--TOTAL COLIFORM BACTERIA		
General Information.....	3-1	9
Monitoring Requirements.....	3-2	9
Analytical Requirements.....	3-3	12
Best Available Technology.....	3-4	14
Public Notification Requirements.....	3-5	14
Sanitary Surveys.....	3-6	14
Chapter 4--INORGANIC CHEMICALS		
General Information.....	4-1	17
Monitoring Requirements.....	4-2	17
Analytical Requirements.....	4-3	20
Best Available Technology.....	4-4	20
Compliance Monitoring.....	4-5	20
Additional Proposed Contaminant Compliance.....	4-6	20
--FLUORIDE REQUIREMENTS		
General Information.....	4-7	23
Monitoring Requirements.....	4-8	23
Analytical Requirements.....	4-9	23
Best Available Technology.....	4-10	23
Compliance Monitoring.....	4-11	23
--LEAD AND COPPER REQUIREMENTS		
General Information.....	4-12	26
Monitoring Requirements.....	4-13	26
Analytical Requirements.....	4-14	30
Best Available Technology.....	4-15	30
Reporting Requirements and Records.....	4-16	33

Accession For	
NTIS GRANT	☒
DTIC TAB	☐
Unannounced	☐
Justification	
By	
Distribution/	
Availability Codes	
Dist	Avail and/or Special
A-1	

Chapter 5--SYNTHETIC ORGANICS		
General Information.....	5-1	35
Monitoring Requirements.....	5-2	35
Analytical Requirements.....	5-3	35
Best Available Technology.....	5-4	39
Compliance Monitoring.....	5-5	39
Chapter 6--DISINFECTANTS AND DISINFECTANT BY-PRODUCTS (DBPS)		
General Information.....	6-1	41
Total Trihalomethanes Requirements.....	6-2	41
Monitoring Requirements.....	6-3	41
Analytical Requirements.....	6-4	42
Best Available Technology.....	6-5	42
Compliance Monitoring.....	6-6	42
Chapter 7--RADIONUCLIDES REQUIREMENTS		
General Information.....	7-1	45
Monitoring Requirements.....	7-2	45
Analytical Requirements.....	7-3	45
Proposed Best Available Technology.....	7-4	45
Compliance Monitoring.....	7-5	49
Chapter 8--NATIONAL SECONDARY DRINKING WATER REGULATIONS AND PHYSICAL CHARACTERISTICS		
General Information.....	8-1	51
Monitoring Requirements.....	8-2	51
Compliance Monitoring.....	8-3	51
Chapter 9--PUBLIC NOTIFICATION		
General Information.....	9-1	53
General Public Notification Requirements.....	9-2	53
Appendixes		
A--Proposed MCLGs and MCLs for Inorganic Chemicals.....		55
B--Proposed Monitoring for Synthetic Organic Chemicals.....		57
C--Disinfectant By-Products and Disinfectants.....		61
D--State Water Quality Agencies.....		65
Bibliography		76
Glossary		78
Index		83

LIST OF TABLES

<u>Table No.</u>		<u>Page</u>
3-1	Total Coliform Sampling Requirements According to Population Served	10
4-1	Inorganic Contaminant MCLs/MCLGs	18
4-2	Inorganics Compliance Monitoring Requirements	19
4-3	Inorganic Contaminants Analytical Methods	21
4-4	Best Available Technology for Inorganic Chemicals	22
4-5	Fluoride Monitoring Requirements	24
4-6	Methodology for Fluoride	25
4-7	Monitoring Requirements for Lead and Copper In Tap Water	28
4-8	Water Quality Parameter Monitoring.....	31
4-9	Lead and Copper Analytical Methods.....	32
5-1	Synthetic Organic Chemicals - MCLGs and MCLs..	36
5-2	Organics Compliance Monitoring Requirements...	37
5-3	Synthetic Organic Chemicals-Analytical Methods	38
5-4	Best Available Technology for Synthetic Organic Materials	40
6-1	TTHM Monitoring Requirements	41
7-1	Radionuclide Monitoring Requirements	46
7-2	Radionuclide Analytical Requirements	47
7-3	Radionuclide MCLs/MCLGs	48
8-1	Secondary Drinking Water MCLs	52

A BEE GUIDE TO COMPLYING WITH THE SAFE DRINKING WATER ACT

Chapter 1

INTRODUCTION

1-1. Scope.

a. The purpose of this technical report is to provide base-level Bioenvironmental Engineering Services (BES) personnel with the information they need to comply with Safe Drinking Water Act (SDWA) regulations. Two circumstances make publication of a summary document appropriate at this time. The first is HQ USAF/SGPA's decision to reference Code of Federal Regulations rather than incorporate them into AFR 161-44, Management of the Drinking Water Surveillance Program. Consequently, BES personnel will not have a ready reference to all the regulatory issues that they have had in the past. The second circumstance is the availability now, 5 years after the last major amendments to the SDWA, of regulatory information on all major water contaminants. Some contaminants not covered in this report will certainly be regulated in the future, but compliance with them will be less costly and affect fewer bases.

b. This report is not a substitute for the "old" AFR 161-44, since it does not address aspects of the base drinking water surveillance program like swimming pool monitoring, wartime water monitoring, water treatment plant operations, ice sampling, and monitoring of aircraft watering points. It was also inappropriate for the report to address every aspect of SDWA, e.g., underground injection or surface water treatment rules. Because it was not practical to include specific guidance promulgated by individual states, the BES should contact their state drinking water agency before finalizing their base procedures.

1-2. Primary Enforcement Responsibility.

a. The EPA water standards, monitoring requirements, and reporting requirements represent the minimum requirements necessary to protect the consumers' health and to ensure compliance with the SDWA. These requirements apply to all active Air Force, Air National Guard, and Air Force Reserve facilities.

b. Each Air Force public water distribution system (PWDS) must comply with the SDWA, and the National Primary Drinking Water Regulations (NPDWRs). In the United States and its territories, the provisions of the SDWA and the NPDWRs are enforced by the states except in the few instances in which the state has not been delegated primary enforcement responsibility (primacy) by the EPA. States that have primacy may establish drinking water regulations, monitoring schedules, and reporting requirements more stringent than, or in addition to, those in the NPDWRs. Air Force public water systems in these states are required to comply with these additional requirements as well as federal enforcement actions as carried out by the EPA Regional Office.

c. Outside the continental United States, the Major Command Surgeon's office acts as the state and is responsible for maintaining a program to comply with the directives given in the SDWA.

1-3. Water Systems Not Covered by the SDWA. Air Force installations meeting all the criteria in paragraphs a through d are not required to comply with this regulation since they do not meet the definition of PWDS:

a. Installations with systems consisting of distribution and storage facilities only and having no collection or treatment facilities. Treatment facilities would include Air Force owned chlorination and/or fluoridation systems connected to a municipally owned PWDS.

b. Installations obtaining all of their drinking water from a public water system that is owned or operated by another party (non-Air Force).

c. Installations which do not sell water to any party off the installation boundary.

d. Installations that are not a carrier conveying passengers in interstate commerce.

For example: If your base receives water from another party off the base and the water receives no treatment from the base, the base system is not considered a PWDS according to the regulation.

1-4. Use of this Report. This report is designed to be used in conjunction with AFR 161-44; the Federal Register, dated as early as 2 Apr 86; the Code of Federal Regulations; EPA guidance documents; state regulations; and other sources of drinking water compliance information. Located in the back of this report is an index listing of all the primary and secondary contaminants referenced in this report with their page numbers. This reference will assist the BES in finding a particular contaminant.

1-5. Updating of this Report. Even though EPA has promulgated most of the NPDWRs having far reaching impact, the Armstrong Laboratory Water Quality Function will update this technical report as major changes occur.

Chapter 2

BACKGROUND ON DRINKING WATER REGULATIONS

2-1. History.

a. Prior to 1974, state health departments monitored and regulated public water supplies and the U.S. Public Health Service (USPHS) regulated water on interstate carriers like trains, planes and buses. Drinking water program audits showed poor water bacteriological quality, insufficient monitoring, inadequate treatment, inadequate staffs, and inadequate funding. The discovery of organic contaminants in drinking water was the catalyst for Public Law 93-523 (Title XIV of the Public Health Service Act, Safety of Public Water Systems) in Dec 74, also known as the Safe Drinking Water Act (SDWA).

b. The SDWA was the first authorization by Congress of national drinking water regulations and maximum permissible levels. The USPHS had established a set of interstate standards in 1962 that were still used in the early 1970s when EPA assumed responsibility for setting drinking water standards.

c. The 1986 Amendments (Public Law 99-339) arose from continued public concern about unregulated contaminants and contamination of groundwater by industrial solvents and pesticides. Concerns included pathogens (viruses and protozoa like Giardia lamblia and Cryptosporidium parvum) which were not controlled under the 1974 regulations for turbidity and coliform bacteria. Other public concerns included the widespread contamination of shallow groundwater, lead in plumbing material, radon, poor past definitions of treatment techniques, changes in public notification needs, and the need for better groundwater supply protection. The 1986 Amendments addressed all these concerns and also documented the improved analytical techniques available.

d. The 1986 Amendments appropriated federal funds for the various provisions of the Act from 1987 through 1991. Congress will review the authorization for funding and make further changes to the law in 1992 or 1993.

e. Additional amendments to the SDWA have been made to address specific Congressional concerns. For example, the Lead Contamination Control Act of 1988 Amendment addressed rules for reducing lead contamination in drinking water used by children. Additional contamination-specific legislation may occur in the future.

2-2. SDWA Scope.

a. SDWA authorized EPA to set regulations, conduct studies, and oversee implementation of the NPDWRs. State government health departments were expected to accept major responsibility for implementing and enforcing the program (primacy). States/districts that do not have primacy at this time are Washington D.C., Indiana, and Wyoming (as of Feb 91). Since EPA can withdraw primacy, BESs can confirm their state has primacy by calling EPA State Programs Office, 202-382-5522. Puerto Rico has primacy. Where the state does not have primacy, the base should work with the regional office of EPA Safe Drinking Water Branch (Region 5 for Indiana (312-353-2151); Washington D.C., should go through Region 3, in Pennsylvania, Drinking Water Groundwater Protection Branch

(215-597-8227); and Wyoming bases should contact the Region 8 office in Denver, Colorado, Drinking Water Branch (303-293-1652)).

b. Primacy states can adopt more stringent and more extensive standards than national standards. Congress has waived federal sovereign immunity to state and local requirements concerning the SDWA. In Section 1447, the Act states "Each federal agency having jurisdiction over any federally owned or maintained public water system...shall be subject to, and comply with, all Federal, State, and local requirements, administrative authorities, and process and sanctions respecting the provision of safe drinking water...and to the same extent as any non-governmental entity."

c. The law assigned public water suppliers day-to-day responsibility to meet regulations. This included responsibility to routinely monitor the water and give results to the regulatory agency, report violations to public, and correct problems.

2-3. 1986 Amendments.

a. Require EPA publish regulations for 83 contaminants by Jun 89 and regulate an additional 25 contaminants every 3 years. These 83 contaminants are listed in the 5 Oct 83 Federal Register. (Those regulated to date are addressed in this technical report.)

b. Require EPA to establish a monitoring program for unregulated contaminants to develop occurrence data for evaluating health risks.

c. Require EPA to develop a triannual Drinking Water Priority List of known or anticipated contaminants which may require regulation under the SDWA. The 14 Jan 91 Code of Federal Regulations (CFR) has the latest list.

d. Require EPA to review and revise published regulations for contaminants every 3 years.

e. Amend enforcement rules to allow EPA to issue administrative orders for NPDWR violations, civil penalties up to \$25,000 a day for violations, and assess fines under \$5,000 without going to district court. Recent Government Accounting Office (GAO) audits show EPA has done poorly enforcing provisions of the SDWA. As a result, EPA is increasing emphasis on enforcement.

f. Require the use of lead-free pipe, solder, or flux after 19 Jun 86 in the installation or repair of public water systems and plumbing for drinking water. Lead-free is defined as 0.2% lead for solder and flux; 8.0% for pipes and fittings. Public notification is required concerning the lead content of materials used in distribution or plumbing systems or the corrosivity of water that has caused leaching.

2-4. Lead Contamination Control Act (LCCA).

a. On 1 Nov 88, Congress passed a new amendment to the SDWA known as the Lead Contamination Control Act of 1988. The LCCA requires EPA to provide guidance to states and localities to test for and remedy lead contamination in drinking water in schools and day-care centers (child development centers).

The law requires states to establish programs to help local educational agencies test for and remedy lead contamination in drinking water and from water coolers.

b. The Air Force implemented the LCCA through the Lead Assessment Program as directed by HQ USAF/SGP letter 6 Oct 89. The AFOEHL/CC letter, 5 Dec 89, Implementation of the Lead Assessment Program, provided MAJCOMs instructions for implementing EPA guidance in Air Force schools. The GAO has criticized the states and EPA for failure to adequately implement the provisions of the LCCA.

c. Other sidelights of the LCCA are the requirements for the EPA to publish a list of water coolers that are not lead free and for the Consumer Product Safety Commission to negotiate consent agreements with cooler manufacturers concerning the return of hazardous coolers. The final list of drinking water coolers that are not lead free has been published in the Federal Register on 18 Jan 90.

d. A consent order with the Scotsman Group, Inc., concerning Halsey Taylor water coolers was published in the Federal Register on 1 Jun 90. Armstrong Laboratory Water Quality Function has sent the sampling guidance to MAJCOMs.

2-5. Some Important Definitions in the Law.

a. Applicability and Definition of Water Systems. The law applies to all public owned water systems having 15 or more service connections and serving at least 25 people. The expanded definition includes two types of water systems--community and noncommunity.

1. A community system is used by at least 25 year-round residents and has 15 or more service connections. For example, a base housing area, where the base has its own water supply, is a community system.

2. A noncommunity system is used by travelers or intermittent users for at least 60 days each year, or can serve an average of 25 people for at least 60 days each year and has 15 or more service connections. A noncommunity system might be a motel with its own well; this is a transient, noncommunity system. Other noncommunity systems include schools or factories (base work areas) with their own water supply where the same people drink the water throughout the year, but not 24-hours a day; this is a nontransient, noncommunity system.

b. National Primary Drinking Water Regulations (NPDWRs).

1. A NPDWR is a multipart regulation that sets the maximum contaminant level (MCL), the maximum contaminant level goal (MCLG), and prescribes the recommended treatment technique, or best available technology (BAT), and the analytical information for a particular contaminant.

2. The MCLG is set at a level where no known or anticipated human health effects will occur. It allows an adequate margin of safety. Wherever carcinogens are involved, the MCLG is zero.

3. The MCL is set as close to the MCLG as "feasible." Feasibility considerations include the BAT for treatment, the existence of analytical and sampling capabilities, and general compliance costs. An MCL need not be a contaminant level, but can be a treatment technique. (For example, the Surface Water Treatment Rule describes a filtration and chlorination MCL treatment technique for Giardia rather than a measurable concentration.)

c. Vulnerability Assessments, Sanitary Surveys, and Compositing.

1. EPA allows states to reduce monitoring for volatile organic chemicals (VOCs), asbestos, and pesticides/PCBs (polychlorinated biphenyls) when the PWDS can show the contaminants of concern either have not been used in the watershed area (use waiver) or the source of water for the system is not susceptible to contamination. Susceptibility is based on prior occurrence, vulnerability assessment results, environmental persistence and transport of the contaminant, and Wellhead Protection Program results. The PWDS must receive a waiver the calendar quarter before the quarter when monitoring was to begin. The state may reduce VOC sampling frequency to once every 6 years for nonvulnerable groundwater systems. PWDSs have responsibility for conducting vulnerability assessments.

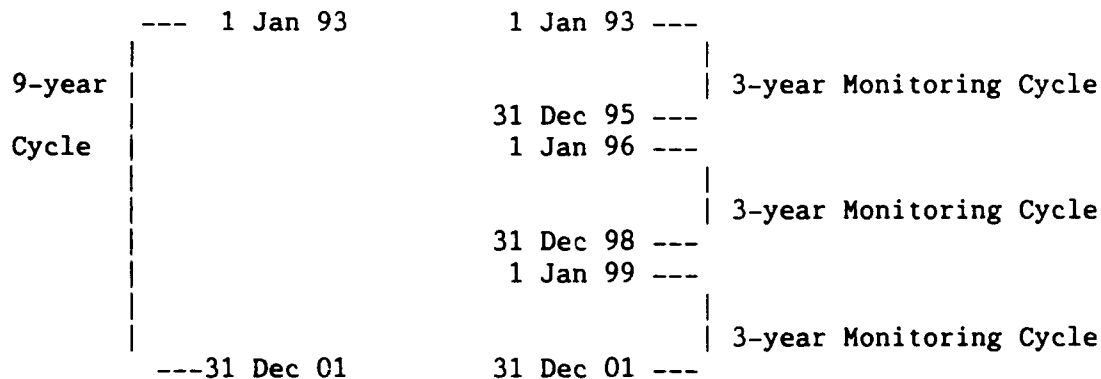
2. A sanitary survey is an on-site review of the water system to evaluate its adequacy for drinking water. These surveys are required for PWDS collecting fewer than five bacteriological samples per month.

3. The state may also reduce the total number of organic samples a PWDS must analyze by allowing compositing of samples from a maximum of five sampling points. The laboratory composites the samples according to the base's instructions.

2-6. EPA Standardized Monitoring Requirements.

a. Monitoring requirements generally follow a three-tier approach first outlined on 22 May 89. States may decrease required monitoring (above EPA minimums).

b. To standardize monitoring cycles, EPA established 3-, 6-, and 9-year cycles. Each 9-year cycle consists of three 3-year compliance periods. The first full 3-year period beginning 18 months after the promulgation date of a rule is the initial monitoring period. For example, rules promulgated 30 Jan 91 will start a 3-year monitoring cycle in Jan 93. A single sample round might be required for nonvulnerable PWDS in the Jan 96 and Jan 99 3-year cycles. A standardized monitoring framework will consolidate sample time frames as EPA promulgates and repromulgates drinking water regulations in the future.



c. In general, EPA has directed monitoring frequencies increase when a contaminant is measured at a certain concentration. Those concentrations vary by class or toxicity of the contaminant and may be set at the MCL, 50% of the MCL, or the detection limit of the analytical method used to measure the contaminant. After exceeding the trigger concentration, systems must immediately increase monitoring to quarterly to establish a baseline. After a baseline has been established, EPA has allowed states to reduce the frequency if the system is reliable and consistently below the MCL.

Chapter 3

TOTAL COLIFORM BACTERIA

3-1. General Information.

a. The maximum contaminant level goal (MCLG) for total coliform bacteria (including fecal coliform and Escherichia coli) is zero. The maximum contaminant level (MCL) is based on the presence or absence of total coliforms versus the pre-Dec 90 enumeration method based on the concentration of coliforms in the water. The MCL is no more than 5% positive samples per month for systems analyzing at least 40 samples a month. The MCL is no more than one positive sample per month for systems analyzing less than 40 samples. In addition, the MCL is violated wherever a routine sample tests positive for fecal coliforms or E. coli or any repeat sample tests positive for total coliforms.

b. EPA published the final Total Coliform Rule in the CFR on 29 Jun 89 (54 FR 27547), the proposed rule on 3 Nov 87 (52 FR 42224), and a partial stay of certain provisions of the final rule 15 Jan 91 (56 FR 101556).

3-2. Monitoring Requirements.

a. Each base supporting a PWDS must develop a written, site-specific plan. The state may review and revise the plan. The serviced population determines the number of routine monitoring samples according to Table 3-1.

1. Community PWDS serving 25-1,000 people and using groundwater may ask the state to reduce the monitoring frequency. The state must approve the reduction in writing. Past sampling must show no contamination. There must be a sanitary survey conducted in the past 5 years showing the system is supplied solely by a protected groundwater source and free of sanitary defects.

2. Noncommunity PWDS serving 25-1,000 people and using groundwater must monitor each calendar quarter the system provides water to the public.

b. Most PWDS samples must be collected at regular intervals throughout the month. Systems serving less than 4,900 people, using groundwater and collecting from different sites may collect all samples on a single day.

c. Collect repeat samples for all initial samples that test positive for total coliforms.

1. Repeat sampling requires a sample from the same tap as the original, an upstream and a downstream sample within five service connections of the tap. If the sample site is at a dead end in the system, or within one service connection of an end in the system, the state may waive either the upstream or the downstream followup sample.

2. Collect all repeat samples on the same day except where the state has authorized systems with single service connections authority to collect consecutive samples over 4 days.

3. Systems that collect only a single bacteriological sample monthly must collect four followup samples.

TABLE 3-1. TOTAL COLIFORM SAMPLING REQUIREMENTS ACCORDING TO POPULATION SERVED

Population Served	Minimum No. of Routine Samples Per Month ¹	Population Served	Minimum No. of Routine Samples Per Month
25 to 1,000 ²	1 ³	59,001 to 70,000	70
1,001 to 2,500	2	70,001 to 83,000	80
2,501 to 3,300	3	83,001 to 96,000	90
3,301 to 4,100	4	96,001 to 130,000	100
4,101 to 4,900	5	130,001 to 220,000	120
4,901 to 5,800	6	220,001 to 320,000	150
5,801 to 6,700	7	320,001 to 450,000	180
6,701 to 7,600	8	450,001 to 600,000	210
7,601 to 8,500	9	600,001 to 780,000	240
8,501 to 12,900	10	780,001 to 970,000	270
12,901 to 17,200	15	970,001 to 1,230,000	300
17,201 to 21,500	20	1,230,001 to 1,520,000	330
21,501 to 25,000	25	1,520,001 to 1,850,000	360
25,001 to 33,000	30	1,850,001 to 2,270,000	390
33,001 to 41,000	40	2,270,001 to 3,020,000	420
41,001 to 50,000	50	3,020,001 to 3,960,000	450
50,001 to 59,000	60	3,960,001 or more	480

¹ In lieu of the frequency specified, a Noncommunity Water System (NCWS) using groundwater and serving 1,000 persons or fewer may monitor at a lesser frequency specified by the state until a sanitary survey is conducted and reviewed by the state. Thereafter, NCWSs using groundwater and serving 1,000 persons or fewer must monitor in each calendar quarter during which the system provides water to the public, unless the state determines that some other frequency is more appropriate and notifies the system (in writing). Five years after promulgation, NCWSs using groundwater and serving 1,000 persons or fewer must monitor at least once/year.

A NCWS using surface water, or groundwater under the direct influence of surface water, regardless of the number of persons served, must monitor at the same frequency as a like-sized Community Water System (CWS). A NCWS using groundwater and serving more than 1,000 persons during any month must monitor at the same frequency as a like-sized CWS, except that the state may reduce the monitoring frequency for any month the system serves 1,000 persons or fewer.

² Includes public water systems which have at least 15 service connections, but serve fewer than 25 persons.

³ For a CWS serving 25-1,000 persons, the state may reduce this sampling frequency, if a sanitary survey conducted in the last 5 years indicates that the water system is supplied solely by a protected groundwater source and is free of sanitary defects. However, in no case may the state reduce the frequency to less than once/quarter.

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 previously. The additional samples must be collected within 24 hours of notification of a positive result. Monitoring personnel must repeat this process until they don't detect total coliforms, or they violate the total coliform MCL and the state waives the requirement to conduct further followup sampling.

5. If a system collecting fewer than five routine samples per month has one or more total coliform-positive samples and the state does not invalidate the samples as discussed below, monitoring personnel must collect at least five routine samples during the next month the system provides water to the public. The state can waive this requirement if the state performs a site visit before the end of the following month, or the state has determined the cause of the problem and establishes it has been fixed.

6. After a system collects a routine sample, and before it learns the results of the analysis of that sample, it collects another routine sample(s) from within five adjacent service connections of the initial sample, and the initial sample contains coliforms, then the subsequent samples can count as repeat samples instead of routine samples.

d. Other bacteriological samples. The Surface Water Treatment Rule (SWTR) may require additional bacteriological sampling for locations using surface water and not practicing filtration. BESs at installations that must comply with the SWTR (i.e., they obtain and treat drinking water from surface water or groundwater under the direct influence of surface water) should familiarize themselves with the SWTR requirements (29 Jun 91, 54 FR 27486). Bacteriological samples following disinfection from pipe placement or replacement are not used in compliance calculations.

e. Under certain conditions, the state may invalidate coliform samples so they do not count in compliance calculations. These conditions include the following:

1. The laboratory establishes that improper sample analysis caused the total coliform positive result.

2. The state, on the basis of evaluating the repeat samples, determines the total coliform positive sample resulted from a domestic or other nondistribution system plumbing problem.

3. The state has substantial grounds to believe the 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 still collects the required repeat samples and uses them in determining compliance with the MCL for total coliforms.)

f. Laboratories must invalidate certain samples due to analytical problems. These problems include producing a turbid culture in the absence of gas production for multiple tube fermentation technique or confluent growth and colonies too numerous to count using the membrane filter technique. In these cases, the laboratory must collect another sample within 24 hours at the same

location and continue to resample and analyze until it obtains a valid result. The state may waive the 24-hour time limit on a case-by-case basis.

g. If any routine or repeat sample is total coliform positive, the system must analyze the medium from that sample to determine if either fecal coliforms or E. coli are present. On a case-by-case basis, the state can allow a public water system to forgo fecal coliform and E. coli testing on a coliform positive sample if the system assumes fecal coliform or E. coli are present. Figure 3-1 summarizes the monitoring requirements.

3-3. Analytical Requirements.

a. We encourage Air Force personnel monitoring drinking water to familiarize themselves with all of the introductory chapters of Part 9000 of Standard Methods for the Examination of Water and Wastewater, 17th edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1989. This reference gives detailed guidance on quality assurance, laboratory apparatus, washing and sterilization, preparation of media, sample collection, preservation and storage.

b. Total coliform analyses must use one of the following methods:

1. Multiple-Tube Fermentation (MTF) Technique, 10 tubes, described in Standard Methods for the Examination of Water and Wastewater (SM).

2. Membrane Filter (MF) Technique described in SM.

3. Presence-Absence (P-A) Coliform Test described in SM.

4. Minimal Medium ONPG-MUG (MMO-MUG) Test (sometimes referred to as the Autoanalysis Colilert System or minimal medium o-Nitrophenol-B-d-Galactopyranoside 4-Methylumbelliferyl-B-d-Glucuronide), as set forth in "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 55, pp. 1003-1008, Apr 89.

c. Fecal coliform and E. coli analysis must use the following procedures:

1. When the MTF technique or P-A coliform test is used 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) Escherichia coli 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.) Alternatively, the laboratory can swab the entire membrane surface or transfer an individual total coliform positive colony into the EC medium. Gently shake the inoculated EC tubes to insure adequate mixing and incubate in a waterbath at 44.5(+/-0.2) degrees C for 22-24 hours. Gas

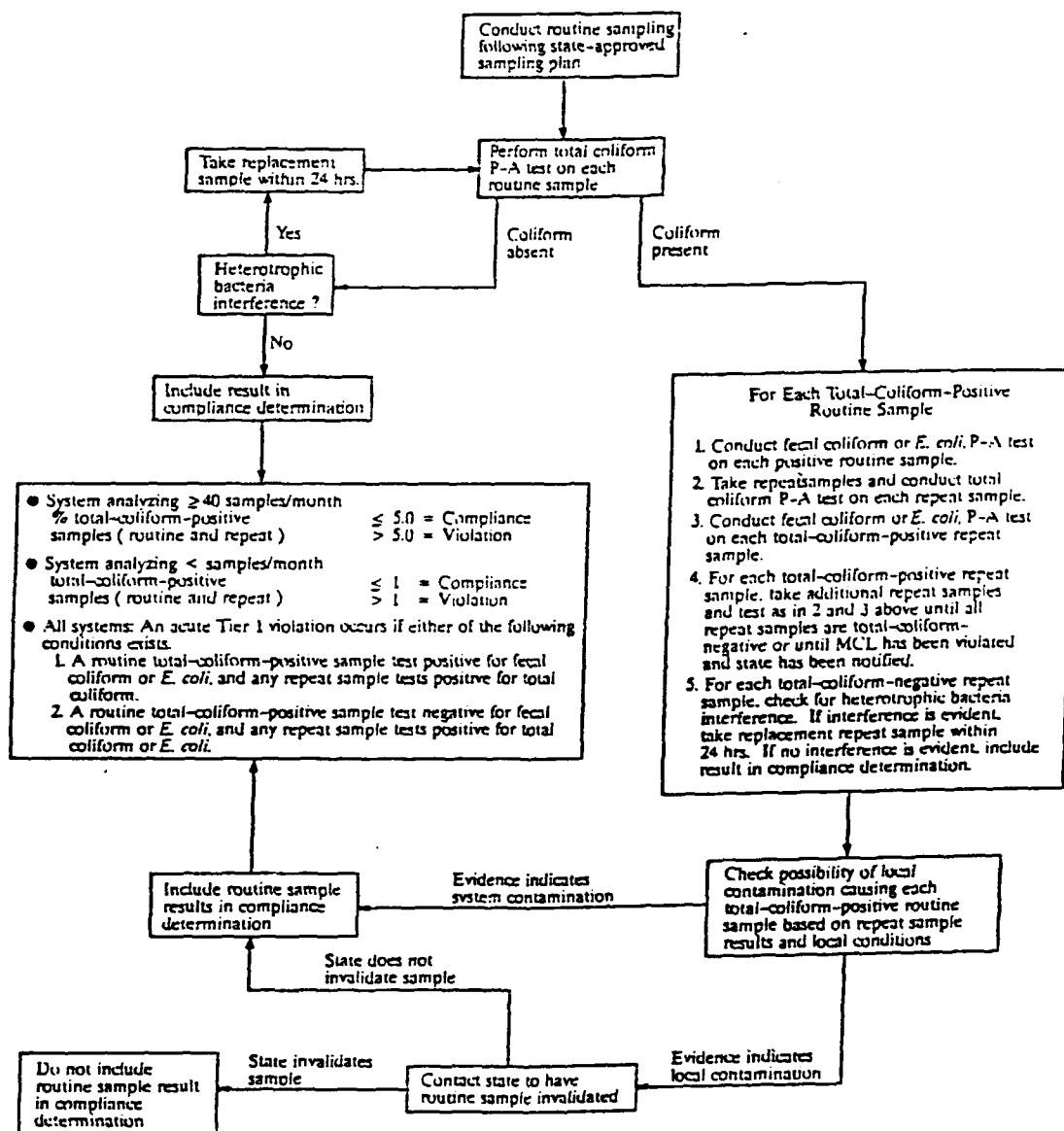


Figure 3-1. TOTAL COLIFORM RULE

Ref: Pontius, F.W. New Regulations for Total Coliforms. Journal American Water Works Association, 82:8:16 (August 1990)

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 SM.

2. The MMO-MUG (Minimal Medium o-Nitrophenol-B-d-Galactopyranoside 4-Methylumbelliferyl-B-d-Glucuronide) Colilert test is not approved for EPA for the detection of E. coli at this time (8 Jan 91, 56 FR 5638), but may be approved in the future.

3. EC medium plus MUG (4-Methylumbelliferyl-B-d-Glucuronide) and nutrient agar plus MUG are also approved for E. coli detection.

3-4. Best Available Technology. EPA lists five BATs for bacteriological contamination:

a. Protection of wells from contamination by coliforms by appropriate placement and construction.

b. Maintenance of a disinfectant residual throughout the distribution system.

c. Proper maintenance of the distribution system, including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, and continual maintenance of positive water pressure in all parts of the distribution system.

d. Filtration and/or disinfection of surface water.

e. The development and implementation of an EPA-approved State Wellhead Protection Program under section 1428 of the SDWA.

3-5. Public Notification Requirements.

a. When the public water system violates the MCL for total coliforms, but has not detected fecal coliform or E. coli, they notify the public according to paragraph 9-2.

b. When the public water system identifies fecal coliform or E. coli, a Tier 1 violation has occurred, and they must notify the state by the end of the notification-of-results-day. The public must be notified in accordance with paragraph 9-2, and any additional requirements from state agencies.

3-6. Sanitary Surveys.

a. PWDS which do not collect five or more routine samples per month must undergo an initial sanitary survey by 29 Jun 94 for community public water systems and 29 Jun 94 for noncommunity water systems. After the initial survey, systems must undergo another sanitary survey every 5 years, except that noncommunity PWDS using only protected and disinfected groundwater, must undergo subsequent sanitary surveys at least every 10 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.

b. Before conducting a sanitary survey, check to see whether previous data collected for a wellhead protection program is available.

c. Sanitary surveys must be performed by the state or an agent approved by the state. The operators of the water system are responsible for ensuring the survey takes place.

d. Items evaluated during a sanitary survey include wells or raw water pumps, storage reservoirs and pressure tanks, service pumps, the quality of bacteriological samples and chemical analysis, the distribution system, the disinfection system, the groundwater source, the surface water source, and an evaluation of system capacities.

Chapter 4

INORGANIC CHEMICALS

4-1. General Information.

a. On 30 Jan 91, Maximum Contaminant Levels (MCLs) for eight inorganic chemicals (IOCs) that were proposed in FR 54:97:2206, became final. The effective date of this regulation is 30 Jul 92. This means that these new MCLs, analytical methods, and monitoring schedules do not have to be met until 30 Jul 92 and are not enforceable until the first compliance period beginning 1 Jan 93. The eight IOCs are as follows: asbestos, cadmium, chromium, mercury, nitrate, nitrite, total nitrite and nitrate, and selenium. They can be found in Table 4-1.

b. Six additional IOC MCLs were proposed on 25 Jul 90. These additional MCLs will not be final until Mar 92 and not effective until 18 months after being finalized. The six proposed IOCs are as follows: antimony, beryllium, cyanide, nickel, sulfate, and thallium. Their proposed MCLs and MCLGs can be found in Appendix A.

4-2. Monitoring Requirements.

a. Initial Sampling Requirements.

1. Initial sampling varies depending on system type and contaminant as described in Table 4-2.

2. Systems begin monitoring by 1 Jan 93, the start of the first monitoring cycle as discussed in section 2-6. However, each primacy state may create its own, more stringent monitoring schedule.

b. Monitoring Frequency.

1. Monitoring frequency varies depending on system size and whether contaminants are detected during initial sampling.

2. For asbestos, nitrate, and nitrite, monitoring frequency depends on the percentage of contaminant detected compared with the MCL.

3. Monitoring frequency must be completed according to the schedule in Table 4-2. The BES should pay close attention to instances where reduced monitoring can be accomplished. Don't rely on the state to call you about reducing sampling. The BES should know the circumstances for reduced monitoring. Table 4-2 has the reduced sampling/analysis monitoring conditions.

4. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment.

5. Surface water systems shall take a minimum of one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment.

TABLE 4-1. INORGANIC CONTAMINANT MCLS/MCLGS

Contaminant	MCL until 30 Jul 92	MCL after 30 Jul 92	MCLG after 30 Jul 92
Arsenic	0.05 mg/l	0.05 mg/l	0.05 mg/l
Asbestos ¹	N/A	7 million fibers/l (longer than 10 μ m)	7 million fibers/l (longer than 10 μ m)
Barium ²	1.0 mg/l	1.0 mg/l	1.0 mg/l
Cadmium ¹	0.010 mg/l	0.005 mg/l	0.005 mg/l
Chromium ¹	0.05 mg/l	0.1 mg/l	0.1 mg/l
Copper	N/A	1.3 mg/l	1.3 mg/l
Fluoride ³	4.0 mg/l	4.0 mg/l	4.0 mg/l
Lead	0.05 mg/l	0.015 mg/l	0 mg/l
Mercury ¹	0.002 mg/l	0.002 mg/l	0.002 mg/l
Nitrate ⁴	10 mg/l (as N)	10 mg/l (as N)	10 mg/l (as N)
Nitrite ⁴	N/A	1 mg/l (as N)	1 mg/l (as N)
Total Nitrite & Nitrate ⁴	N/A	10 mg/l (as N)	10 mg/l (as N)
Selenium ¹	0.01 mg/l	0.05 mg/l	0.05 mg/l
Silver	0.05 mg/l	SMCL (1 mg/l)	N/A

¹MCLs apply to community water systems and non-transient, noncommunity water systems.

²Barium is still a proposed contaminant. EPA intends to promulgate the final rule by late 91. The existing MCL still holds.

³Fluoride also has a secondary maximum contaminant level (SMCL) at 2.0 mg/l. MCL only applies to community water systems.

⁴MCLs apply to community, non-transient noncommunity, and transient noncommunity water systems.

TABLE 4-2. INORGANICS COMPLIANCE MONITORING REQUIREMENTS

Contaminant	Baseline requirement		Trigger that increases monitoring	Waivers
	Groundwater	Surface water		
Barium Cadmium Chromium Mercury Selenium	1 sample/3 yr	Annual sample	>MCL	Yes ¹
Asbestos	1 sample every 9 years.....		>MCL	Yes ²
Nitrate	Annual	Quarterly	>50% MCL	Yes ³
Nitrite	Annual	Quarterly	>50% MCL	Yes ⁴

¹ State may reduce repeat sampling frequency to 1 sample every 9 years after 3 samples < MCL.

² EPA has shifted the responsibility of vulnerability assessments from states to systems. Each PWDS can decide whether to conduct a vulnerability assessment.

³ State may reduce repeat sampling frequency if after 1 year <50% of MCL, surface water systems may reduce to an annual sample.

⁴ State may reduce repeat sampling frequency to 1 sample if <50% of MCL.

c. **Additional Proposed Contaminants.** Monitoring frequency for the 6 additional proposed contaminants can be found in Appendix A.

4-3. **Analytical Requirements.** The analytical methods for inorganic chemicals are listed in Table 4-3.

4-4. **Best Available Technology.** BATS are listed in Table 4-4.

4-5. **Compliance Monitoring.**

a. Compliance is based on an annual running average for each sample point for systems monitoring quarterly or more frequently. For systems monitoring annually or less frequently, compliance is based on a single sample unless the state requests a confirmation sample.

b. The MCLs and MCLGs for inorganic chemicals are listed in Table 4-1. This table reflects the existing MCLs and the new MCLs. As stated earlier, these new MCLs are not enforceable until 1 Jan 93. They are effective 30 Jul 92. Each PWDS has 6 months to get into compliance.

1. If the level of any contaminant is less than the MCL, the system is in compliance.

2. The system is out of compliance if

(a) the level of any contaminant exceeds the MCL,

(b) any sample would cause the annual average to be exceeded, or

(c) the average of the original and the repeat sample exceed the MCL.

3. If the system is out of compliance:

(a) Immediately begin monitoring quarterly until the state determines the system is reliable and consistent.

(b) Groundwater systems must take a minimum of 2 samples per quarter.

(c) Surface water systems must take a minimum of 4 samples per quarter.

(d) Notify the public according to Chapter 9.

4. For nitrate and nitrite, quarterly monitoring is required if a sample is >50% of MCL. Follow the procedure in paragraph 4-5.b.3.

4-6. **Additional Proposed Contaminant Compliance.** On 22 May 89, the EPA proposed a list of 6 additional IOCs that must be monitored by each public water system if the state determines that the water system is vulnerable to

TABLE 4-3. INORGANIC CONTAMINANTS ANALYTICAL METHODS

Contaminant	Methodology ¹¹	EPA ¹	Reference (method #)		
			ASTM ²	SM ³	Other
Asbestos	Transmission Electron Microscopy	EPA ⁹			
Barium	Atomic absorption; furnace technique	208.2		304	
	Atomic absorption; direct aspiration	208.1		303C	
	Inductively-coupled plasma	200.7 ^{1,6}			
Cadmium	Atomic absorption; furnace technique	213.2		304	
	Inductively-coupled plasma	200.7A ⁶			
Chromium	Atomic absorption; furnace technique	218.2		304 ⁷	
	Inductively-coupled plasma	200.7 ^{1,6}			
Mercury	Manual cold vapor technique	245.1	D3223-80	303F	
	Automated cold vapor technique	245.2			
Nitrate	Manual cadmium reduction	353.3	D3867-85B	418C	
	Automated hydrazine reduction	353.1			
	Automated cadmium reduction	353.2	D3867-85A	418F	
	Ion selective electrode				WeWWG/5880 ⁵
Nitrite	Ion chromatography	300.0			B-1011 ¹⁰
	Spectrophotometric	354.1			
	Automated cadmium reduction	353.2	D3667-85A	418F	
	Manual cadmium reduction	353.3	D3867-85B	418C	
	Ion chromatography	300.0			B-1011 ¹⁰
Selenium	Atomic absorption; gaseous hydride	270.3	D3859-84A	303E ⁸	I-3667-85 ⁴
	Atomic absorption; furnace technique	270.2	D3859-84B	304	

¹"Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 (EPA-600/4-79-020). March 1983. Available from ORD Publications, CERL, EPA, Cincinnati, OH 45268.

²Annual Book of ASTM Standards, Vol. 11.01 American Society for Testing and Materials, 1961 Race Street, Philadelphia, PA 19103.

³"Standard Methods for the Examination of Water and Wastewater," 16th edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985.

⁴"Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," Techniques of Water-Resources Investigations of the U.S. Geological Survey Books, Chapter A1, 1985, Open-File Report 85-495. Available from Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, MS 306 Box 24525, Denver Federal Center, Denver CO 80225.

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

⁶200.7A "Inductively-Coupled Plasma Atomic Emission Analysis of Drinking Water," Appendix to Method 200.7, March 1987, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.

⁷The addition of 1 mL of 30% H₂O₂^{T2} to each 100 mL of standards and samples is required before analysis.

⁸Prior to dilution of the Se calibration standard, add 2 mL of 30% H₂O₂ for each 100 mL of standard.

⁹"Analytical Method for Determination of Asbestos Fibers in Water," EPA-600/4-83-043, September 1983, U.S. EPA Environmental Research Laboratory, Athens, GA 30613.

¹⁰"Waters Test Method for the Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography," Method B-1011, Millipore Corporation, Waters Chromatography Division, 34 Maple Street, Milford, MA 01757.

¹¹For approved analytical procedures for metals, the technique applicable to total metals must be used.

TABLE 4-4. BEST AVAILABLE TECHNOLOGY FOR INORGANIC CHEMICALS

Contaminant	AA	CC	CF	DF	GAC	IE	LS	ED	RO
Asbestos		X	X	X					
Barium*						X	X	X	X
Cadmium			X			X	X		X
Chromium			X			X	(1)		X
Mercury			(2)		X		(2)		(2)
Nitrate/Nitrite						X		(4)	X
Selenium	X		(3)				X	X	X

(1) Chromium III only

(2) Mercury influent concentrations $\leq 10 \mu\text{g/l}$

(3) Selenium IV only

(4) Nitrate only

Key:

AA- Activated alumina

CC- Corrosion control

CF- Coagulation/Filtration

DF- Direct & diatomite filtration

GAC-Granular activated carbon

IE- Ion exchange

LS- Lime softening

ED- Electrodialysis

RO- Reverse osmosis

*Barium is still a proposed contaminant. The EPA intends to promulgate the final level by late 91.

contamination by these chemicals. These contaminants are proposed. They will not be final until Mar 92. Their proposed MCLs and MCLGs can be found in Appendix A.

Fluoride Requirements

4-7. **General Information.** The fluoride regulation establishes a MCLG and a MCL to protect against crippling skeletal fluorosis. The MCL for fluoride became effective 2 Oct 87. The provisions of the rule are in effect and community water systems are expected to comply with its requirements. The final rule for fluoride was dated 2 Apr 86 and can be found in 51 FR 11396.

4-8. **Monitoring Requirements.**

a. Monitoring requirements are based on the water source. Table 4-5 describes these requirements.

b. If more than one source of water, sample from each source at entry point to distribution system.

c. If more than one source of water and sources combined, sample after the combination and before entry to distribution system.

d. The state may reduce monitoring to once every 10 years if it determines that the system is not likely to exceed the MCL (CFR 141.23g).

e. The Centers for Disease Control recommends daily fluoride monitoring for systems that practice fluoridation. In addition, the BES may also need to sample more frequently to meet dental regulation requirements.

4-9. **Analytical Requirements.** Four analytical methods are EPA-approved for compliance monitoring. They are listed in Table 4-6.

4-10. **Best Available Technology.** Central treatment using activated alumina adsorption or reverse osmosis is specified as BAT for fluoride removal.

4-11. **Compliance Monitoring.** EPA set both the MCLG and MCL at 4.0 mg/l to protect against crippling skeletal fluorosis. The SMCL was set at 2.0 mg/l to protect against objectionable dental fluorosis, not considered by EPA to be an adverse health effect. These values are listed in Table 4-1.

a. If a sample is less than the MCL, the system is in compliance.

b. The system is out of compliance when the level of any sample exceeds the MCL.

c. If the system is out of compliance:

1. Immediately report to the state.

2. The state will inform you of additional samples and further action to take.

TABLE 4-5. Fluoride Monitoring Requirements

Water Source	Frequency of Samples	Number of Samples	Type of Samples
Groundwater	every 3 years	1*	treated
Surface water	every year	1*	treated

* Sample at entry point to distribution system

TABLE 4-6. METHODOLOGY FOR FLUORIDE

Methodology	Reference (Method No.) ¹			
	EPA ²	ASTM ³	SM ⁴	Other
Colorimetric SPADNS, with distillation	340.1	D1179-72A	43 A&C	
Potentiometric ion selective electrode	340.2	D1179-72B	413 B	
Automated Alizarin fluoride blue, with distillation (complexone)	340.3		413 E	129-71W ⁵
Automated ion selective electrode				380-75WE

¹"Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, Ohio 45268 (EPA-600/4-79-020), March 1983. Available from ORD Publications, CERL, EPA, Cincinnati, Ohio 45268. For approved analytical procedures for metals, the technique applicable to total metals must be used.

²(Reserved)

³Annual Book of ASTM Standards, part 31 Water. American Society for Testing and Materials, 1916 Race Street, Philadelphia, Pennsylvania 19103.

⁴"Standard Methods for the Examination of Water and Wastewater," 16th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985.

⁵"Fluoride in Water and Wastewater, Industrial Method = 129-71W." Technicon Industrial Systems, Tarrytown, New York 10591. December 1972.

3. The general public notice requirements apply to this rule and can be found in section 9-2 of this text.

Lead and Copper Requirements

4-12. General Information.

a. EPA published the final lead and copper NPDWRs 7 Jun 91 (FR 56:110:26461). The regulation establishes an MCLG of 1.3 mg/l for copper and of zero mg/l for lead. It also established an "action level" above which water systems will have to take corrosion control treatment steps, implement public education programs, and remove lead service lines if appropriate. The action level for treatment is 0.015 mg/l for lead and 1.3 mg/l for copper in more than 10 percent of household taps sampled.

b. The regulations apply to community and non-transient, noncommunity systems. They do not apply to transient, noncommunity systems. Monitoring is required at the consumer's tap in high-risk homes, in some service lines, for source water, and, in some cases, for corrosion control parameters.

4-13. Monitoring Requirements.

a. Source Water Requirements.

1. Bases where tap samples do not exceed the action level for lead or copper will not have to take source water samples. Source water sampling will only be required for a system that fails to meet the lead or copper action level on the basis of tap samples. Samples will be collected in accordance with (IAW) the inorganic chemical sampling requirements of 40 CFR 141.23.

2. Bases exceeding a lead or copper action level must take a sample at each entry point to the PWDS within 6 months. Additional sampling requirements for source water are based on whether water treatment is required and whether the system uses groundwater or surface water (40 CFR 141.88 contains the details).

b. Monitoring Requirements for Lead and Copper in Tap Water.

1. Systems serving from 3,301 to 50,000 people must begin a 6-month monitoring period on 1 Jul 92. Systems serving less than 3,300 people begin a 6-month monitoring period on 1 Jul 93. Before that period begins, bases must identify a pool of target sampling sites based on targeting criteria, i.e., a "materials evaluation" of the distribution system. The pool may not include sites using point-of-use or point-of-entry treatment devices. Should the tap samples exceed the action level, additional sampling must be taken for water quality parameters in the same 6-month period. Consequently, in order to complete all requirements on time, bases should identify sites before the monitoring window begins and collect tap samples early in the monitoring window.

(a) The materials evaluation must be based on the base's historical corrosivity monitoring (40 CFR 141.42), plumbing records, inspection records, and the results of prior water analyses for lead and copper. The base should carefully document its rationale for selecting the sample pool, because

if the base is unable to exclusively use Tier 1 sites, it will have to explain in writing to the state why it was unable to do so.

(b) Sample sites are classified as Tier 1, 2, or 3. However, the description of the tiers varies depending on whether they are applied for community water systems or non-transient noncommunity water systems.

(1) For community water systems, Tier 1 sites are single family structures that contain copper pipes with lead solder installed after 1982, contain lead pipes, and/or are served by a lead service line. If the base is unable to identify sufficient Tier 1 sites, they can complete their sampling pool with Tier 2 sampling sites. Tier 2 sampling sites consist of buildings, including multiple-family residences, that contain copper pipes with lead solder installed after 1982, or contain lead pipes, and/or are served by a lead service line. If the base has insufficient Tier 1 and Tier 2 sites, they can complete their sampling pool with Tier 3 sampling sites. Tier 3 sampling sites are single family structures that contain copper pipes with lead solder installed before 1983.

(2) For non-transient noncommunity water systems, Tier 1 sampling sites consist of buildings that contain copper pipes with lead solder installed after 1982, contain lead pipes, and/or are served by a lead service line. If insufficient Tier 1 sites exist, the base will complete its sampling pool with sampling sites that contain copper pipes with lead solder installed before 1983.

(c) Any water system whose distribution systems contains lead service lines shall draw 50% of the samples it collects during each monitoring period from sites that contain lead pipes, or copper pipes with lead solder, and 50% of those samples from sites served by a lead service line.

(d) Samples in successive monitoring periods should be collected from the same site as the previous period. Where this is not possible, the base should pick another sampling site in its sampling pool which meets the same targeting criteria, and is within reasonable proximity of the original site.

2. Table 4-7 shows the number of samples the base is required to take from the sampling pool. A small or medium size system that meets the lead and copper action levels during each of two consecutive 6-month monitoring periods may reduce the number of samples in accordance with Table 4-7, reduced monitoring, and reduce the frequency of sampling to once a year. A small or medium size system that meets the lead and copper action levels during three consecutive years of monitoring may reduce the frequency of monitoring for lead and copper from annually to once every 3 years. Systems sampling annually or less frequently shall conduct the lead and copper tap sampling during the months of Jun, July, Aug, or Sep.

3. Samples must be at least 1 liter in volume and collected from a cold water kitchen or bathroom sink tap. First draw samples from a non-residential building shall be collected at an interior tap from which water is typically drawn for consumption. Samples must represent water that has stood in the service line and structure plumbing for at least 6 hours.

Table 4-7. MONITORING REQUIREMENTS FOR LEAD AND COPPER IN TAP WATER

Population Served by System	No. of sites (standard monitoring)*	No. of sites (reduced monitoring)^
> 100,000	100	50
10,001-100,000	60	30
3,301-10,000	40	20
501-3,300	20	10
101-500	10	5
< 100	5	5

*Six-month monitoring period.

^One-year monitoring period.

4. Bases may allow residents to collect samples after instructing the residents of the sampling procedures. However, they may not challenge the results based on alleged errors in sample collection. The base should keep a copy of the instructions provided to residents with other lead and copper sample documentation. Samples need not be preserved until after collection.

5. The action level is based on the 90th percentile of the tap samples computed as follows:

(a) Arrange the results of all tap monitoring in ascending order from the sample with the lowest concentration to the sample with the highest concentration. Multiply the number of samples by 0.9 to identify the 90th percentile contaminant level sample. The contaminant concentration in the 90th percentile sample is the 90th percentile contaminant level.

(b) For water systems serving fewer than 100 people that collect 5 samples per monitoring period, the 90th percentile is computed by taking the average of the highest and second highest concentrations.

c. Service Line Monitoring.

1. Base personnel may need to take service line samples to support the service line replacement program or to gather additional information about a problematic site. Consequently, CE will provide the instructions on when, where, and how many service line samples to take. Systems failing to meet the lead action level in tap samples after installing source water treatment or corrosion control may be required to replace lead service lines. A system is not required to replace an individual lead service line if the lead concentration in all service line samples from that line is less than or equal to 0.015 mg/l. A system may also cease replacing lead service lines under certain conditions based on the results of lead service line sampling (40 CFR 141.84).

2. Each service line sample should be 1 liter in volume and have stood motionless in the lead service line for at least 6 hours. There are three ways to collect service line samples.

(a) Collect the sample at the tap after flushing the volume of water between the tap and the lead service line. Calculate the volume of water based on pipe interior diameter and length of pipe.

(b) For single-family buildings, collect the sample at the tap after flushing the water until there is a significant change in temperature.

(c) Collect the sample directly from a tap into the lead service line.

d. Water Quality Parameter Monitoring.

1. All water systems that exceed the lead or copper action level shall monitor water quality parameters (e.g., pH, alkalinity, conductivity, etc.) in addition to lead and copper. In general, these samples should be representative of water quality throughout the distribution system. Bases may consider using coliform sampling points to conduct this sampling. Samples at entry points to the distribution system shall be from locations representative of each source after treatment. If sources are combined prior to distribution, the samples should be during periods of normal operating conditions and represent all sources being used. Table 4-8 shows the number of water quality parameter sites based on system population.

2. Samples must be collected during the same monitoring periods as those specified for collecting tap samples for compliance with action levels. Two tap samples must be taken at each site for pH, alkalinity, orthophosphate (when a phosphate inhibitor is used), silica (when a silicate compound inhibitor is used), calcium, conductivity, and water temperature. Each applicable parameter must be analyzed at each entry point to the PWDS. Additional monitoring of water quality parameters is required after installation of corrosion control treatment (see 40 CFR 141.87 for details).

3. States may direct additional water quality parameter monitoring.

4-14. Analytical Requirements. Table 4-9 lists the proposed analytical methods. Analysis shall only be conducted by laboratories that have received conditional approval by the state.

4-15. Best Available Technology (BAT).

a. **Source Water Treatment.** States determine source water treatment BAT from ion exchange, reverse osmosis, lime softening or coagulation/filtration.

b. **Installation of Optimal Corrosion Control.** A small or medium size water system is deemed to have optimized corrosion control if the system meets the lead and copper action levels during each of two consecutive 6-month monitoring periods. Treatment steps and time lines for corrosion control are described in detail in 40 CFR 141.81 for cases where the system exceeds the action levels.

c. **Lead Service Line Replacement.** Lead service line replacement is required for systems exceeding the action level after implementation of applicable corrosion control and source water treatment.

d. **Public Education.** Any system exceeding the lead action level shall implement a public education program. Community and non-transient noncommunity requirements vary slightly.

1. Community water systems failing to meet the lead action level based on tap samples have 60 days to insert notices in water bills, submit information to newspapers, deliver pamphlets to certain public organizations, and submit radio and television announcements (40 CFR 141.85).

TABLE 4-8. WATER QUALITY PARAMETER MONITORING

Population Served by System	No. of sites for water quality parameters
> 100,000	25
10,001-100,000	10
3,301-10,000	3
501-3,300	2
101-500	1
< 100	1

TABLE 4.9. LEAD AND COPPER ANALYTICAL METHODS

Contaminant	Methodology	Reference (Method Number)		SM	USGS
		EPA	ASTM		
Lead	Atomic absorption; furnace technique	239.2	D3559-85D	3113	
	Inductively-coupled plasma; mass spectrometry	200.8			
	Atomic absorption platform furnace technique	200.9			
Copper	Atomic absorption; furnace technique	220.2	D1688-90c	3113	
	Atomic absorption; direct aspiration	220.1	D1688-90A	3111-B	
	Inductively-coupled plasma	200.7		3120	
	Inductively-coupled plasma; mass spectrometry	200.8			
	Atomic absorption; platform furnace	200.9			
pH	Electrometric	150.1	D1293-84B	4500-H	
		150.2			
Conductivity	Conductance	120.1	D1125-82B	2510	
Calcium	EDTA titrimetric	215.2	D511-88A	3500-CaD	
	Atomic absorption; direct aspiration	215.1	D511-88B	3111-B	
	Inductively-coupled plasma	200.7		3120	
Alkalinity	Titrimetric	310.1	D1067-88B	2320	
	Electrometric titration				I-1030-85
Orthophosphate, unfiltered, no digestion or hydrolysis.		365.1			
Colorimetric, automated, ascorbic acid.	Colorimetric, ascorbic acid, two reagent	365.3		4500-P-F	
	Colorimetric, ascorbic acid, two reagent	365.2	D515-88A		I-1601-85
	Colorimetric, phosphomolybdate; automated-segmented flow; automated discrete				I-2601-85
					I-2598-85
	I on chromatography	300.0	D4327-88	4110	
Silica	Colorimetric, molybdate blue; automated-segmented flow				I-1700-85
	Colorimetric	370.1	D659-88		I-2700-85
	Molybdosilicate			4500-Si-D	
	Heteropoly blue			4500-Si-E	
	Automated method for molybdate-reactive silica			4500-Si-F	
	Inductively-coupled plasma	200.7		3120	
Temperature	Thermometric			2550	

¹ The procedures 239.2, 220.2, 220.1, 150.1, 150.2, 120.1, 215.2, 215.1, 310.1, 365.1, 365.3, 365.2, and 370.1 are incorporated by reference and shall be done in accordance with "Methods for Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH (EPA-600/4-79-020), Revised March 1983, pp. 239.2-1 through 239.2-2 and metals-1 through metals-19, 220.2-1 through 220.2-2 and metals-1 through metals-19, 220.1-1 through 220.1-2 and metals-1 through metals-19, 150.1-1 through 150.1-3, 150.2-1 through 150.2-3, 120.1-1 through 120.1-3, 215.2-1 through 215.2-3, 215.1-1 through 215.1-2, 310.1-1 through 310.1-3, 365.1-1 through 365.1-9, 365.3-1 through 365.3-4, 365.2-1 through 365.2-8, and 370.1-1 through 370.1-5, respectively. 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 may be obtained from ORD Publications, CERL, EPA, Cincinnati, OH 45268. Copies may be inspected at the United States Environmental Protection Agency, 401 M Street, SW., Room E3-15, Washington, D.C. 20460 or at the Office of the Federal Register, 1100 L Street, NW., Room 8401, Washington, D.C.

² The procedures D3559-85D, D1688-90C, D1688-90A, D1293-84B, D1125-82B, D511-88, D1067-88B, D515-88A, D4327-88, and D659-88 are incorporated by reference and shall be done in accordance with Annual Book of ASTM Standards, Vol. 11.01, American Society for Testing and Materials, 1990. 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 may be obtained from American Society for Testing and Materials, 1916 Race Street, Philadelphia, PA 19103. Copies may be inspected at the United States Environmental Protection Agency, 401 M Street, SW., Room E3-15, Washington, D.C. 20460 or at the Office of the Federal Register, 1100 L Street, NW., Room 8401, Washington, D.C.

³ The procedures 3113, 3111-B, 3120, 4500-H, 2510, 3500-Ca-D, 3120, 2320, 4500-P-F, 4500-P-E, 4110, 4500-Si-D, 4500-S-E, 4500-S-F, and 2550 are incorporated by reference and shall be done in accordance with "Standard Methods for the Examination of Water and Wastewater," 17th Edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1989, pp. 3-32 through 3-43, 3-20 through 3-23, 3-53 through 3-63, 4-94 through 4-102, 2-57 through 2-61, 3-85 through 3-87, 2-35 through 2-39, 4-178 through 4-181, 4-117 through 4-178, 4-2 through 4-6, 4-184 through 4-187, 4-168 through 4-189, 4-189 through 4-191, and 2-80 through 2-81, respectively. 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 may be obtained from the American Water Works Association, Customer Service, 6666 West Quincy Avenue, Denver, CO 80235, Phone (303) 794-7711. Copies may be inspected at the United States Environmental Protection Agency, 401 M Street, SW., Room E3-15, Washington, D.C. 20460 or at the Office of the Federal Register, 1100 L Street, NW., Room 8401, Washington, D.C.

⁴ The procedures I-2601-85, I-1030-85, I-1601-85, I-2598-85, I-1700-85, and I-2700-85 are incorporated by reference and shall be done in accordance with "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," 3rd edition, U.S. Department of Interior, U.S. Geological Survey, 1989, pp. 55-56, 381-382, 383-385, 387-388, 415-418, and 417-419, respectively. 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 may be purchased from the Books and Open-File Reports Section, U.S. Geological Survey, Federal Center, Box 25425, Denver, CO 80225. Copies may be inspected at the United States Environmental Protection Agency, 401 M Street, SW., Room E3-15, Washington, D.C. 20460 or at the Office of the Federal Register, 1100 L Street, NW., Room 8401, Washington, D.C.

⁵ "Determination of Metals and Trace Elements in Water and Wastes by Inductively-Coupled Plasma Atomic Emission Spectrometry," Revision 3.2, August 1990, U.S. EPA, EMSL. This document is available from U.S. EPA, EMSL, Cincinnati, OH 45268.

⁶ "Determination of Trace Elements in Water and Wastes by Inductively-Coupled Plasma-Mass Spectrometry," Method 200.8, August 1990, Revision 4.1, U.S. EPA, EMSL. This document is available from U.S. EPA, EMSL, Cincinnati, OH 45268.

⁷ "Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry," Method 200.9, August 1990, U.S. EPA, EMSL. This document is available from U.S. EPA, EMSL, Cincinnati, OH 45268.

⁸ "Determination of Inorganic Ions in Water by Ion Chromatography," Method 300.0, December 1989, U.S. EPA, EMSL. This document is available from U.S. EPA, EMSL, Cincinnati, OH 45268.

⁹ For analyzing Lead and copper, the technique applicable to total metals must be used and samples cannot be filtered.

2. Non-transient noncommunity water systems are required to post information material in public places and distribute informational pamphlets to each person served by the non-transient noncommunity water system.

3. The base may discontinue delivery of public education materials if the system has met the action level during the most recent 6-month monitoring period, but shall recommence public education if a subsequent monitoring period exceeds the action level.

4-16. Reporting Requirements and Records.

a. Water systems must report the following information to the state (40 CFR 141.90).

1. The results on all tap water samples within the first 10 days following the end of each applicable monitoring period (i.e., every 6-months, annually, or every 3 years) and the criteria under which the site was selected for the system's sampling pool.

(a) A certification that each first draw sample is 1-liter in volume and, to the best of their knowledge, has stood motionless in the interior plumbing for at least "x" hours (i.e., 6, 8, or however many hours).

(b) Additional certification that the residents were informed of proper sampling procedures (where residents collected the samples).

(c) The 90th percentile lead and copper concentrations.

(d) A designation of any site which changed since the previous monitoring period and an explanation why the sample site changed.

2. The results of all water quality sampling and the results of all source water samples within the first 10 days following the end of each applicable monitoring period.

3. By the commencement of the monitoring period, a letter to the state justifying the system's selection of non-Tier 1 sampling sites.

4. By the commencement of the monitoring period, a letter to the state justifying the system's inability to make 50% of the sampling pool sites with lead service lines (as appropriate).

5. Requests for reduced sampling frequency (i.e., to either annual or triennial sampling).

6. Additional reports are required for systems with corrosion control requirements, source water treatment requirements, and lead service line replacement programs.

7. By Dec 31st of each year, any water system subject to the public education requirements shall submit a letter to the state demonstrating that the system has delivered the public education materials. This information shall

include a list of all newspapers, radio stations, television stations, facilities and organizations to which the system delivered public education materials during the previous year.

8. Any system which collects sampling data in addition to that required by the regulations shall report the results to the state by the end of the applicable monitoring period during which the samples were collected.

b. Systems shall retain original records of all sampling data and analyses, reports, surveys, letters, evaluations, schedules, state determinations, and other records required by 40 CFR 141.81-141.88 for no fewer than 12 years.

Chapter 5

SYNTHETIC ORGANICS

5-1. General Information.

a. On 30 Jan 91, 18 Pesticides/PCBs, 10 VOCs and 2 other organic chemicals that were proposed in FR 54:97:22060 became final. These chemicals can be found in Table 5-1. This brings a total of 19 pesticides/PCBs, 18 VOCs, and 2 other organic chemicals that will be regulated. The effective date of this regulation is 30 Jul 92. This means that these new MCLs, analytical methods, and monitoring schedules do not have to be met until 30 Jul 92 and are not enforceable until the first compliance period beginning 1 Jan 93.

b. An additional 150 organic chemicals were proposed for monitoring on 25 Jul 90. These additional SOCs MCLs will not be promulgated until Mar 92. A list of these proposed contaminants can be found in Appendix B.

5-2. Monitoring Requirements.

a. Initial Sampling Requirements.

1. Initial sampling varies depending on the system type and the contaminant.

2. Initial compliance period is required to start in 1993 and last until 1995.

b. Monitoring Frequency.

1. Monitoring frequency varies depending on system size and whether contaminants are detected during initial sampling.

2. Monitoring frequency depends on the percentage of contaminant detected compared with a detection limit.

3. Monitoring frequency must be completed according to the schedule in Table 5-2. The BES should pay close attention to instances where they can reduce monitoring. The state is tasked with many activities and BES should not assume they will be informed of possible reduced sampling.

4. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment.

5. Surface water systems shall take a minimum of one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment.

5-3. **Analytical Requirements.** Analytical requirements for pesticides/PCBs and VOCs are listed in Table 5-3.

TABLE 5-1. SYNTHETIC ORGANIC CHEMICALS - MCLGS AND MCLs

SOC	MCL until 30 Jul 92 (mg/L)	MCLG after 30 Jul 92 (mg/L)	MCL after 30 Jul 92 (mg/L)
Pesticides/PCBs:			
Alachlor		zero	0.002
Aldicarb*		0.001	0.003
Aldicarb sulfone*		0.002	0.003
Aldicarb sulfoxide*		0.001	0.003
Atrazine		0.003	0.003
Carbofuran		0.04	0.04
Chlordane		zero	0.002
2,4-D		0.07	0.07
1,2-Dibromo-3-chloropropane (DBCP)		zero	0.0002
Endrin ¹	0.0002	0.0002	0.0002
Ethylene dibromide (EDB)		zero	0.00005
Heptachlor		zero	0.0004
Heptachlorepoxyde		zero	0.0004
Lindane		0.0002	0.0002
Methoxychlor		0.04	0.04
PCBs (as decachlorobiphenyls)		zero	0.0005
Pentachlorophenol		zero	0.001
Toxaphene		zero	0.003
2,4,5-TP (Silvex)		0.05	0.05
VOCs:			
Benzene ¹	0.005	zero	0.005
Carbon tetrachloride ¹	0.005	zero	0.005
o-Dichlorobenzene		0.6	0.6
cis-1,2-Dichloroethylene		0.07	0.07
trans-1,2-Dichloroethylene		0.1	0.1
1,1-Dichloroethylene ¹	0.007	0.02	0.007
1,1,1-Trichloroethane ¹	0.20	0.02	0.20
1,2-Dichloroethane ¹	0.005	zero	0.005
1,2-Dichloropropane		zero	0.005
Ethylbenzene		0.7	0.7
Monochlorobenzene		0.1	0.1
para-Dichlorobenzene ¹	0.075	0.075	0.075
Styrene		0.1	0.1
Tetrachloroethylene		zero	0.005
Trichloroethylene ¹	0.005	zero	0.005
Toluene		1.0	1.0
Vinyl chloride ¹	0.002	zero	0.002
Xylene (Total)		10	10
Other Organics:			
Acrylamide	zero	treatment technique	
Epichlorohydrin	zero	treatment technique	

* Proposed MCLG and MCL levels. EPA intends to promulgate final levels by late 1991.

¹ These Pesticides/PCBs and VOCs currently in 40 CFR part 161.41 are to be incorporated in a final rule by late 1991.

TABLE 5-2. ORGANICS COMPLIANCE MONITORING REQUIREMENTS

Contaminant	Base requirement		Trigger that increases monitoring	Waivers
	Groundwater	Surface water		
VOCs	Quarterly.....		>0.0005 mg/l	Yes ^{1,2}
Pesticides/PCBs	4 quarterly samples/3 yrs During period designated by State for pesticides (141.24(a)(1))		Detection ⁴	Yes ^{2,3}

¹ State may reduce repeat sampling frequency to annually after 1 year of no detection and every 3 years after 3 rounds of no detection.

² EPA has shifted the responsibility of vulnerability assessments from states to systems. Each PWDS can decide whether to conduct a vulnerability assessment.

³ State may reduce repeat sample frequency to the following if after 1 round of no detection; systems > 3,300 reduce to 2 samples/yr every 3 years, or systems < 3,300 reduce to 1 sample every 3 years.

⁴ Method Detection Limits

Contaminant	Detection Limit
Alachlor	0.0002 mg/l
Aldicarb	0.0005 mg/l
Aldicarb sulfoxide	0.0005 mg/l
Aldicarb sulfone	0.0008 mg/l
Atrazine	0.0001 mg/l
Carbofuran	0.0009 mg/l
Chlordane	0.002 mg/l
Dibromochloropropane	0.00002 mg/l
2,4-D	0.0001 mg/l
Ethylbenzene	
Ethylene dibromide	0.00001 mg/l
Heptachlor	0.00004 mg/l
Heptachlorepoxyde	0.00002 mg/l
Lindane	0.0002 mg/l
Methoxychlor	0.0001 mg/l
PCBs	0.001 mg/l
Pentachlorophenol	0.00001 mg/l
Toxaphene	0.001 mg/l
2,4,5-TP	0.0002 mg/l

TABLE 5-3. SYNTHETIC ORGANIC CHEMICALS - ANALYTICAL METHODS

SOC	EPA Methods
VOCs:	
o-Dichlorobenzene	502.1
cis-1,2-Dichloroethylene	502.2
trans-1,2-Dichloroethylene	503.1
1,2-Dichloropropane	524.1
Ethylbenzene	524.2
Monochlorobenzene	524.2
Styrene	524.2
Tetrachloroethylene	524.2
Toluene	524.2
Xylenes	524.2
Pesticides/PCBs:	
Dibromochloropropane	504
Ethylene dibromide	505
Alachlor	505, 507, 525
Atrazine	505, 507, 525
Chlordane	505, 508, 525
Heptachlor	505, 508, 525
Heptachlorepoxyde	505, 508, 525
Lindane	505, 508, 525
Methoxychlor	505, 508, 525
Toxaphene	505
PCBs ¹	505, 508
PCBs (as decachlorobiphenyl)	508A
2,4-D	515.1
2,4,5-TP (Silvex)	515.1
Pentachlorophenol	515.1
Aldicarb	531.1
Aldicarb sulfoxide	531.1
Aldicarb sulfone	531.1
Carbofuran	531.1

¹Methods 505 and 508 are used as screens only. If detected in 505 or 508, PWDS must confirm using Method 508A.

5-4. **Best Available Technology.** Specified BATs for SOCs are listed in Table 5-4. For VOCs, point of entry (POE) devices, although not designated BAT, are also an acceptable means of compliance, with state approval, if certain criteria are met. Point of Use (POU) devices and bottled water are considered acceptable, at state discretion, only as interim measures to avoid unreasonable risks to health until full compliance can be achieved.

5-5. **Compliance Monitoring.**

a. Compliance is based on an annual running average for each sample point for systems monitoring quarterly or more frequently. For systems monitoring annually or less frequently, compliance is based on a single sample unless the state requests a confirmation sample.

b. The MCLGs and MCLs for Pesticides/PCBs and VOCs are listed in Table 5-1.

c. If the level of any contaminant is less than the MCL, the system is in compliance.

d. If the level of any contaminant is at its detection limit (Table 5-1) but less than its MCL,

1. immediately begin monitoring quarterly until state determines the system is reliable and consistent,

2. groundwater systems must take a minimum of 2 samples per quarter, and

3. surface water systems must take a minimum of 4 samples per quarter.

e. If the level of any contaminant exceeds the MCL,

1. immediately notify the state,

2. begin quarterly monitoring, and

3. notify public according to Chapter 9.

TABLE 5-4. Best Available Technology for Synthetic Organic Materials

Contaminant	GAC	PTA	PAP
Pesticides/PCBs:			
Alachlor	x		
Aldicarb*	x		
Aldicarb sulfone*	x		
Aldicarb sulfoxide*	x		
Atrazine	x		
Carbofuran	x		
Chlordane	x		
2,4-D	x		
Dibromochloropropane	x	x	
Endrin ¹	x		
Ethylene dibromide	x	x	
Heptachlor	x		
Heptachlorepoxyde	x		
Lindane	x		
Methoxychlor	x		
PCBs	x		
Pentachlorophenol	x		
Toxaphene	x		
2,4,5-TP (Silvex)	x		
VOCs:			
Benzene ¹	x	x	
Carbon tetrachloride ¹	x	x	
o-Dichlorobenzene	x	x	
cis-1,2-Dichloroethylene	x	x	
trans-1,2-Dichloroethylene	x	x	
1,1-Dichloroethylene ¹	x	x	
1,1,1-Trichloroethane ¹	x	x	
1,2-Dichloroethane ¹	x	x	
1,2-Dichloropropane	x	x	
Ethylbenzene	x	x	
Monochlorobenzene	x	x	
para-Dichlorobenzene ¹	x	x	
Styrene	x	x	
Tetrachloroethylene	x	x	
Trichloroethylene ¹	x	x	
Toluene	x	x	
Vinyl chloride ¹		x	
Xylene (Total)	x	x	
Other Organics:			
Acrylamide			x
Epichlorohydrin			x

KEY: GAC - Granular activated carbon
PTA - Packed tower aeration
PAP - Polymer addition practices

* Proposed BAT. EPA intends to promulgate the final BAT by late 1991.

¹ These Pesticides/PCBs and VOCs currently in 40 CFR part 161.41 are to be incorporated in a final rule by late 1991.

Chapter 6

DISINFECTANTS AND DISINFECTANT BY-PRODUCTS (DBPS)

6-1. General Information.

a. The EPA has established a science advisory board (SAB) to assist in the development of regulations for disinfectants and disinfectant by-products. The group has reviewed the by-products which have shown to occur or are anticipated to occur from the addition of disinfectants commonly used in water treatment. These disinfectants include chlorine, chloramine, chlorine dioxide, and ozone. Existing toxicological studies of the disinfectants and by-products were also reviewed by the SAB. It was noted that further toxicology studies are necessary.

b. The EPA has established a "short list" of candidate disinfectants and DBPs that are of concern as possible contaminants in drinking water. An additional list of by-products considered for development of MCLs and MCLGs has also been prepared. These are shown in Appendix C.

c. The EPA anticipates a proposed regulation in Sep 91, with a final regulation in late 1992. Discussion within the EPA and SAB concerning the DBPs of chlorination revolves around the establishment of MCLs for each contaminant or the establishment of an MCL for a surrogate contaminant such as trihalomethanes (THMs). The whole issue of MCLs for DBPs, including a revised MCL for THMs, is under consideration at this time.

6-2. **Total Trihalomethanes Requirements.** These requirements apply only to water systems that add a disinfectant (oxidant, such as chlorine, chlorine dioxide, chloramines or ozone) to any part of the treatment process.

6-3. Monitoring Requirements.

a. Monitoring requirements are based on system size. Unless the state has approved a reduced schedule, PWDS must analyze sample for total trihalomethanes (TTHM) according to Table 6-1.

TABLE 6.1. TTHM MONITORING REQUIREMENTS

Population Served by System	Quantity of Samples	Frequency of Samples	Type of Sample
10,000 or more	4*	quarterly	treated
Less than 10,000	1*	annually	treated

*per water treatment plant

b. One of the samples must be taken at a point in the distribution system reflecting the maximum residence time of water in the systems. The

remaining samples should be taken at representative locations within the distribution system.

c. Systems using groundwater sources that add a disinfectant should have one sample analyzed for maximum TTHM potential.

d. Systems using surface water sources, in whole or in part, that add a disinfectant should analyze for TTHM as part of the annual water sample submitted as required by 6-3a.

6-4. Analytical Requirements.

a. The analysis methods for trihalomethanes are "The Analysis of Trihalomethanes in Drinking Water by the Purge and Trap Method," Method 501.1, or "The Analysis of Trihalomethanes in Drinking Water by Liquid/Liquid Extraction, Method 501.2," Environmental Monitoring and Support Laboratory, Environmental Research Center, Cincinnati, Ohio 45268, May 15, 1979.

b. Samples for TTHM shall be dechlorinated upon collection to prevent further production of TTHM.

c. Samples for maximum TTHM potential should not be dechlorinated and should be held for 7 days at 25 degrees C (or above) prior to analysis.

d. All samples should be submitted in special containers obtained from Armstrong Laboratory by the Analytical Services Division.

6-5. Best Available Technology.

a. BAT for precursor removal includes conventional treatment modifications and granular activated carbon with up to 30 minutes empty bed contact time and regeneration every 3 months.

b. BAT for alternative oxidants includes using chlorine dioxide with chlorite residual removal and chloramines, and ozone plus chloramines.

c. BAT for by-product removal includes air stripping, GAC adsorption, reducing agents, free chlorine, and ozone.

6-6. Compliance Monitoring.

a. The maximum contaminant level for TTHMs is 0.1 mg/l. TTHMs include Chloroform, Bromoform, Bromodichloromethane, and Dibromochloromethane.

b. If 10,000 or more served:

1. Average the quarterly samples covering any 12-month period.

2. If the average exceeds the MCL, then report to the state and notify the public according to Chapter 9.

3. If the average is less than the MCL, then the system is in compliance.

c. If less than 10,000 served:

1. Groundwater -- Analyze for maximum TTHM potential:

(a) If results are less than MCL the system is in compliance.

(b) If results are equal to or exceed the MCL, collect and analyze a sample for TTHMs. If the MCL is exceeded, then report to the state and notify the public according to Chapter 9.

2. Surface water -- If TTHM MCL exceeded:

(a) Initiate an additional sample.

(b) If MCL still exceeded, report to the state and notify the public according to Chapter 9.

(c) If MCL is not exceeded, the system is in compliance.

Chapter 7

RADIONUCLIDE REQUIREMENTS

7-1. General Information.

a. Presently, EPA regulates two radionuclide contaminants and two categories of emitters in community water systems. These are combined radium-226 and 228, gross alpha activity excluding radon and uranium, and beta particle and photon radioactivity. EPA proposes to add two contaminants, radon-222 and uranium in the future. The category of adjusted gross alpha emitters regulates alpha emitters and is the gross alpha measurement less uranium and less radium-226. The category of beta and photon emitters regulates total beta and photon emitters. In addition the EPA proposes unregulated contaminant monitoring of lead-210, a long-lived progeny of radon-222.

b. EPA published a proposed rule 18 Jul 91 (FR Vol 56, No. 138) and has scheduled final MCL promulgation in Apr 93.

7-2. Monitoring Requirements.

a. Monitoring of the current MCLs will continue through 1995.

1. Gross Alpha Particle Activity, Radium-226 and Radium-228. 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 contained at quarterly intervals. Bases may substitute gross alpha activity for radium-226 and 228 activity in some cases (40 CFR 141.26). Bases must sample at least once every four years. At the state's discretion, if the average annual concentration is less than half the maximum contaminant levels, analysis of a single sample may be substituted for the quarterly sampling procedure. A community water system with 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. The state may order more frequent or additional sampling.

2. Monitoring requirements for manmade radioactivity in community water systems apply to surface water systems serving greater than 100,000 persons, when required by the state, or when nuclear facility contamination has occurred.

b. Monitoring of the proposed MCLs will follow the standardized 3-, 6-, and 9-year cycling scheme shown in Table 7-1.

7-3. Analytical Requirements. Analytical methods for radionuclides are listed in Table 7-2.

7-4. Proposed Best Available Technology.

a. Radon: Aeration.

Table 7-1. RADIONUCLIDE MONITORING REQUIREMENTS

Calendar Year	1993	1994	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Framework Divisions	First 9-year cycle											
Monitor for Current MCLs	Initial Period											
Repeat period	Repeat period											
GW/ SW ₂	New Monitoring Requirements Not Yet In Effect											
GW/ SW ₂	New Monitoring Requirements Not Yet In Effect											
GW	New Monitoring Requirements Not Yet In Effect											
GW/SW Waiver ³	New Monitoring Requirements Not Yet In Effect											
GW/ SW	New Monitoring Requirements Not Yet In Effect											
GW/SW Waiver ³	New Monitoring Requirements Not Yet In Effect											
Ra-226, Ra-228, Uranium	State Discretion											
Ra-226, Ra-228, Uranium	1/cycle											

¹ Calendar to be adjusted to time of final regulations.

² Vulnerable systems only (based on Vulnerability Assessment).

³ Waiver based on monitoring results.

⁴ Numbers shown in each monitoring period refer to number of samples per sampling point per year.

⁵ Gross Beta is a screen for Ra-228 and an MCL standard.

⁶ Gross Alpha is a screen for Ra-226 and uranium, and an MCL standard.

Ref: "Fact Sheet Radionuclides in Drinking Water"
Office of Groundwater and Drinking Water, United States
Environmental Protection Agency; Washington D.C. June 1991

Table 7-2. RADIONUCLIDE ANALYTICAL REQUIREMENTS

Contaminant	Methodology	Reference	
		EPA (1)	SM (2)
Naturally occurring			
Gross alpha and beta.	Evaporation	900.0	7110 B
Gross alpha	Co-precipitation		
Radium 226	Radon emanation	903.1	7500-Ra B
	Radiochemical	903.0	
Radium 228	Radiochemical	904.0	7500-Ra D
Radon 222	Liquid scintillation	*	*
	Lucas cell	**	**
Uranium	Radiochemical	908.0	7500-U B
	Fluorometric	908.1	7500-U C
	Alpha spectrometry	***	***
Manmade			
Radioactive cesium.	Precipitation	901.0	7500-Cs B
Radioactive iodine.	Precipitation	902.0	7500-I B
Radioactive strontium 89, 90.	Precipitation	905.0	7500-Sr B
	Radiochemical	****	****
Tritium	Liquid scintillation	906.0	7500-3H B
Gamma and photon emitters	Gamma ray spectrometry	901.1	

(1) "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA Environment Monitoring and Support Laboratory, Cincinnati, OH (EPA-600/4-80-032, August 1980. (EPA, 1980).

(2) "Standard Methods for the Examination of Water and Wastewater," 17th edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1989. (APHA, 1989).

* Method 913-Radon in drinking water by liquid scintillation, Environmental Monitoring and Support Laboratory, Las Vegas, NV. (EPA 1991q).

** Appendix D, Analytical Test Procedure, "The Determination of Radon In Drinking Water," p.22, Two Test Procedures for Radon In Drinking Water, Interlaboratory Collaborative Study, EPA/600/2-87/082, March 1987. (EPA, 1987e).

*** "Radiochemical Analytical Procedures for Analysis of Environmental Samples," p.33, EMSL-LV-0539-17, March 1979. (EPA, 1976b).

**** "Interim Radiochemical Methodology for Drinking Water," p. 108-114, EPA-600/4-75-008, March 1976. (EPA, 1976).

TABLE 7-3. RADIONUCLIDE MCLS/MCLGS

Contaminant	Current MCLs	Proposed ¹ MCLGs	Proposed MCLs
Radon-222	N/A	0	300 pCi/L
Radium-226	5 pCi/L ²	0	20 pCi/L
Radium-228	5 pCi/L ²	0	20 pCi/L
Uranium	N/A	0	20 µg/L ³
Beta & Photon	4 pCi/L ⁴	0	4 mrem ede/yr ⁵
Gross Alpha	15 pCi/L ⁶	0	15 pCi/L ⁷

¹Proposed 18 Jul 91, FR Vol 56, No 138.

²The MCL of 5pCi/L pertains to combined radium-226 and radium-228.

³Using an activity-to-mass conversion of 1.3 pCi/µg, 20µg/L uranium is approximately 30 pCi/L.

⁴The MCL pertains to the sum of beta particle and photon radioactivity from manmade radionuclides.

⁵The MCL pertains to the sum of beta particle and photon radioactivity from manmade radionuclides excluding radium-228. The unit ede/yr refers to the dose committed over a period of 50 years to the reference man from an annual intake at the rate of 2 liters of drinking water per day.

⁶Gross alpha activity includes radium-226, but excludes radon and uranium.

⁷Gross alpha activity excludes radium-226, radon-222 and uranium.

- b. Radium-226: Ion exchange; lime softening; reverse osmosis.
- c. Radium-228: Ion exchange; lime softening; reverse osmosis.
- d. Uranium: Coagulation/filtration; reverse osmosis; anion exchange; lime softening.
- e. Gross Beta and Photon Emitters: Reverse osmosis; ion exchange (mixed bed).
- f. Adjusted Gross Alpha Emitters: Reverse osmosis.

7-5. Compliance Monitoring.

a. Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment beginning in the compliance period starting 1 Jan 96. Surface water systems shall take a minimum of one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment beginning 1 Jan 96. Except for radon and gross beta sampling, the state may allow compositing from a maximum of five sampling points. Compositing is done in the laboratory. If the composite sample concentration is greater than or equal to 3 pCi/l of any radionuclide, non-composited samples must be analyzed.

b. Frequency of samples will be as follows:

1. Radon. Groundwater systems or systems using both ground and surface water will take four consecutive quarterly samples during the first year of each 3-year compliance cycle. Annual samples are required in the second and third years of each compliance period. Initial monitoring for radon must be completed by 1 Jan 99. States may require monitoring for radon in surface waters. States may also grant a waiver for radon monitoring if the state determines the base is reliably and consistently below the MCL. Minimum sampling for radon with a waiver is one sample for every 3-year compliance period. States may consider data collected after 1 Jan 90 which is collected and analyzed consistent with the new rules.

2. Radium, Uranium, and Adjusted Gross Alpha. Groundwater systems, surface water systems and systems using both ground and surface water shall take one sample annually at each post-treatment sampling during each 3-year compliance period starting 1 Jan 96. If all samples are less than the MCL in the first 3 years (96-98), then the state can reduce monitoring. States may consider data collected after 1 Jan 85, if they were collected and analyzed consistent with the new rules.

3. Beta and Photon Emitters. Only systems determined by the state to be vulnerable need to sample for beta and photon emitters. Vulnerability shall be based on the proximity of the water source(s) to facilities using or producing radioactive materials. Vulnerable systems shall monitor quarterly for beta and annually for tritium and strontium, beginning in the compliance period starting Jan 96.

4. Confirmation Samples. The state may require one additional sample be collected as soon as possible after the initial sample was taken that indicated an excess of the standard for radon, radium, adjusted gross alpha, uranium, and beta and photon emitters. When this occurs, the average of the initial and confirmation sample shall be averaged to determine the system's compliance. Systems may apply to the state to conduct more frequent monitoring than the minimum specified in the regulations.

c. Table 7-3 has a listing of the proposed MCLs and MCLGs and the current existing MCLs.

1. The maximum contaminant levels for beta particle and photon radioactivity from manmade radionuclides is 4 mrem ede/yr (mrem ede/yr refers to the dose committed over a period of 50 years to reference man from an annual intake at the rate of 2 liters of drinking water per day).

2. If samples are conducted at a frequency greater than annually, e.g., quarterly, compliance is determined by a running annual average at each sampling point. If the average at any sampling point is greater than the MCL, then the system is out of compliance. If any one sample would cause the annual average to be exceeded, then the system is out of compliance immediately. Samples below the detection limit shall be calculated at one-half the detection limit for the purpose of determining the annual average. For annual and less frequent sampling, if the level of contaminant at any sampling point is greater than the MCL, and a confirmation sample is required by the state, the determination of compliance will be based on the average of the two samples. Where a public water system has a separable part of the distribution system, only those parts of the system that exceeded the MCL needed to conduct increased monitoring.

Chapter 8

NATIONAL SECONDARY DRINKING WATER REGULATIONS

AND

PHYSICAL CHARACTERISTICS

8-1. General Information.

a. Secondary Maximum Contaminant Levels (SMCLs) are not enforceable Federally and establish limits for contaminants in drinking water which may affect the aesthetic qualities and the public's acceptance of drinking water (e.g., palatability, taste, and odor). BES should check whether their primacy state has adopted and is enforcing secondary standards. The CFR addresses national secondary drinking water regulations in part 143.

b. The basis for physical quality standards is primarily related to consumer acceptance of the color, odor, and appearance of the water. The characteristics that affect the water's acceptance are pH, odor, color, corrosivity, and total dissolved solids (TDS). These characteristics are regulated under the National Secondary Drinking Water Standards.

8-2. **Monitoring Requirements.** EPA recommends that systems monitor for these contaminants at intervals no less frequent than monitoring for inorganic chemical contaminants. More frequent monitoring for contaminants such as pH, color, odor or others may be appropriate under certain circumstances.

8-3. Compliance Monitoring.

a. The levels represent reasonable goals for drinking water quality. The states may establish higher or lower levels, depending upon local conditions such as unavailability of alternate source waters and the effect on public health and welfare. Some states enforce secondary standards. Table 8-1 lists the SMCLs.

b. The EPA promulgated two new SMCLs, aluminum and silver, on 30 Jan 91 (FR Vol 56, No 20). These new SMCLs will be effective after 30 Jul 92.

TABLE 8-1. SECONDARY DRINKING WATER MCLS

Contaminant	SMCL
Aluminum	0.05 to 0.2 mg/l ¹
Chloride	250 mg/l
Color	15 color units
Copper	1.0 mg/l
Corrosivity	noncorrosive
Fluoride	2.0 mg/l
Foaming Agents	0.5 mg/l
Iron	0.3 mg/l
Manganese	0.05 mg/l
Odor	3 Threshold odor number
pH	6.5 - 8.5
Silver	0.1 mg/l ¹
Sulfate	250 mg/l
Total Dissolved Solids	500 mg/l
Zinc	5 mg/l

¹Effective 30 Jul 92

Chapter 9

PUBLIC NOTIFICATION

9-1. **General Information.** The EPA issued a final rule for public notification in the 28 Oct 87, 53 FR 41534. In this action, the EPA promulgated new general public notification requirements.

9-2. **General Public Notification Requirements.**

a. There is a two-tier structure for public notification. The first tier is for more severe violations or failures that require prompt notification of the persons served by the PWDS (Figure 9-1). This category includes failure to comply with a MCL, a prescribed treatment technique, or a variance or exemption schedule. The second tier is for violations or failures of a lesser degree that still require public notification (Figure 9-1). These include failure to comply with monitoring requirements or a testing procedure prescribed by a NPDWR, or that the system is operating under a variance or exemption.

b. Mandatory health effects language is required on all public notices for Tier 1 violations; however, this language is only required in Tier 2 when the PWDS operates under a variance or exemption. This language can be found in the 31 Jan 91 Federal Registry.

c. Notice to New Base Personnel. All new military or civilian personnel assigned to the installation (and their families), new contractor personnel performing work on the installation, and all personnel on temporary duty at the installation must be provided 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. This notice will be provided at the time the person reports to the installation.

d. General Content of Public Notice. Each notice required by paragraph 9-2a must provide a clear and readily understandable explanation of the violation, any potential adverse health effects, the population at risk, the steps that the PWDS 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 appropriate civil engineering point of contact (owner) or a designee to serve as a source of additional information concerning the notice. Where appropriate, the notice shall be multilingual.

e. Availability of Results.

1. Notification shall be made to the persons served by the PWDS and to the Administrator of the EPA of the availability of the results of monitoring for drinking water contaminants.

2. The results of the drinking water monitoring shall be submitted to the state within 30 days of receipt from the certified laboratory. The following information will be submitted as a minimum:

- (a) Results of all analytical methods, including negatives.
- (b) Name and address of the PWDS that supplied the sample.
- (c) Contaminants for which the analyses were performed.
- (d) Analytical method(s) used.
- (e) Date of sample.
- (f) Date of analysis.
- (g) Name of point of contact concerning information on the monitoring results.

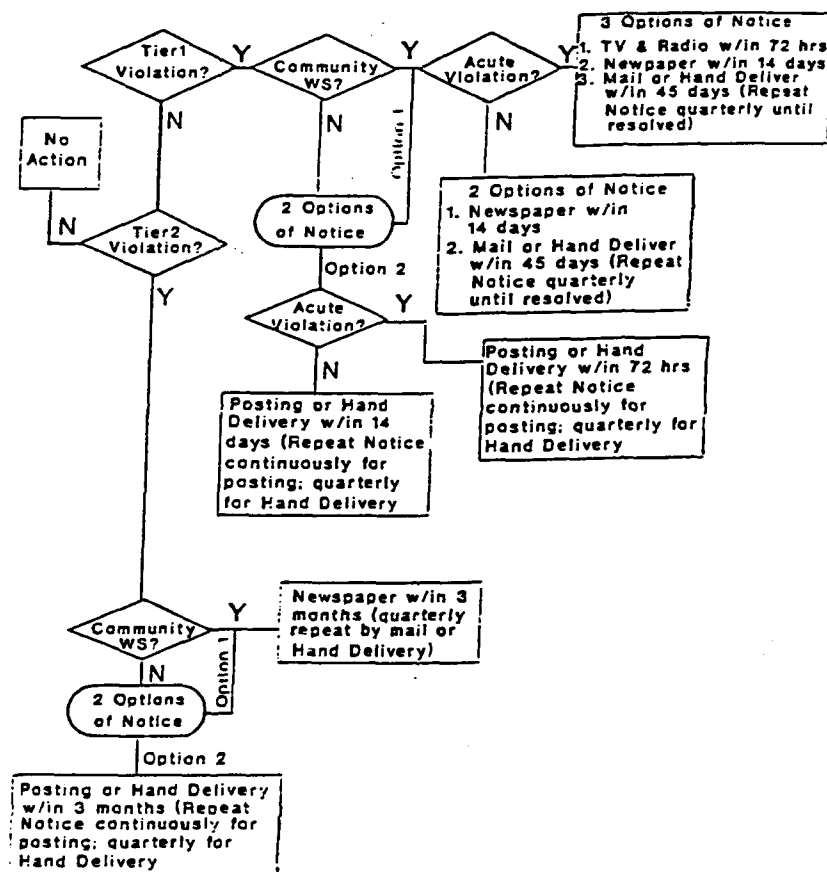


Figure 9-1. PUBLIC NOTIFICATION REQUIREMENTS

Ref: "Fact Sheet Drinking Water Regulations under the Safe Drinking Water Act,"
Criteria and Standards Division Office of Drinking Water, United States
Environmental Protection Agency; Washington, D.C., May 1990.

APPENDIX A
PROPOSED MCLGS AND MCLS FOR INORGANIC CHEMICALS

APPENDIX A

PROPOSED MCLGS AND MCLS FOR INORGANIC CHEMICALS

Contaminant	MCLG in mg/l	MCL in mg/l
Antimony	0.003	0.01/0.005
Beryllium	0	0.001
Cyanide	0.2	0.2
Nickel	0.1	0.1
Sulfate	400	400
Thallium	0.0005	0.002/0.001

Note: 1. These tentative MCLs and MCLGs are subject to change based in part on sample data collected in conjunction with 30 Jan 91 FR Vol 56 No 20.

2. Sampling. Community and non-transient, noncommunity take one sample at each sampling point and report to the state by 31 Dec 95. Groundwater and surface water systems shall take a minimum of one sample at every entry point to the distribution system after treatment which is representative of each well or source water (as appropriate). Where sources are combined before distribution, sample under normal (representative) conditions. States may allow compositing in the laboratory of up to five sampling points.

3. Waivers. States may grant a waiver if data collected after 1 Jan 90 indicates contamination would not occur. Systems serving fewer than 150 service connections may send a letter to the state instead of monitoring advising the state that the system is available for sampling.

APPENDIX B
PROPOSED MONITORING FOR SYNTHETIC ORGANIC CHEMICALS

TABLE B-1

23 Additional SOCs Proposed for Monitoring

Monitoring is proposed for the following contaminants if the state determines the system is vulnerable to contamination.

Aldrin
 ^Benzo(a)pyrene
 Butachlor
 Carbaryl
 *Dalapon
 Di(2-ethylhexyl)adipate
 Di(2-ethylhexyl)phthalates
 Dicamba
 Dieldrin
 *Dinoseb
 Diquat
 Endothall
 *Glyphosate
 Hexachlorobenzene
 *Hexachlorocyclopentadiene
 3-Hydroxycarbofuran
 Methomyl
 Metolachlor
 Metribuzin
 *Oxamyl (vydate)
 ^Benz(a)anthracene
 ^Benzo(b)fluoranthene
 ^Benzo(k)fluoranthene
 ^Chrysene
 ^Dibenz(a,h)anthracene
 ^Indenopyrene
 *Picloram
 Propachlor
 *Simazine
 *2,3,7,8-TCDD (Dioxin)

^Indicates polynuclear aromatic hydrocarbons (PAHs)

*Currently included in list of 83 contaminants proposed for regulation.

Note: Each community and non-transient, noncommunity water system shall take four consecutive quarterly samples at each sampling point for each contaminant listed above and report the results to the state. Monitoring must be completed by 31 Dec 95. Systems may apply to the state for a waiver of this monitoring requirement. Waiver criteria are specified in 40 CFR 141.24(h)(6). Groundwater and surface water systems shall take a minimum of one sample at every entry point to the distribution system after treatment which is representative of each well or source water (as appropriate). Where sources are combined before distribution, sample under normal (representative) conditions. States may allow compositing in the laboratory of up to five sampling points. Systems serving fewer than 150 service connections may send a letter to the state instead of monitoring advising the state that the system is available for sampling.

TABLE B-2

84 Additional SOCs Proposed for Monitoring at State's Discretion

Monitoring for the following contaminants is at the discretion of the state.

Ametryn	Famphur
Aspon	Fenamiphos
Atration	Fenarimol
Azinphos methyl	Fenitrothion
Bolstar	Fensulfothion
Bromacil	Fenthion
Butylate	Fluridone
Carboxin	Fonophos
Chlorneb	HCH-alpha
Chlorobenzilate	HCH-beta
Chloropropham	HCH-delta
Chloropropylate	HCH-gamma
Chloropyrifos	Hexazinone
Chlorothalonil	Malathion
Coumaphos	Merphos
Cycloate	Methyl paraoxon
DCPA	Methyl parathion
4,4'-DDD	Mevinphos
4,4'-DDE	MGK 264
4,4'-DDT	MGK 326
Demeton-O	Molinate
Demeton-S	Napropamide
Diazinon	Norflurazon
Dichlofenthion	Pebulate
Dichloran	cis-Permethrin
Dichlorovos	trans-Permethrin
Diphenamid	Phorate
*Diquat	Phosmet
Disulfoton	Promaton
Disulfoton sulfone	Prometryn
Disulfoton sulfoxide	Pronamide
Endosulfan I	Propazine
Endosulfan II	Simetryn
Endosulfan sulfate	Stirofos
*Endothal	Tebuthiuron
Endrin aldehyde	Terbacil
EPN	Terbufos
EPTC	Terbutryn
Ethion	Triademefon
Ethoprop	Tricyclazole
Ethyl parathion	Trifluralin
Etridiazole	Vernolate

*Currently included in list of 83 contaminants proposed for regulation.

TABLE B-3

**43 Additional Proposed Contaminants for which Monitoring
is Required under the VOC rule**

List 1

Bromobenzene
Bromodichloromethane
Bromoform
Bromomethane
Chlorobenzene
Chlorodibromomethane
Chloroethane
Chloroform
Chloromethane
o-Chlorotoluene
p-Chlorotoluene
Dibromomethane
m-Dichlorobenzene
o-Dichlorobenzene
1,2,3-Trichloropropane
cis-1,2-Dichloroethylene
Dichloromethane
1,1-Dichloroethane
1,2-Dichloropropane
1,3-Dichloropropane
2,2-Dichloropropane
1,1-Dichloropropene
1,3-Dichloropropene
Ethylbenzene
1,1,1,2-Tetrachloroethane
1,1,2,2-Tetrachloroethane
Tetrachloroethylene
1,1,2-Trichloroethane

List 2

Bromochloromethane
n-Butylbenzene
Dichlorodifluoromethane
Fluorotrichloromethane
Hexachlorobutadiene
Isopropyltoluene
p-Isopropyltoluene
Naphthlene
n-Propylbenzene
sec-Butylbenzene
tert-Butylbenzene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,2,4-Trimethylbenzene
1,3,5-Trimethylene

APPENDIX C
DISINFECTANTS AND DISINFECTANT BY-PRODUCTS (DBPs)

TABLE C-1

CANDIDATE DISINFECTANTS AND DISINFECTANT BY-PRODUCTS

DISINFECTANT BY-PRODUCTS

Haloacetic acids

Dibromoacetic acid
 Dichloroacetic acid
 Monobromoacetic acid
 Trichloroacetic acid

Haloacetonitriles

Bromochloroacetonitrile
 Dibromoacetonitrile
 Dichloroacetonitrile
 Trichloroacetonitrile

Haloketones

1,1-Dichloropropanone
 1,1,1-Trichloropropanone

Trihalomethanes

Bromodichloromethane
 Bromoform
 Chloroform
 Dibromochloromethane

Other

Chloral hydrate
 Chloropicrin

Chlorophenols

2-Chlorophenol
 2,4-Dichlorophenol
 2,4,6-Trichlorophenol

Cyanogen chloride

MX (3-chloro-4-(dichloromethyl)
 -5-hydroxy-2(5H)-furanone)

N-Organochloramines

Ozone by-products

DISINFECTANTS

Ammonia

Chloramines
 Chlorate
 Chlorine
 Chlorine dioxide
 Chlorite
 Hypochlorite ion
 Hypochlorous acid

TABLE C-2

**DISINFECTANTS AND DISINFECTANT BY-PRODUCTS CONSIDERED FOR DEVELOPMENT
OF MCLGS AND MCLS**

Bromate
Chloramine
Chlorate
Chlorine
Chlorine dioxide
Chlorite
Chloropicrin
Cyanogen chloride
Formaldehyde
Haloacetic acids
Hydrogen peroxide
Iodate
TTHMs (25 to 650 mg/L)

**DISINFECTANT BY-PRODUCTS CONSIDERED FOR DEVELOPMENT OF TREATMENT
TECHNIQUES**

MX (3-chloro-4-(dichloromethyl)-5-hydroxy-2(5H)-furanone)
(as a surrogate for mutagenicity)

Total oxidizing substances (as a surrogate for organic peroxides and
epoxides)

Assimilable Organic Carbon (AOC) (as a surrogate for microbiological
quality of oxidized waters)

APPENDIX D
STATE WATER QUALITY AGENCIES

STATE WATER QUALITY AGENCIES

Alabama

Department of Environmental Management
Water Division
1751 Federal Drive
Montgomery, AL 36130
(205) 271-7825

Alaska

Department of Environmental Conservation
Division of Environmental Quality Management
Pouch 0
Juneau, AK 99811
(907) 465-2640

Arizona

Department of Health Services
Office of Waste and Water Quality Management
2005 N. Central Ave.
Phoenix, AZ 85007
(602) 257-2305

Arkansas

Department of Pollution Control and Ecology
Water Division, 208, Planning Section
8001 National Drive
Little Rock, AR 72209
(501) 652-7444

California

Water Resources Control Board
P.O. Box 100
901 P Street
Sacramento, CA 95801
(916) 322-3132

Colorado

Department of Health
Water Quality Control Division
4210 E. 11th Ave.
Denver, CO 80220
(303) 320-8333

Connecticut

Department of Environmental Protection
Water Compliance and Hazardous Substances
State Office Building
122 Washington St.
Hartford, CT 06106
(203) 566-2588

Delaware

Department of Natural Resources and Environment Control
Division of Water Resources
89 Kings Highway
P.O. Box 1401
Dover, DE 19903
(302) 739-4761

District of Columbia

Department of Consumer and Regulatory Affairs
Environmental Control Division
5010 Overlook Ave., S.W.
Washington, D.C. 20032
(202) 767-7370

Florida

Department of Environmental Regulation
Division of Environmental Programs
Water Quality Planning Section
2600 Blair Stone Road, Suite 531
Twin Towers Office Building
Tallahassee, FL 32301
(904) 488-0780

Georgia

Department of Natural Resources
Environmental Protection Division, Water Protection Branch
270 Washington St., S.W., Room 702
Atlanta, GA 30334
(404) 656-4887

Hawaii

Department of Health
Pollution Investigation and Enforcement Division
P.O. Box 3378
Honolulu, HI 96801
(808) 543-8200

Idaho

Department of Health and Welfare
Division of Environmental Quality
Bureau of Water Quality
State House
Boise, ID 83720
(208) 334-5867

Illinois

Environmental Protection Agency
Division of Water Pollution Control
2200 Churchill Road
P.O. Box 19276
Springfield, IL 62794-9276
(217) 782-1654

Indiana

Office of Water Management
105 S. Meridian St.
P.O. Box 6015
Indianapolis, IN 46206-6015
(317) 232-8476

Iowa

Department of Natural Resources
Surface and Ground Water Protection Bureau
Wallace State Office Building
900 E. Grand Ave.
Des Moines, IA 50319
(515) 281-8690

Kansas

Department of Health and Environment
Division of Environment
Bureau of Water Protection
Forbes AFB Building No. 740
Topeka, KS 66620
(913) 296-5567

Kentucky

Natural Resources and Environmental Protection Cabinet
Division of Water Quality
18 Reilly Rd., Fort Boone Plaza
Frankfort, KY 40601
(502) 564-3410

Louisiana

Department of Environmental Quality
Office of Water Resources
Natural Resources Building
625 N. Fourth Street
Baton Rouge, LA 70804
(504) 342-6363

Maine

Department of Environmental Protection
Bureau of Water Quality Control
State House, Station 17
Augusta, MA 04333
(207) 289-3355

Maryland

Department of Natural Resources
Water Resources Administration (Water Resources Programs)
Taves State Office Building
Annapolis, MD 21401
(301) 269-3846

Department of Environment Water Management Administration
Construction Grants Program (Water Quality Standards, NPDES Permits, and Sewage Treatment)
2500 Broening Highway
Baltimore, MD 21224
(301) 631-3000

Massachusetts

Department of Environmental Quality Engineering
Division of Water Pollution Control
1 Winter St.
Boston, MA 02108
(617) 292-5673

Department of Environmental Quality Engineering
Division of Water Supply
1 Winter St.
Boston, MA 02108
(617) 292-5770

Michigan

Department of Natural Resources
Water Resources Commission
Water Quality Division
P.O. Box 30028
Lansing, MI 48909
(517) 373-1949

Minnesota

Minnesota Pollution Control Agency
Division of Water Pollution Control
520 Lafayette Rd. North
St. Paul, MN 55155
(612) 296-7202

Mississippi

Department of Environmental Quality
P.O. Box 10385, Southport Mall
Jackson, MS 39289-0385
(601) 961-5171

Missouri

Department of Natural Resources
Water Quality Program
Division of Environmental Quality
Jefferson State Office Building
101 Jefferson St.
Jefferson City, MO 65102
(314) 751-1300

Montana

Department of Health and Environmental Sciences
Division of Environmental Sciences
Water Quality Bureau
Cogswell Building, Room A206
Helena, MT 59620
(406) 444-4206

Nebraska

Department of Environmental Control
Water Pollution Control Division
P.O. Box 94877-301 Centennial Mall
Lincoln, NE 68509
(402) 471-2186

Nevada

Department of Conservation and Natural Resources
Water Resources Division
201 S. Fall St.
Carson City, NV 89710
(702) 687-4380

New Hampshire

Water Supply and Pollution Control Commission
Health and Human Services Building
6 Hazen Drive
P.O. Box 95
Concord, NH 03301
(603) 271-3504
Oil Pollution
(603) 271-3444

New Jersey

Department of Environmental Protection
Division of Water Resources
Wastewater Facilities Management Element
401 East State Street
P.O. Box CN029
Trenton, NJ 08625
(609) 292-1638

New Mexico

Health and Environment Department
Environmental Improvement Division
Surface Water Quality
Harold Runnels State Office Building
1190 St. Francis Drive
P.O. Box 968
Santa Fe, NM 87504-0968
(505) 827-2918

New York

Department of Environmental Conservation
Division of Waters
50 Wolf Rd.
Albany, NY 12233
(518) 457-6674

North Carolina

Department of Natural Resources and Community Development
Division of Environmental Management
Water Quality Section
P.O. Box 27687
Raleigh, NC 27611
(919) 733-5083

North Dakota

Department of Health
Division of Water Supply and Pollution Control
1200 Missouri Ave., Room 203
Bismark, ND 58505
(701) 224-2354

Ohio

Environmental Protection Agency
Division of Water Pollution Control
P.O. Box 1049
1800 Watermark Drive
Columbus, OH 43266-0149
(614) 644-2001

Oklahoma

Department of Pollution Control (Planning and Coordination)
P.O. Box 53504
1000 N.E. 10th St.
Oklahoma City, OK 73152
(405) 271-4468

Water Resources Board (Industrial Discharge, Water Quality Control)
Water Quality Division
P.O. Box 150
Oklahoma City, OK 73101-0150
(405) 231-2500

Department of Health (Municipal Discharge Control)
Environmental Health Services
Water Quality Services
1000 N.E. 10th St.
Oklahoma City, OK 73152
(405) 271-5600

Oregon

Department of Environmental Quality
Water Quality Division
811 S.W. Sixth Avenue
Portland, OR 97204
(503) 229-5342

Pennsylvania

Department of Environmental Resources
Bureau of Water Quality Management
P.O. Box 2063, 11th Floor/Fulton Building
200 N. 3rd Street
Harrisburg, PA 17101-2063
(717) 787-2666

Puerto Rico

Environmental Quality Board
Division of Water/Water Resources
P.O. Box 11488
Santurce, Puerto Rico 00910
(809) 725-5140

Rhode Island

Department of Environmental Management
Division of Water Resources
291 Promenade Street
Providence, RI 02908
(401) 277-3961

South Carolina

Department of Health and Environmental Control
Environmental Quality Control
Bureau of Wastewater and Stream Quality Control
2600 Bull St.
Columbia, SC 29201
(803) 734-5300

South Dakota

Department of Water and Natural Resources
Office of Water Quality
Joe Foss Building
523 E. Capitol
Pierre, SD 57501
(605) 773-3351

Tennessee

Department of Public Health
Bureau of Environmental Health
Office of Water Management
344 Cordell Hull Bldg.
Nashville, TN 37219
(615) 741-3111

Texas

Texas Water Commission
P.O. Box 13087
Capitol Station
Austin, TX 78711
(512) 463-7830

Utah

Division of Environmental Health
Bureau of Water Pollution Control
P.O. Box 16690
Salt Lake City, UT 84116
(801) 538-6146

Vermont

Water Quality Division (Water Quality)
Department of Environmental Conservation
103 S. Main Street, Building 10 North
Waterbury, VT 05676
(802) 244-5638

Virginia

State Water Control Board
P.O. Box 11143
Richmond, VA 23230
(804) 367-1006

Washington

Department of Ecology
Office of Water Programs
Mail Stop PV-11
Olympia, WA 98504
(206) 459-6000

West Virginia

Department of Natural Resources
Division of Water Resources
1201 Greenbrier St.
Charleston, WV 25311
(304) 348-8855

Wisconsin

Department of Natural Resources
Division of Environmental Standards
Bureau of Water Resources and Management
P.O. Box 7921
Madison, WI 53707
(608) 266-2121

Wyoming
Department of Environmental Quality
Water Quality Division
122 West 25th Street
Cheyenne, WY 82002
(307) 777-7781

BIBLIOGRAPHY

1. AFR 161-44, Management of the Drinking Water Surveillance Program (24 Nov 89)
2. "Fact Sheet Drinking Water Regulations Under The Safe Drinking Water Act." Criteria and Standards Division Office of Drinking Water, U.S. Environmental Protection Agency, Washington, D.C., May 1990.
3. Pontius, Federick. "Complying With the New Regulations." Journal of American Water Works Association, 82(2):32-52; 1990.
4. "Providing Water that's Fit to Drink." Camp Dresser and McKee, Inc. (June 1990).
5. Title 40, Code of Federal Regulations, Part 141 Subpart B, Maximum Contaminant Levels.
6. Title 40, Code of Federal Regulations, Part 141 Subpart C, Monitoring and Analytical Requirements.
7. Title 40, Code of Federal Regulations, Part 141 Subpart D, Reporting Public Notification and Recordkeeping.
8. Title 40, Code of Federal Regulations, Part 141 Subpart E, Special Regulations, Including Monitoring Regulations and Prohibition on Lead Use.
9. Title 40, Code of Federal Regulations, Part 141 Subpart F, Maximum Contaminant Level Goals.
10. Title 40, Code of Federal Regulations, Part 141 Subpart G, National Revised Primary Drinking Water Regulations: Maximum Contaminant Levels.
11. "Methods of Chemical Analysis of Water and Wastes," EPA Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268 (EPA-600/4-79-020). March 1983. Available from ORD Publications, CERL, EPA, Cincinnati, OH 45268.
12. Annual Book of ASTM Standards, Vol. 11.01 American Society for Testing and Materials, 1961 Race Street, Philadelphia, PA 19103.
13. "Standard Methods for the Examination of Water and Wastewater," 16th edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1985.
14. "Methods for Determination of Inorganic Substances in Water and Fluvial Sediments," Techniques of Water-Resources Investigations of the U.S. Geological Survey Books, Chapter A1, 1985, Open-File Report 85-495. Available from Open-File Services Section, Western Distribution Branch, U.S. Geological Survey, MS 306 Box 24525, Denver Federal Center, Denver CO 80225.
15. "Orion Guide to Water and Wastewater Analysis," Form WeWWG/5880, p.5, 1985, Orion Research, Inc., Cambridge, MA.

16. "Inductively-Coupled Plasma Atomic Emission Analysis of Drinking Water," Appendix to Method 200.7, March, 1987, U.S. EPA, Environmental Monitoring and Support Laboratory, Cincinnati, OH 45268.
17. "Analytical Method for Determination of Asbestos Fibers in Water," EPA-600/4-83-043, September 1983, U.S. EPA Environmental Research Laboratory, Athens, GA 30613.
18. "Waters Test Method for the Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography," Method B-1011, Millipore Corporation, Waters Chromatography Division, 34 Maple Street, Milford, MA 01757.
19. "Standard Methods for the Examination of Water and Wastewater," 17th edition, American Public Health Association, American Water Works Association, Water Pollution Control Federation, 1989.
20. Annual Book of ASTM Standards, Vol. 11.01 American Society for Testing and Materials, 1961 Race Street, Philadelphia, PA 19103.
21. "Determination of Trace Elements by Stabilized Temperature Graphite Furnace Atomic Absorption Spectrometry," Method 200.9, August 1990, Revision 1.1, U.S. EPA Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268.
22. "Determination of Trace Elements in Waters and Wastes by Inductively Coupled Plasma--Mass Spectrometry," Method 200.8, August 1990, Revision 4.3, U.S. EPA Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268.
23. "Determination of Metals and Trace Elements in Water and Wastes by Inductively Coupled Plasma--Atomic Emission Spectrometry," Method 200.7, Revision 3.2, August 1990, U.S. EPA, Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268.

GLOSSARY

Acute. Certain violations such as nitrate and fecal coliform bacteria can pose acute (immediate) risk to human health. MCL violations are defined by regulation and require additional notice by electronic media (only for community water systems). Currently, EPA only defines violations of the nitrate and total coliform standard as an acute violation. However, states may define additional violations as acute violations.

Best Available Technology (BAT). A treatment technique that makes it feasible for purposes of meeting the MCL. BATs are only recommendations; but alternative technology must be able to achieve BAT reduction levels.

Community Water System (CWS). A public water system that pipes water for human consumption to at least 15 service connections used by year-round residents, or one that regularly serves at least 25 year-round residents (e.g., municipality, subdivision, mobile home park).

Compliance Cycle. A standardized monitoring cycle that EPA established consisting of 3-, 6-, and 9-year cycles.

Compliance Period. Three-year intervals in which a 9-year cycle consists of three 3-year periods.

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

Contaminated Water. Water that has been intruded by microorganisms, chemical wastes, or wastewater in a concentration that makes the water unfit for its intended use.

Conventional Filtration Treatment. A series of processes including coagulation, flocculation, sedimentation, and filtration resulting in substantial particulate removal.

Disinfection. A process which inactivates pathogenic organisms in water by chemical oxidants or equivalent agents.

Domestic or Other Nondistribution System Plumbing Problem. A coliform contamination problem in a public water system with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken.

Filtration. A process for removing particulate matter from water by passage through porous media.

Flocculation. A process to enhance agglomeration or collection of smaller floc particles into larger, more easily settleable particles through gentle stirring by hydraulic or mechanical means.

Gross Alpha Particle Activity. The total radioactivity due to alpha particle emission as inferred from measurements on a dry sample.

Groundwater Under the Direct Influence of Surface Water. Any water beneath the surface of the ground with (1) significant occurrence of insects or other microorganisms, 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.

Health Hazards. Any condition including faulty operating conditions, devices, or water treatment practices that may have undesirable effects on the consumer's health.

Initial Compliance Period. The first full 3-year period beginning 18 months after promulgation date of a rule.

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

Maximum Contaminant Level (MCL). The maximum permissible level of a contaminant in drinking water which is delivered to any user of a public water system. MCLs are established by the National Primary Drinking Water Regulations.

Maximum Total Trihalomethane Potential (MTTP). 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.

National Interim Primary Drinking Water Regulations (NIPDWRs). Under the 1974 SDWA, the USEPA was charged with proposing enforceable interim drinking water regulations by March 1975. Specific time lines were given in the act for regulation development. This regulation was renamed as the National Primary Drinking Water Regulation.

National Primary Drinking Water Regulation (NPDWR). The standards for drinking water quality. Each NPDWR contains an MCLG, an MCL or treatment technique, approved analytical, monitoring and reporting requirements for a contaminant of concern.

Noncommunity Water System. A public water system that distributes water for human consumption to at least 15 service connections used by individuals other than year-round residents for at least 60 days a year, or serves 25 or more people at least 60 days a year (e.g., schools, factories, rest stops, interstate carrier conveyances). Also see Non-transient Noncommunity Water System and Transient Noncommunity Water System.

Non-transient Noncommunity Water System. A noncommunity water system that serves at least 25 of the same persons over 6 months per year (e.g., schools, factories, industrial parks, office buildings).

Picocurie (pCi). Quantity of radioactive material producing 2.22 nuclear transformations a minute. One picocurie equals 0.037 Becquerels.

Point of Disinfection Application. The point where the disinfectant is applied and water downstream of that point is not subject to recontamination by surface water run-off.

Population Served. The number of people who reside in the area serviced by the public water system. Transient military and civilian personnel who live off-base will be counted by the community water distribution system where they reside. In-patient population at the hospital and alert flight crews will be counted at their permanent place of residence.

Potable Water. Water that has been examined and treated to meet the proper standards and declared by the responsible authorities to be fit for drinking.

Public Water System or Public Water Distribution System (PWDS). A system that provides piped water for human consumption if such system has at least 15 service connections or regularly serves an average of 25 individuals 60 or more days out of the year. Such a system includes: (1) any collection, treatment, storage, and distribution facilities under the 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 and can be publicly or privately owned.

Raw Water:

- a. Untreated water that enters the first unit of a water treatment plant.
- b. Water used as a source of water supply taken from a natural or impounded body of water, such as a stream, lake, pond, or underground aquifer.

Rem. 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. One rem is 1/100 seiverts.

Repeat Compliance Period. The 3-year compliance periods that begin after promulgation of the initial compliance period.

Safe Drinking Water Act (SDWA). The act that establishes standards for drinking water safety, Public Law 93-523, Title XIV of the Public Health Service Act, Safety of Public Water Systems. Amended in 1986.

Sanitary Defects. Conditions that may permit the contamination of a water supply during or after treatment. Examples include connections to water supplies that are not safe, raw water bypasses in treatment plants, plumbing fixtures that are not properly designed and installed, or leaking water and sewer pipes in the same trench.

Sanitary Survey. An on-site review by personnel trained in environmental engineering or epidemiology of waterborne diseases. The review is to evaluate the adequacy of the source and the capability of the facilities to produce and distribute safe drinking water.

Sedimentation. A process for removal of solids before filtration by gravity or separation.

Slow Sand Filtration. A process involving passage of raw water through a bed of sand at low velocity (generally less than 0.4 miles per hour) resulting in substantial particulate removal by physical and biological mechanisms.

State. In the United States and its territories, the agency of the state government that has primary enforcement responsibility (primacy) according to the Safe Drinking Water Act, Section 1413. Outside the United States and its territories, the Major Command Surgeon (MAJCOM/SG) is the state and is responsible for establishing a program to be consistent with the direction given in this regulation.

Surface Water. All water which is open to the atmosphere and subject to surface run-off.

System in a Single Service Connection. A system which supplies drinking water to consumers via a single service line.

Tier 1 Violations. More serious violations, including failure to comply with an MCL; failure to comply with prescribed treatment techniques; and failure to meet variance or exemption schedules.

Tier 2 Violations. Less serious violations, including failure to comply with monitoring requirements; failure to comply with a testing procedure prescribed by a NPDWR; and operating under a variance or exemption.

Too Numerous to Count. The total number of bacterial colonies exceeds 200 on a 47-mm diameter membrane filter used for coliform detection.

Transient Noncommunity Water System. A noncommunity water system that does not meet the definition of a non-transient noncommunity water system (e.g., highway rest stops, restaurants, motels, golf courses, parks).

Treated Water. Water that has been processed to make it potable. The treatment process may include sedimentation, filtration, softening and disinfection.

Trihalomethane (THM). An organic compound derived from methane where 3 of the 4 hydrogen atoms in methane are each replaced by a halogen, i.e., chlorine, bromine, or iodine, atom in the molecular structure. It is a disinfectant by-product.

Total Trihalomethane (TTHM). The sum of the concentrations in milligrams per liter of the trihalomethane compounds (chloroform, dibromochloromethane, bromodichloromethane, and tribromomethane).

Virus. A virus of fecal origin which is infectious to humans by waterborne transmission.

Vulnerability. Vulnerability is the determination of the potential risk of contamination of PWDS. The vulnerability of each Air Force PWDS shall be determined by the state based upon an assessment of the following factors: (1) Previous monitoring results, (2) Number of persons served by the water system, (3) Proximity to commercial or industrial use, disposal, or storage of hazardous materials, and (4) Protection of the water source.

Vulnerability Assessment. Part of emergency planning to ensure potable water supplies in the event of natural disasters, low intensity conflicts, or conventional war.

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

Water Quality. The chemical, physical, radiological, and microbiological characteristics of water with respect to its suitability for a particular purpose.

INDEX

<u>CONTAMINANT</u>	<u>PAGE</u>
Acrylamide	36,40
Alachlor	36-38,40
Aldicarb	36-38,40
Aldicarb sulfone	36-38,40
Aldicarb sulfoxide	36-38,40
Aldrin	58
Alkalinity	30,32
Alpha	45-50
Aluminum	52
Ametryn	59
Ammonia	62
Antimony	17,56
AOC (Assimilable Organic Carbon)	63
Arsenic	18
Asbestos	6,17-19,21,22
Aspon	59
Atration	59
Atrazine	36-38,40
Azinphos methyl	59
Barium	18,19,21,22
Benz(a)anthracene	58
Benzene	36,40
Benzo(a)pyrene	58
Benzo(b)fluoranthene	58
Benzo(k)fluoranthene	58
Beryllium	17,56
Beta	45-50
Bolstar	59
Bromacil	59
Bromate	63
Bromobenzene	60
Bromochloroacetonitrile	62
Bromochloromethane	60
Bromodichloromethane	42,60,62
Bromoform	42,60,62
Bromomethane	60
Butachlor	58
n-Butylbenzene	60
sec-Butylbenzene	60
tert-Butylbenzene	60
Butylate	59
Cadmium	17-19,21,22
Calcium	30,32
Carbaryl	58
Carbofuran	36-38,40
Carbon tetrachloride	36,40
Carboxin	59
Carcinogens	5
Cesium 134	47

Chloral hydrate	62
Chloramines	41,42,62,63
Chlorate	62
Chlordane	36-38,40
Chloride	52
Chlorination	2,6
Chlorine	41,42,62,63
Chlorine dioxide	41,62,63
Chlorite	42,62,63
Chlorneb	59
Chlorobenzene	60
Chlorobenzilate	59
Chlorodibromomethane	60
Chloroethane	60
Chloroform	42,60
Chloromethane	60,62
2-Chlorophenol	62
Chloropicrin	62,63
Chloropropham	59
Chloropropylate	59
Chloropyrifos	59
Chlorothalonil	59
o-Chlorotoluene	60
p-Chlorotoluene	60
Chromium	17-19,21,22
Chrysene	58
Coliform Bacteria	3,9-15,17,19
Color	51-52
Conductivity	30,32
Copper	18,26-33,52
Corrosivity	51-52
Coumaphos	59
<u>Cryptosporidium parvum</u>	3
Cyanide	17,56
Cyanogen chloride	62,63
Cycloate	59
2,4-D	36-38,40
Dalapon	58
Dibenz(a,h)anthracene	58
Dibromochloropropane (DBCP)	36-38,40
Dibromomethane	60
DCPA	59
4,4'-DDD	59
4,4'-DDE	59
4,4'-DDT	59
Demeton-O	59
Demeton-S	59
Diazinon	59
Dibromoacetic acid	62
Dibromoacetone nitrile	62
Dibromochloromethane	62
Dicamba	58
Dichlofenthion	59
Dichloran	59

Dichloroacetic acid	62
Dichloroacetoneitrile	62
Dibromochloromethane	42
m-Dichlorobenzene	60
o-Dichlorobenzene	36,38,40,60
para-Dichlorobenzene	36,40
Dichlorodifluoromethane	60
cis-1,2-Dichloroethylene	36,38,40,60
trans-1,2-Dichloroethylene	36,38,40
1,1-Dichloroethane	36,40,60
1,1-Dichloroethylene	36
Dichloromethane	60
2,4-Dichlorophenol	62
1,2-Dichloropropane	36,38,40,60
1,3-Dichloropropane	60
2,2-Dichloropropane	60
1,1-Dichloropropanone	62
1,1-Dichloropropene	60
1,3-Dichloropropene	60
Dichlorovos	59
Dieldrin	58
Di(2-ethylhexyl)adipate	58
Di(2-ethylhexyl)phthalates	58
Dinoseb	58
Diphenamid	59
Diquat	58,59
Disinfectants	41-43,62
Disulfoton	59
Disulfoton sulfone	59
Disulfoton sulfoxide	59
Endosulfan I	59
Endosulfan II	59
Endosulfan sulfate	59
Endothall	58
Endrin	36,40
Endrin aldehyde	59
Epichlorohydrin	36,40
EPN	59
EPTC	59
<u>Escherichia coli</u>	9,12-14
Ethion	59
Ethoprop	59
Ethylbenzene	36-38,40,60
Ethylene dibromide (EDB)	36-38,40
Ethyl parathion	59
Etridiazole	59
Famphur	59
Fenamiphos	59
Fenarimol	59
Fenitrothion	59
Fensulfothion	59
Fenthion	59
Filtration	6
Fluoridation	2,23

Fluoride	18,23-25,52
Fluorotrichloromethane	60
Fluridone	16,59
Foaming Agents	52
Fonophos	59
Formaldehyde	63
<u>Giardia lamblia</u>	3,6
Glyphosate	58
Gross Beta	45-50
Haloacetic acids	62,63
Haloacetonitriles	62
Haloketones	62
HCH-alpha	59
HCH-beta	59
HCH-delta	59
HCH-gamma	59
Heptachlor	36-38,40
Heptachlor epoxide	36-38,40
Hexachlorobenzene	58
Hexachlorobutadiene	60
Hexachlorocyclopentadiene	58
Hexazinone	59
Hydrogen peroxide	63
3-Hydroxycarbofuran	58
Hypochlorite ion	62
Hypochlorous acid	62
Indenopyrene	58
Iodate	63
Iodine 131	47
Iron	52
Isopropyltoluene	60
p-Isopropyltoluene	60
Lead	3,4,16,18,26-33
Lead-210	45
Lindane	37,38,40
Malathion	59
Manganese	52
Mercury	17-19,21,22
Merphos	59
Methomyl	58
Methoxychlor	36-38,40
Methyl paraxon	59
Methyl parathion	59
Metolachlor	58
Metribuzin	58
Mevinphos	59
MGK 264	59
MGK 326	59
Molinate	59
Monobromoacetic acid	62
Monochlorobenzene	36,38,40
MX (3-chloro-4-dichloromethyl-5-hydroxy-2(5H)-furanone)	62,63
Naphthlene	60
Napropamide	59

Nickel	17,56
Nitrate	17-22
Nitrite	17-22
Total Nitrite/Nitrate	17,18
Norflurazon	59
Odor	51-52
n-Organochloramines	62
Orthophosphate	30,32
Oxamyl (Vydate)	58
Ozone by-products	62
Ozone	41,42
PCBs	6,35-40
Pebulate	59
Pentachlorophenol	36,37,40
cis-Permethrin	59
trans-Permethrin	59
Pesticides	6,35-40
pH	30,32,51-52
Photon	45-50
Phorate	59
Phosmet	59
Phthalates	58
Picloram	58
Promaton	59
Prometryn	59
Pronamide	59
Propachlor	58
Propazine	59
n-Propylbenzene	60
Radionuclides	45-50
Radium-226	45-50
Radium-228	45-50
Radon	3,45-50
Selenium	17-19,21,22
Silica	30,32
Silver	18,52
Silvex (2,4,5-TP)	36-38,40
Simazine	58
Simetryn	59
Stirofos	59
Strontium 89	46,47,49
Strontium 90	46,47,49
Stryene	36,38,40
Sulfate	17,52,56
2,3,7,8-TCDD (Dioxin)	58
Tebuthiuron	59
Temperature	30,32
Terbacil	59
Terbufos	59
Terbutryn	59
1,1,1,2-Tetrachloroethane	60
1,1,2,2-Tetrachloroethane	60
Tetrachloroethylene	36,38,40,60
Thallium	17,56

Toluene	36,38,40
Total Dissolved Solids	51-52
Toxaphene	36-38,40
2,4,5-TP (Silvex)	36-38,40
Triademefon	59
Trichloroacetic acid	62
Trichloroacetonitrile	62
1,2,3-Trichlorobenzene	60
1,2,4-Trichlorobenzene	60
1,1,1-Trichloroethane	36,40
1,1,2-Trichloroethane	60
Trichloroethylene	36,40
2,4,6-Trichlorophenol	62
1,2,3-Trichloropropane	60
1,1,1-Trichloropropanone	62
Tricyclazole	59
Trifluralin	59
Trihalomethanes	41,42
Total trihalomethanes	41
1,2,4-Trimethylbenzene	60
1,3,5-Trimethylene	60
Tritium	47,49
TTHMs	63
Turbidity	3
Uranium	45,47-49
Vernolate	59
Vinyl Chloride	36,40
VOCs (Volatile Organic Chemicals)	6,35-41
Xylene (Total)	36,38,40
Zinc	52