



UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

March 9, 1988

SAB-EHC-88-021

Hon. Lee M. Thomas
Administrator
U.S. Environmental Protection
Agency
401 M Street, SW
Washington, D.C. 20460

OFFICE OF
THE ADMINISTRATOR

Dear Mr. Thomas:

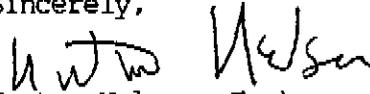
The Drinking Water Subcommittee of the Science Advisory Board's Environmental Health Committee has completed its review of scientific information supporting EPA's efforts to develop proposed rules for surface water treatment and coliforms and is pleased to forward its report to you.

In summary, the Subcommittee:

- o Agrees that using total coliforms as the primary standard is reasonable and endorses EPA's intent to develop a guidance document for this rule.
- o Recommends that EPA be more specific regarding the disinfection requirements to be used following filtration.
- o Expresses concern over the adequacy of the scientific basis for some of the requirements and the documentation for the disinfection component of the rule.
- o Recommends that the guidance document accompanying the proposed surface water treatment rule stress that raising the concentration of chlorine to meet the needed contact time (CT) values may affect the future ability of water suppliers to comply with new disinfectant regulations.
- o Concludes that the tracer approach for CT is generally scientifically supportable but suggests certain refinements.
- o Concludes that insufficient data exist to demonstrate that implementation of the proposed filtration rule will significantly reduce Legionellosis.
- o Recommends additional research in various areas, including the effectiveness of the intended treatment techniques for Legionellosis.

The Subcommittee appreciates the opportunity to review the scientific bases of these proposed rules. We request that the Agency officially respond to the scientific advice presented in the attached report.

Sincerely,



Norton Nelson, Chairman
Executive Committee



Richard A. Griesemer, Chairman
Environmental Health Committee



Gary Carlson, Chairman
Drinking Water Subcommittee

Drinking Water Subcommittee Review of the Scientific Bases of Proposed
Rules for Surface Water Treatment and Coliforms

The Drinking Water Subcommittee met on August 6 1987 to consider a draft report prepared by its Filtration Technology Workgroup following the latter's review of scientific information supporting EPA's efforts to develop proposed rules for surface water treatment and coliforms. Appendix A presents the roster of the Subcommittee and the Workgroup. The documents under review are listed in Appendix B. Appendix C includes the rationale EPA used in developing the rules, and Appendix D is a fact sheet provided by the Office of Drinking Water (ODW) for the two rules.

The Filtration Technology Workgroup first met on May 22 1987 to identify the issues for its review and procedures for conducting its evaluation. It reconvened on August 5 1987 to further address the key issues and prepare a draft report for the full Subcommittee's consideration. The report, in its present form, represents the combined efforts of the Workgroup and the Subcommittee.

I. Coliform Rule

Coliforms are the only group of micro-organisms for which enough scientific data exist to develop an individual standard. The Subcommittee agrees with ODW's intent to continue to use total coliform as a primary standard, and to rely upon fecal coliforms to ascertain the public health significance of total coliform positives.

Protecting public health by instituting early corrective actions, rather than only repeat sampling, is recommended. The Subcommittee endorses EPA's plan to develop a guidance document for this rule. Guidance on actions such as boosting disinfectant residual, flushing, more intensive treatment plant and tapwater disinfectant residual monitoring and cross-connection investigation should all be addressed in this document.

The rule proposes the use of random sampling sites rather than fixed sites. The Subcommittee recommends that EPA revise and reword this concept because, as written, it is not clear. EPA should also develop a strategy for a larger number of fixed sites for periodic sampling. The Subcommittee does not endorse totally random sampling.

The Subcommittee recommends the use of heterotrophic plate count (HPC). Although EPA's rationale justifying its use is interference in coliform measurements, it has merit on its own as a disinfection performance verification criterion. The Subcommittee also recommends that the Agency consider other plating methods (referring specifically to the sixteenth edition of Standards Methods) and media as alternatives to the pour plate method. These more sensitive methods are more stringent but easier to apply.

More thought needs to be given to the practical application of the CT concept as a regulation. As chlorine reacts it changes, for instance, from free to monochloramine to organic chloramine. Measuring a residual at the end of a time period, therefore, can lead to erroneous CT values. Many water utilities now use one disinfectant during treatment, and another subsequently. The Subcommittee recommends that at least two points of measurement be used at a minimum: 1) the end of the contact basin or plant, and 2) the first distribution system sampling point, where $CT = C_1T_1 + C_2T_2$.

Research is needed both in the laboratory and in the field on the effect of confounding variables on the magnitude of CT. In the laboratory, data are needed on the CT values for Giardia strain variation. A further rationale for laboratory and field data is to identify the effect of micro-organism aggregation on CT. The effects of filtration, sedimentation and coagulation on these CT values are especially important.

In summary, the Subcommittee: agrees with the form of the coliform rule; endorses ODW's effort to develop a guidance document to accompany the rule; recommends that the concept of random sampling should be revised; recommends that EPA consider other HPC plating methods that are of equal or greater stringency; and agrees with the use of CT, but recommends better definition.

II. The Filtration Rule and Guidance Manual

The proposed filtration rule is needed to protect public health because of the lack of scientific data on specific micro-organisms that can pose a significant risk. Waterborne disease outbreaks persist in the U.S., and pathogens are not readily detected. EPA is proposing this general rule instead of establishing standards for specific contaminants. The specific filtration requirements are presented in the rule, while an associated guidance manual discusses other issues not subject to regulation.

The Subcommittee's comments address four issues: 1) allocation of microbiological removals between filtration and disinfection processes when both are provided; 2) regulations for adequate filtration of low turbidity supplies; 3) possible disagreements between the surface water treatment rule and the guidance manual; and 4) documentation of the scientific bases of the rule and the manual.

The Subcommittee supports the goal of requiring filtration and disinfection of all surface water supplies because they will provide consumers with greater protection from microbiological contamination and with improved water quality. Also, it is not clear that a less stringent requirement will be effective in preventing waterborne disease. The Subcommittee recognizes, however, that not all water consumers are at equal risk from contamination and that in the adoption of such a goal other factors needed to be considered by policy makers, including economic and technological feasibility. A key issue in deciding whether to implement this goal rests upon a definition of acceptable risk; this issue is chiefly one of a social/value judgement rather than scientific judgement.

The performance of actual filtration facilities can vary widely, but well operated plants can achieve substantial (three and four log) removal of some micro-organisms. The key to successful filtration lies in proper pretreatment, i.e. coagulant addition, and (usually) flocculation and sedimentation.

The surface water treatment rule proposes a filtered water turbidity of 0.5 nephelometric turbidity units (NTUs). This is achievable by all well operated filtration facilities, but it does not guarantee effective treatment for plants treating low turbidity sources. The 0.5 NTU requirement should be supplemented with other criteria, such as per cent removal of turbidity and/or heterotrophic plate count to better evaluate filtration performance.

The surface water treatment rule and the guidance manual contain some conflicts. For example, the rule requires 99.99 per cent inactivation of enteric viruses after filtration of clean water, while the manual recommends only 2 log units. Also, the rule requires 3 log units removal of Giardia and 4 log units removal of enteric viruses by a combination of filtration and disinfection, while the manual recommends these levels be achieved by disinfection alone after filtration.

Many filtration and disinfection requirements in the proposed rule and statements in the guidance manual are not well supported by peer reviewed scientific documentation. In some cases, ODW relies upon presentations, unpublished papers and unreferenced reports when more authoritative evidence is available. This is the case for much of the rule. For disinfection, some important studies and analyses have not yet been published and, thus, their validity remains to be established. EPA should develop regulations on well documented peer reviewed data.

III. Issues Related to Contact Time

A. Need for Both CT and Filtration. The use of the CT concept provides valuable support for the filtration rule. However, more data are needed to apply it for controlling Giardia. Also, more attention needs to be given to the problems encountered in measuring CT because of the large uncertainties.

The Subcommittee recommends that CT be used as a disinfection control procedure. Because of the lack of sufficient scientific measurements, it does not favor CT to eliminate the need for filtration because of the utility of the multiple barrier principle.

The disinfection of well filtered water supplies is easier and more effective than for unfiltered supplies, and this should be reflected in the rule and the manual. Disinfectant requirements, in terms of CT for filtered supplies, should be stated in the rule, and guidance for their implementation should be included in the manual. The guidance should also reflect the observation that a CT unit of disinfection will provide a greater micro-organism kill in filtered water than for an unfiltered supply.

B. Values of CT Proposed. The literature support for the CT values proposed is based upon a few unpublished reports and theses. For Giardia, the data are based on one study that has not been peer reviewed. Few data are available on confounding factors such as strain variation, aggregation potential and association with particulate matter. All three are of concern for viruses, and the fact that CT values in the guidance manual are related to Giardia, which has substantially greater CT values than viruses, reduces but does not eliminate the significance of this omission for particle association. The potential for aggregation of Giardia cysts in the natural environment and strain variation in sensitivity to disinfection are not addressed in the supporting documentation. The Subcommittee recommends that further research be conducted to address these issues, but implementation of such research should not delay or impede issuance of the rule.

The Subcommittee has several concerns over the major document upon which the Giardia CTs are based.¹ The Clark paper is an analysis of the data for the only inactivation study based on animal infectivity rather than in vitro excystation. The Subcommittee requested an additional review of this manuscript by Dr. Charles Haas of the Illinois Institute of Technology. His concerns correspond with those raised by the Subcommittee. The two major concerns include possible problems with the design of the Hibler study (which cannot be addressed because the raw data are not available), and the appropriateness of the Clark paper because of possible nonlinearities in the curves used. The Haas evaluation has already been submitted to the Office of Drinking Water.

C. Measurement of CT. Measurement of CT at maximum flow has limitations. In order to determine a more accurate and precise value, the Subcommittee recommends that CT be measured at several flow values to better define the minimum CT, and not just the minimum T. Further, the Subcommittee observes that the C value is likely to be variable with flow and the point of measurement. Thus, the Subcommittee recommends that both C and T be measured for minimum, average and maximum flow at the first distribution system sampling point. The minimum value of CT (not minimum C times minimum T) should be used. Tracer studies should be used to measure T, with 10 per cent of dose indicating the time.

IV. Filtration Rule--Legionella

The Subcommittee concludes that insufficient data exist to demonstrate that implementation of the filtration rule will significantly reduce Legionellosis. It also concludes that this is an important consideration because:

- o The Centers for Disease Control estimates that approximately 50,000-100,000 cases of Legionellosis occur in the U.S. annually.
- o Foodborne outbreaks, or secondary spread, have not been reported.
- o More than 28 million noninstitutionalized individuals in the U.S. have risk factors (age 65, immuno-compromised status) that could predispose them to the disease.

¹ Unpublished paper by Clark, et al., entitled "Inactivation of Giardia Lamblia by Chlorine: A Mathematical and Statistical Analysis."

Although Legionella should be significantly reduced by filtration and disinfection, its ability to regrow in the distribution system results in an offsetting potential threat to the public health. The Subcommittee also believes that a reliance upon a residual in the distribution system may be inadequate, as there is little research to indicate necessary levels of disinfectant required to eliminate Legionella at the tap. The Subcommittee concludes that there is, at present, no scientific evidence to indicate that the proposed surface water treatment rule will significantly reduce Legionellosis.

Appendix A

Roster of Drinking Water Subcommittee

Chairman:

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Dr. C. Richard Cothorn, Executive Secretary, Environmental Health Committee, Science Advisory Board (A-101F), U.S. Environmental Protection Agency, Washington, D.C. 20460

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Dr. Betty Olson, Program in Social Ecology, University of California, Irvine California 92717

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Dr. Joan Rose, Department of Microbiology and Immunology, Building PHM, #90, Room 201, University of Arizona, Tucson, Arizona 85721

Dr. Mark Sobsey, ESE-Public Health (201H), University of North Carolina, Chapel North Carolina 27514

Executive Secretary:

Dr. C. Richard Cothorn, Executive Secretary, Environmental Health Committee, Science Advisory Board, (A-101F), U.S. Environmental Protection Agency, Washington, D.C. 20460

Appendix B

Documents Submitted by the Office of Drinking Water

Proposed Rule (Surface Water Treatment Rule): Water Pollution Control, National Primary Drinking Regulations; Filtration, Disinfection, Turbidity, Giardia Lamblia, Viruses, Legionella, Heterotrophic Bacteria. June 25 1987 (and earlier drafts dated April 21 and May 22 1987).

Proposed Rule: Water Pollution Control, National Primary Drinking Water Regulations; Total Coliforms. June 25 1987 (and earlier drafts)

Guidance Document for the Surface Water Treatment Rule

Drinking Water Criteria Documents for:

Total Coliforms, April 16 1984

Giardia, February 29 1984

Legionella, March 1985

Turbidity, September 1 1985

Viruses, June 1985

Heterotrophic Bacteria, May 25 1984

Manuscript by M. Brett Borup, "The Determination of Waterborne Pathogen Sampling Requirements Using Statistical Quality Control Techniques," Tennessee Technical University, Clarksville, Tennessee

Manuscript by Robert M. Clark, Eleanor J. Read and John C. Hoff, "Inactivation of Giardia by Chlorine: A Mathematical and Statistical Analysis," U.S. Environmental Protection Agency, Cincinnati, Ohio. May 1987.

Manuscript by John C. Hoff, "Inactivation of Microbial Agents by Chemical Disinfectants," U.S. Environmental Protection Agency, Cincinnati, Ohio

Manuscript by Stig Regli, Appiah Amirtharajah, John C. Hoff and Paul Berger, "Treatment for Control of Waterborne Pathogens: How Safe Is Safe Enough?" U.S. Environmental Protection Agency, Washington, D.C.

Appiah Amirtharajah, "Variance Analysis and Criteria for Treatment Regulations," Journal of the American Water Works Association (March 1986), pp. 34-49.

Draft Proceedings, "Workshop on Filtration: Disinfection and Microbial Monitoring," American Water Works Association Research Foundation.

Appendix C

EPA Rationale for the Proposed Surface Water Treatment Regulations

The overall purpose of the surface water treatment rule is to control waterborne disease incidence caused by pathogens in public water systems using surface water sources. The rule will serve as minimum criteria which, for the most part, should be maintained when new disinfection by-product regulations are promulgated. The Workgroup recognizes that the rule may affect the criteria contained in future disinfectant by-product regulations.

The rule also represents EPA's attempt to respond to Congressional requirements, i.e., to regulate Giardia, viruses, HPC, Legionella, and turbidity, within statutory deadlines, while not creating conflict with future disinfection by-product regulations.

EPA intends to set disinfection requirements for ground water at a later date in conjunction with new disinfection by-product regulations. In the interim, the total coliform rule, which pertains to both surface and ground water systems, will identify systems with high risk from pathogen contamination and, thereby, necessitate disinfection treatment. Also, the coliform rule will help identify which ground water systems may be eligible for a variance to the forthcoming disinfection requirements.

The following general principles, as written in the preamble to the proposed rule, form the basis for the criteria:

1. The public's best assurance for obtaining drinking water of consistent good quality is reliance upon a properly designed and operated public water system.
2. Water to be used for human consumption should be obtained from the best available source.
3. All surface water supplies are at risk from pathogen contamination.
4. All public water systems should practice adequate disinfection, and detectable residuals of the disinfectant should be measurable in all parts of the distribution system.
5. The level of treatment in public water systems provided should at least be commensurate with the potential for pathogen contamination in the source water. Multiple barriers of treatment, including filtration, are desirable to provide a consistently high quality water supply.
6. To minimize the introduction of unnecessary contaminants during treatment, public water systems should employ processes that will reduce the concentration of precursor chemicals prior to the introduction of disinfectant chemicals.
7. Public water systems should employ strong oxidants, including ozone, chlorine and chlorine dioxide with adequate contact time for pathogen inactivation before the water enters the distribution system.

Chloramines are appropriate for maintaining a residual in the distribution system when stronger oxidants are not feasible. Ozone, because of its potency in destroying micro-organisms and its rapid dissipation, is particularly encouraged for use in clarification processes and as a disinfectant.

8. Public water systems should adjust pH levels to optimize clarification and disinfection processes within the treatment plant and corrosion control within the distribution system.

9. Adequate monitoring, tailored to the particular circumstances, should be practiced in all public water systems. This should include monitoring of microbiological parameters, and physical factors affecting water quality such as turbidity, pH, and temperature; and disinfectant residuals. Raw water monitoring should be conducted to determine that an adequate level of treatment is provided.

10. No detectable concentrations of pathogens should be acceptable in a properly operated public water system.

11. The public has a right to be informed of the quality of the water that is being provided by its public water system and should be included in the decision processes.

Appendix D

Fact Sheets for the Surface Water Treatment and Coliform Rules

Office of Drinking Water
Environmental Protection Agency
August 1987

SURFACE WATER TREATMENT REQUIREMENT

Schedule: NPM-----September 1, 1987
Final rule--December 19, 1987

General Requirements

Coverage: All public water systems using any surface water must disinfect, and may be required to filter, unless source water quality and site specific conditions are met.

Treatment technique requirements are established in lieu of MCLs for *Giardia*, viruses, heterotrophic plate count bacteria, *Legionella* and turbidity.

Treatment must achieve at least 99.9 percent removal and/or inactivation of *Giardia lamblia* cysts and 99.99 percent removal and/or inactivation of enteric viruses.

All systems must be operated by qualified operators as determined by the State.

Criteria to be Met to Avoid Filtration

Source Water Criteria

Fecal coliform concentration must not exceed 20/100 ml or the total coliform concentration must not exceed 100/100 ml before disinfection in more than ten percent of the measurements for the previous six consecutive months, calculated each month.

Minimum sampling frequencies for fecal or total coliform determination are:

SYSTEM SIZE (people)	SAMPLES /WEEK
<500	1
500- 3000	2
3,301-10,000	3
10,000-25,000	4
>25,000	5

Also, one coliform density test must be made every day the turbidity exceeds one NTU, if not already conducted under above requirements.

Turbidity levels must be measured every four hours by grab sample or continuous monitoring, and can not exceed five NTUs.

Site Specific Conditions

Disinfection must achieve at least a 99.9 and 99.99 percent inactivation of Giardia lamblia and enteric viruses. This must be demonstrated by system meeting "CT" values ("CT" is the product of residual concentration (mg/l) and contact time (minutes)).

Disinfection system must have redundant components including alternate power supply, automatic alarm and start-up to insure continuous disinfection of the water during plant operation.

System must maintain a disinfectant residual concentration of no less than 0.2mg/l in no more than five percent of the samples each month for any two consecutive months. Samples must be taken at the same frequency as total coliforms under the proposed coliform rule. (See Table 1 and Table 2 of Total Coliform fact sheet.)

System must maintain a disinfectant residual concentration at all times in the water entering the distribution system, demonstrated by continuous monitoring.

System must maintain a watershed control program which will minimize the potential for contamination by human enteric viruses and Giardia lamblia cysts. System must monitor and control the activities in the watershed that may have an adverse impact on water. System must demonstrate through ownership or written agreements with landowners in the watershed, that it is able to limit and control all human activities that may have an adverse impact upon water quality. An annual sanitary survey and report must be conducted which is approved by the state.

System must not have a history of any waterborne disease outbreaks in its present configuration.

System must be in continuous compliance with the long term MCL requirements for total coliforms. (See Total Coliform fact sheet.)

Systems serving more than 10,000 people must be in compliance with the MCL requirements for total trihalomethanes .

Criteria for Filtered Systems

Turbidity Removal

Conventional filtration or direct filtration water must achieve a turbidity levels in the filtered water at all times less than five NTU and not more than 0.5 NTUs in more than five percent of the measurements taken each month. The State may increase this limit up to one NTU if system demonstrates effective removal of Giardia lamblia cysts at such turbidity levels.

Slow sand filtration must achieve a turbidity level in the filtered water at all times less than five NTU and not more than one NTU in more than five percent of the samples taken each month. This limit may be increased by the State (but at no time exceeding five NTU) if the filtered water meets the long-term coliform MCL before disinfection.

Diatomaceous earth filtration must achieve a turbidity level in the filtered water at all times less than five NTU and of not more than one NTU in more than five percent of the samples taken each month.

Other filtration technologies may be used if they are demonstrated to achieve at least 99.9 and 99.99 percent removal/inactivation of Giardia lamblia cysts and enteric viruses, respectively, and are approved by the State. Turbidity limits for these technologies are the same as those for conventional and direct filtration, including the allowance up to one NTU upon approval by the State.

Turbidity Monitoring

Turbidity must be measured every four hours by grab sample or continuous monitoring. For systems using slow sand filtration or filtration technologies other than conventional treatment, direct filtration or diatomaceous earth filtration, the State may reduce sampling the frequency to once per day.

Disinfection Requirements

Disinfection with filtration must achieve at least 99.9 percent and 99.99 percent removal/inactivation of *Giardia* and viruses, respectively. State defines level of disinfection required, depending on technology and source water quality.

System must maintain a disinfectant residual concentration of no less than 0.2 mg/l in no more than five percent of the samples each month for any two consecutive months. Samples must be taken at the same frequency as total coliforms under the proposed coliform rule. (See Table 1 and Table 2 of Total Coliform Fact sheet.)

System must maintain a disinfectant residual concentration at all times in the water entering the distribution system, demonstrated by continuous monitoring.

Analytical Requirements

Testing and sampling must be in accordance with Standards Methods, 16th edition, or methods approved by EPA for total coliforms, fecal coliforms, turbidity, disinfectant residuals, temperature, and pH.

Reporting

Monthly reports to the State for all parameters required in the rule.

Unfiltered water systems must also report annually on their watershed control program and sanitary surveys.

Water-borne disease outbreaks must be reported to the State within 48 hours.

Violations

Systems with unfiltered surface water sources must meet source water quality and site-specific conditions within 48 months of promulgation. If they fail to meet these criteria within 30 months, filtration would be required, but they would not be in violation until failing to meet such criteria after 48 months.

Filtered systems must meet performance criteria and monitoring/reporting requirements for the filtered and disinfection treatment techniques within 48 months of promulgation.

Variances

Variances are not applicable.

Exemptions

Exemptions are allowed for requirement to filter. Systems using surface water must disinfect (i.e., no exemptions); exemptions allowed for degree of disinfection provided.

Regulation:

-40 CFR Part 141 Subpart H (Filtration and Disinfection)

Related Information:

-Supporting publications including justification, guidance, technologies and costs are cited in the preamble to the the proposed regulations.

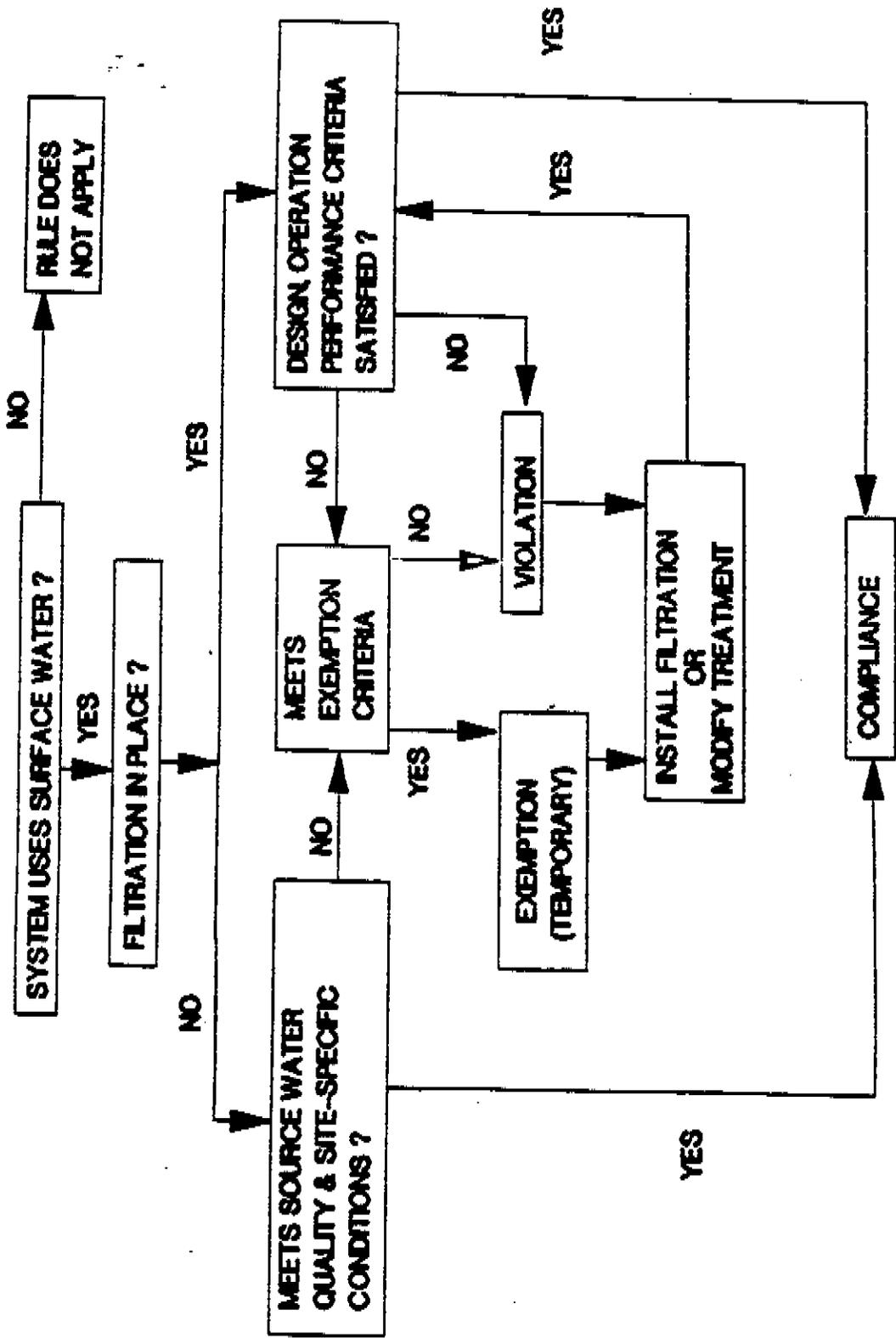
Additional Information:

Safe Drinking Water Hotline
(800) 426-4791 or (202) 382-5533

or

Stig Regli, Environmental Engineer
Science and Technology Branch
Criteria and Standards Division
Office of Drinking Water (WF-550D)
U.S. Environmental Protection Agency
401 M Street, S.W.
Washington, D.C. 20460
202/382-7379

SURFACE WATER TREATMENT



DECISION TREE

FIGURE IV-1

Office of Drinking Water
Environmental Protection Agency
August 1987

TOTAL COLIFORM

Schedule: ~~NPRM~~—September 1, 1987
Final rule—December 19, 1987

Total Coliform MCL

Maximum contaminant level goal—zero

Maximum contaminant levels

Based on presence or absence of total coliforms in sample, rather than density.

Monthly MCL

- No more than 1 coliform-positive sample/month for systems which analyze fewer than 40 samples/month.
- No more than 5% of samples can be coliform-positive if system analyzes at least 40 samples/month.

Long-term MCL

- No more than 5% of most recent 60 samples coliform-positive if system analyzes fewer than 60 samples/year
- No more than 5% of all samples in the past twelve months coliform-positive if system analyzes more than 60 samples/year.

Monitoring frequency

(see attached Table 1 and Table 2 for more detail)

For systems serving 3,300 persons or fewer:

- 5 samples/month, with less monitoring for systems which:
 - (a) filter and disinfect surface water, and disinfect ground water; and
 - (b) have a sanitary survey at the frequency specified in the proposed regulation.
- Reduced monitoring for systems serving 25 to 500 persons when using undisinfected ground water on the basis of sanitary survey and coliform data for the last three years.
- One additional coliform sample each day the turbidity exceeds one NTU for surface water systems not filtering.

For systems serving more than 3,300 persons:

- Based on population served
- Similar to current minimum monitoring requirements for coliforms, but with smaller number of population categories.
- One additional coliform sample each day the turbidity exceeds one NTU for surface water systems not filtering.

Repeat samples

If system has coliform-positive sample, system must collect five repeat samples all on the same day from same location as original sample, except some may be from the next service connection.

If any repeat sample is coliform-positive, system must:

- Analyze positive culture medium to determine if it contains fecal coliforms; and

Additional Information:

Safe Drinking Water Hotline
(800) 426-4791 or (202) 382-5533

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Washington, D.C. 20460
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Table 1

MINIMUM COLIFORM MONITORING REQUIREMENTS

GROUND WATER

No Disinfection:

- * 25-500 persons: 5 samples/month AND a sanitary survey every 5 years.*
- * 501-3,300 persons: 5 samples/month AND a sanitary survey every 3 years.
- * over 3,300 persons: monitoring frequency specified in Table 2 AND a sanitary survey every 3 years.

With Disinfection:

- * 25-500 persons: 5 samples/month OR a sanitary survey every 5 years and one sample/month.
- * 501-3,300 persons: 5 samples/month OR a sanitary survey every 5 years and 3 coliform samples/month.
- * over 3,300 persons: monitoring frequency specified in Table 2.

SURFACE WATER

With Disinfection Only (No Filtration**)

- * 25-500 persons: 5 samples/month AND an annual sanitary survey.
- * 501-3,300 persons: 5 samples/month AND an annual sanitary survey.
- * over 3,300 persons: monitoring frequency specified in Table 2 AND an annual sanitary survey.

With Filtration and Disinfection**

- * 25-500 persons: 5 samples/month OR a sanitary survey every 5 years and one sample/month.
- * 501-3,300 persons: 5 samples/month OR a sanitary survey every 3 years and 3 samples/month.
- * over 3,300 persons: monitoring frequency specified in Table 2.

*State may permit systems serving 25-300 persons to reduce monitoring to 1 sample/month and systems serving 301-500 persons to reduce monitoring to 3 samples/month if 1) sanitary survey results every 3 years are satisfactory, 2) system has not had a waterborne disease outbreak, and 3) system has record of compliance with the coliform MCLs and monitoring requirements.

**As defined in 40 CFR 141.73.

TABLE 2

Minimum Monitoring Frequency

<u>Population served</u>	<u>Samples/month</u>	<u>Population served</u>	<u>Samples/month</u>
25-3,300	5	85,001-90,000	90
3,301-5,800	6	90,001-95,000	95
5,801-6,700	7	95,001-100,000	100
6,701-7,600	8	100,001-200,000	130
7,601-8,500	9	200,001-300,000	160
8,501-10,000	10	300,001-400,000	180
10,001-15,000	15	400,001-500,000	200
15,001-20,000	20	500,001-600,000	220
20,001-25,000	25	600,001-700,000	240
25,001-30,000	30	700,001-800,000	260
30,001-35,000	35	800,001-900,000	280
35,001-40,000	40	900,001-1,000,000	300
40,001-45,000	45	1,000,001-1,200,000	320
45,001-50,000	50	1,200,001-1,400,000	340
50,001-55,000	55	1,400,001-1,600,000	360
55,001-60,000	60	1,600,001-1,800,000	380
60,001-65,000	65	1,800,001-2,000,000	400
65,001-70,000	70	2,000,001-2,500,000	420
70,001-75,000	75	2,500,001-3,000,000	440
75,001-80,000	80	3,000,001-3,500,000	460
80,001-85,000	85	3,500,001-4,000,000	480
		over 4,000,000	500