

(2) Analyses under this section shall be conducted by laboratories that have received approval from EPA to perform sample analysis for compliance with this rule. Laboratories that wish to become approved shall contact EPA in writing at USEPA, Technical Support Division, ICR Laboratory Coordinator, 26 W. Martin Luther King Drive, Cincinnati, OH 45268 not later than November 14, 1996. Requirements for approval are included in "DBP/ICR Analytical Methods Manual", EPA 814-B-96-002.

(c) *Reporting.* (1) A PWS shall report required data and information collected under the provisions of paragraph (a) of this section to EPA, using an EPA-specified computer readable format. A PWS shall submit a monthly report that indicates the analytical results of all samples collected, including quarterly samples taken in that same month, and all process train data. These reports shall be submitted on a diskette no later than the fourth month following sampling. In addition to the information in tables 1 through 6 in paragraph (a) of this section, reports shall include PWSID, ICR plant identification, sample date, analysis date, laboratory identification numbers, analytical methods used, sample identification numbers, quality assurance code, internal standards, surrogate standards, and preserved sample pH, if appropriate.

(2) *Additional Requirements.* A PWS shall submit a DBP and related monitoring sampling plan for EPA approval, using software provided by EPA, for each treatment plant specified in §141.141(b)(2) of this subpart that indicates sampling point locations and monitoring to be conducted at each point, and process treatment train information. This sampling plan shall be submitted to EPA at the same time and on the same diskette as the microbiological sampling plan required by §141.143(c)(3) and no later than eight weeks after the PWS receives the Notice of ICR Final Applicability Determination from EPA, using the procedure specified in "ICR Sampling Manual", EPA 814-B-96-001, April 1996.

(3) All reports required by this section shall be submitted to USEPA (ICR4600), ICR Data Center, Room 1111

East Tower, 401 M Street SW., Washington, DC 20460.

(4) The PWS shall keep all data for at least three years following data submission to EPA.

(d) *Incorporation by reference.* The documents and methods listed in paragraphs (d) (1) and (2) of this section are incorporated by reference for purposes specified in this section. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be inspected at USEPA, Drinking Water Docket (4101), 401 M Street SW., Washington, DC 20460, or at Office of the Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC.

(1) "Standard Methods for the Examination of Water and Wastewater," 19th edition, 1995. Available from the American Public Health Association, 1015 Fifteenth Street, NW., Washington, DC 20005.

(2) "Guidance Manual for Compliance with the Filtration and Disinfection Requirements for Public Water Systems using Surface Water Sources", Appendices C and O, 1991. Available from American Water Works Association, 6666 West Quincy Avenue, Denver, CO 80235.

§ 141.143 Microbial monitoring.

(a) *Monitoring requirements.* (1) *Parameters.* A PWS shall sample for the following parameters for the period specified in §141.141(d) of this subpart and at the location specified and using the analytical methods specified in paragraphs (a)(2) and (b), respectively, of this section. For each sample, a PWS shall determine the densities of total coliforms, fecal coliforms or *Escherichia coli*, *Giardia*, *Cryptosporidium*, and total culturable viruses for each treatment plant required to monitor under the provisions of §141.141(b) of this subpart.

(2) *Monitoring locations.* (i) A PWS shall collect one sample of the treatment plant influent at the frequency specified in §141.141(d) of this subpart.

(A) A sample of treatment plant influent shall be taken at a location at the upstream end of a treatment plant where waters from all intakes are

blended prior to any treatment or chemical addition.

(B) For treatment plants that have multiple intakes and add chemicals at the intake, the PWS shall take an intake sample of the water resource with the poorest microbiological quality (or, if that cannot be determined, the water resource with the highest flow) collected before chemical addition and before pretreatment. If the intakes are expected to have the same source water quality, one representative intake sample may be taken. If a disinfectant is added at or before the intake (e.g., for zebra mussel control), the sample shall be taken in the vicinity of the intake in such manner that the sample is not contaminated by the disinfectant.

(ii) A PWS that, during any of the first twelve months of monitoring at the treatment plant influent, detects 10 or more *Giardia* cysts, or 10 or more *Cryptosporidium* oocysts, or one or more total culturable viruses, in one liter of water; or calculates a numerical value of the *Giardia* or *Cryptosporidium* concentration equal to or greater than 1000 per 100 liters or virus concentration equal to or greater than 100 per 100 liters; or detects no pathogens in the sample and calculates a numerical value of the detection limit for *Giardia* or *Cryptosporidium* concentration equal to or greater than 1000 per 100 liters or virus concentration equal to or greater than 100 per 100 liters; shall also collect one sample of finished water per month at each such treatment plant, beginning in the first calendar month after the PWS learns of such a result. The sample of finished water shall be collected at a point after which all treatment processes for a particular treatment plant are complete (including the clearwell and final point of disinfection) and before the distribution system begins. For each sample of finished water, PWSs shall determine the density of total coliforms, fecal coliforms or *E. coli*, *Giardia*, *Cryptosporidium*, and total culturable viruses. A PWS shall continue finished water monitoring monthly until 18 months of treatment plant influent monitoring has been completed.

(iii) In lieu of conducting finished water monitoring of *Giardia* and *Cryptosporidium* specified in paragraph

(a)(2)(ii) of this section, a PWS may notify EPA in its response to the notice of applicability required by paragraph (c)(3)(i) of this section that the PWS will comply with the alternative monitoring requirements in paragraphs (a)(2)(iii) (A) and (B) of this section. The PWS shall still conduct finished water monitoring for all other microorganisms, except for *Giardia* and *Cryptosporidium* monitoring in the finished water.

(A) The PWS measures the particle counts in the treatment plant influent, at points immediately prior to filtration and after filtration (but before the addition of post-filtration chemicals). Particle counting shall be conducted on the same treatment train as is sampled for monitoring conducted under the provisions of §141.142(a) of this subpart. Such samples shall be collected monthly during the entire 18-month monitoring period, using the procedures contained in the "ICR Sampling Manual", EPA 814-B-96-001, April 1996. The PWS may use either grab or continuous particle counting. Particle counting shall be conducted during the same time as protozoa monitoring required by paragraph (a)(2)(iii)(B) of this section.

(1) If grab sampling is conducted, the PWS shall collect 12 samples per location at the treatment plant influent, filter influent, and filter effluent, over either a 24-hour period or the duration of the filter run, whichever is shorter.

(2) If continuous particle counting is conducted, the PWS shall collect 12 instrument readings per location, evenly spaced in time, at the treatment plant influent, filter influent, and filter effluent, over either a 24-hour period or the duration of the filter run, whichever is shorter.

(3) For each sample, the PWS shall measure particle counts per milliliter in the size ranges of 3µm-5µm, 5µm-7µm, 7µm-10µm, 10µm-15µm, and >15µm, and shall report to EPA the mean value in each size range of the 12 values collected over the sampling period.

(B) The PWS collects and analyzes at least four consecutive months of *Giardia* and *Cryptosporidium* samples at the same locations specified in paragraph (a)(2)(iii)(A) of this section, within the first 12 months of the 18 months

of sampling. The PWS shall collect *Giardia* and *Cryptosporidium* samples during the same time period as it is conducting particle counting. The minimum sample volume for *Giardia* and *Cryptosporidium* analyses shall be 100 liters for treatment plant influent and 1,000 liters for water that has undergone any treatment. The PWS may use results of monitoring for *Giardia* and *Cryptosporidium* in the treatment plant influent specified in paragraph (a)(2) of this section to meet the requirements of this paragraph as long as such monitoring meets the requirements of both this paragraph and paragraph (a)(2) of this section.

(iv) If a PWS has monitored total coliforms, fecal coliforms, or *E. coli* in the treatment plant influent for at least five days/week for any period of six consecutive months beginning after January 1, 1994 and 90% of all samples taken in that six-month period contained no greater than 100 total coliforms/100 ml, or 20 fecal coliforms/100 ml, or 20 *E. coli*/100 ml, the PWS may request to not conduct virus monitoring for that treatment plant, for the duration of the requirement. Even if approved, the PWS may subsequently be required to monitor under the criteria in paragraph (a)(2)(iv)(A) of this section. This request shall be submitted as part of the response to the notice of applicability required by paragraph (c)(3)(i) of this section.

(A) If the PWS is subsequently required to monitor the finished water under the provisions of paragraph (a)(2)(ii) of this section, the PWS shall monitor, along with the other specified organisms, total culturable viruses, as specified in paragraph (a)(2)(i) of this section for treatment plant influent and as specified in paragraph (a)(2)(ii) of this section for finished water, until 18 months of microbial monitoring is completed.

(B) A PWS may use coliform data collected under §141.71(a)(1) of this part for this purpose but, if this is done, the PWS shall submit two separate monitoring reports. One report, to meet the requirements of §141.71(a)(1) of this part, shall continue to be submitted as required by subpart H of this part. The other report shall be submitted to meet

the requirements of paragraph (c)(3) of this section.

(C) If a PWS does not provide EPA with six months of suitable coliform results as part of its response to the notice of applicability, the PWS shall begin virus monitoring. If a PWS begins virus monitoring and subsequently provides EPA with six months of coliform results that are at or below the indicated density limit, and EPA approves the request to not conduct virus monitoring, the PWS may avoid subsequent treatment plant virus monitoring.

(b) Analytical Methods. (1) A PWS shall use the methods listed in paragraphs (b)(1) (i) through (v) of this section for monitoring under this subpart.

(i) Fecal coliforms—specified at §141.74(a)(1) of this part, except that whenever paired source water samples and finished water samples are to be collected, only the fecal coliform procedure (Standard Method 9221E), as specified in §141.74(a)(1) of this part, using EC Medium, can be used. The time between sample collection and initiation of sample analysis shall not exceed eight hours. Samples shall be chilled, but not frozen, and shipped at a temperature of less than 10°C. Samples not processed immediately at the laboratory shall be refrigerated. The laboratory must invalidate samples that arrive frozen or at a temperature greater than 10°C.

(ii) Total coliforms—specified at §141.74(a)(2) of this part. The time between sample collection and initiation of sample analysis shall not exceed eight hours. Samples shall be chilled, but not frozen, and shipped at a temperature of less than 10°C. Samples not processed immediately at the laboratory shall be refrigerated. The laboratory must invalidate samples that arrive frozen or at a temperature greater than 10°C.

(iii) *E. coli*— as specified by §141.21(f)(6) (i) through (iii) of this part, except that the density shall be reported. PWSs using the EC+MUG and ONPG-MUG tests shall use either a 5-tube or 10-tube 10-ml configuration, with serial dilutions of the original sample as needed, and report the Most Probable Number. PWSs may also use a commercial multi-test system for *E.*

coli enumeration, as long as they use M-Endo medium for the initial isolation of the organisms, pick every colony on the plate with the appearance of a total coliform, and streak it for purification before subjecting the colony to a multi-test system. The time between sample collection and initiation of sample analysis, regardless of method used, shall not exceed eight hours. Samples shall be chilled, but not frozen, and shipped at a temperature of less than 10°C. Samples not processed immediately at the laboratory shall be refrigerated. The laboratory must invalidate samples that arrive frozen or at a temperature greater than 10°C.

(iv) *Giardia* and *Cryptosporidium*—ICR Protozoan Method, as described in "ICR Microbial Laboratory Manual", EPA 600/R-95/178, April 1996.

(v) Total culturable viruses—Virus Monitoring Protocol, as described in "ICR Microbial Laboratory Manual", EPA 600/R-95/178, April 1996.

(2) *Laboratories*. A PWS shall use EPA-approved laboratories to analyze for *Giardia*, *Cryptosporidium*, and total culturable viruses. A PWS shall use laboratories certified for microbiology analyses by either EPA or a State under the EPA or State drinking water program for the analysis of total coliforms, fecal coliforms, and *E. coli*. Laboratories that wish to become approved shall contact EPA in writing at USEPA, Technical Support Division, ICR Laboratory Coordinator, 26 W. Martin Luther King Drive, Cincinnati, OH 45268 not later than August 14, 1996. Laboratory approval criteria for *Giardia*, *Cryptosporidium*, and total culturable viruses are found in the "ICR Microbial Laboratory Manual", EPA 600/R-95/178, April 1996.

(3) A PWS shall send EPA a virus archive sample prepared as described in Chapter VIII of "ICR Microbial Laboratory Manual", EPA 600/R-95/178, April 1996, for each water sample identified in paragraph (b)(3) (i) or (ii) of this section.

(i) Samples of treatment plant influent and finished water, for every month after the PWS learns that viruses were detected in any previous sample of finished water.

(ii) Samples of treatment plant influent and finished water, regardless of

whether viruses are detected in the finished water, for every month after the PWS learns that a density of at least 10 viruses/L was detected in any previous treatment plant influent water sample.

(iii) A PWS may arrange to have virus samples shipped directly to EPA by its virus laboratory for archiving.

(iv) Samples shall be sent on dry ice to ICR Virus Archiving Coordinator following the procedures specified in "ICR Microbial Laboratory Manual", EPA 600/R-95/178, April 1996.

(c) *Reporting*. (1) A PWS shall report data and information required under paragraphs (a) and (b) of this section using an EPA-specified computer readable format. A PWS shall submit a monthly report on a diskette, no later than the fourth month following sampling, that indicates the analytical results of all samples collected. Reports shall include PWSID, ICR plant identification, sample date, analysis date, laboratory identification numbers, analytical methods used, sample identification numbers, analytical batch numbers, quality assurance code, and processing batch numbers, if appropriate.

(2)(i) For a PWS using the alternative to *Giardia* and *Cryptosporidium* monitoring in paragraph (a)(2)(iii) of this section, the PWS shall report to EPA the mean value in each size range of the 12 particle counting values collected over the sampling period. In addition, during the four consecutive months when the PWS collects *Giardia* and *Cryptosporidium* samples specified in paragraph (a)(2)(iii)(B) of this section, the PWS shall report to EPA, for each measured site, the densities of *Giardia* and *Cryptosporidium* at each measured site. This information shall be submitted at the same time as the report required by paragraph (c)(1) of this section.

(ii) A PWS that is not required to monitor for total culturable viruses under the provisions of paragraph (a)(2)(iv) of this section shall report to EPA the dates and results of all total coliform, fecal coliform, or *E. coli* monitoring used by the PWS to determine that additional virus monitoring is unnecessary. The report shall indicate all data collected during the six-month time period, and how the data were

used to calculate compliance with this requirement.

(3) *Additional Requirements.* A PWS shall submit a microbiological sampling plan for EPA approval, using software provided by EPA, for each treatment plant specified in §141.141(b) of this subpart that indicates sampling point locations and monitoring to be conducted at each point. This sampling plan shall be submitted to EPA at the same time and on the same diskette as the DBP and related monitoring sampling plan required by §141.142(c)(2) and no later than eight weeks after the PWS receives the Notice of ICR Final Applicability Determination from EPA, using the procedure specified in "ICR Sampling Manual", EPA 814-B-96-001, April 1996.

(4) All reports required by this section shall be submitted to USEPA (ICR4600), ICR Data Center, Room 1111 East Tower, 401 M Street SW., Washington, DC 20460.

(5) The PWS shall keep all data for at least three years following data submission to EPA.

§141.144 Disinfection byproduct precursor removal studies.

(a) *TOC, UFCTOX, THM4, and HAA5 applicability monitoring.* A PWS required to comply with this section shall conduct TOC, UFCTOX, THM4, and HAA5 monitoring specified in §141.141(e)(2) of this subpart. A PWS may use monitoring results from samples required by §141.142(a) of this subpart to meet this requirement to the extent that all requirements in each section are met.

(b) *Treatment study requirements.* A PWS identified in §141.141(b) of this subpart shall conduct disinfection byproduct precursor removal studies (treatment studies). The treatment study shall use bench-and/or pilot-scale systems for at least one of the two appropriate candidate technologies (GAC or membrane processes) for the reduction of organic DBP precursors. The treatment studies shall be designed to yield representative performance data and allow the development of national treatment cost estimates for different levels of organic disinfection byproduct control. The treatment objective of the studies is the achievement of levels of byproducts less than 40 µ g/L TTHM

and 30 µ g/L HAA5, as an annual average. The treatment study shall be conducted with the effluent from treatment processes already in place that remove disinfection byproduct precursors and TOC, to simulate the most likely treatment scenario. PWSs are permitted to optimize these processes or pilot additional processes appropriate for pretreatment for treatment studies. In order to minimize the formation of DBPs, the test water for both the bench- and pilot-scale tests shall be obtained from a location before the first point at which oxidants or disinfectants that form halogenated disinfection byproducts are added. If the use of these oxidants or disinfectants precedes any full-scale treatment process that removes disinfection byproduct precursors, then bench- and pilot-scale treatment processes that represent these full-scale treatment processes are required prior to the GAC or membrane process. A PWS should exercise sound judgement in its selection of treatment process to study and the point at which to obtain water for study. Depending upon the type of treatment study, the study shall be conducted in accordance with the following criteria.

(1) Bench-scale tests are continuous flow tests using rapid small scale column test (RSSCT) for GAC and small scale membrane test apparatus as specified in "ICR Manual for Bench- and Pilot-scale Treatment Studies" (EPA 814-B-96-003, April 1996).

(i) GAC bench-scale testing shall include information on the experimental conditions and results necessary to adequately determine the scaled-up breakthrough curves under the conditions of each RSSCT. At least two empty bed contact times (EBCTs) shall be tested using the RSSCT. These RSSCT EBCTs shall be designed to represent a full-scale EBCT of 10 min and a full-scale EBCT of 20 min. Additional EBCTs may be tested. The RSSCT testing is described in the "ICR Bench- and Pilot-scale Treatment Study Manual" (EPA 814-B-96-003, April 1996). The RSSCT tests at each EBCT shall be run quarterly to ascertain the impact of seasonal variation. Thus a total of four RSSCTs at each EBCT should be run.