

(1) The regulations in this subpart establish criteria under which community water systems (CWSs) and non-transient, noncommunity water systems (NTNCWSs) which add a chemical disinfectant to the water in any part of the drinking water treatment process must modify their practices to meet MCLs and MRDLs in §§ 141.64 and 141.65, respectively, and must meet the treatment technique requirements for disinfection byproduct precursors in § 141.135.

(2) The regulations in this subpart establish criteria under which transient NCWSs that use chlorine dioxide as a disinfectant or oxidant must modify their practices to meet the MRDL for chlorine dioxide in § 141.65.

(3) EPA has established MCLs for TTHM and HAA5 and treatment technique requirements for disinfection byproduct precursors to limit the levels of known and unknown disinfection byproducts which may have adverse health effects. These disinfection byproducts may include chloroform; bromodichloromethane; dibromochloromethane; bromoform; dichloroacetic acid; and trichloroacetic acid.

(b) *Compliance dates*—(1) *CWSs and NTNCWSs*. Unless otherwise noted, systems must comply with the requirements of this subpart as follows. Subpart H systems serving 10,000 or more persons must comply with this subpart beginning January 1, 2002. Subpart H systems serving fewer than 10,000 persons and systems using only ground water not under the direct influence of surface water must comply with this subpart beginning January 1, 2004.

(2) *Transient NCWSs*. Subpart H systems serving 10,000 or more persons and using chlorine dioxide as a disinfectant or oxidant must comply with any requirements for chlorine dioxide in this subpart beginning January 1, 2002. Subpart H systems serving fewer than 10,000 persons and using chlorine dioxide as a disinfectant or oxidant and systems using only ground water not under the direct influence of surface water and using chlorine dioxide as a disinfectant or oxidant must comply with any requirements for chlorine dioxide in this subpart beginning January 1, 2004.

(c) Each CWS and NTNCWS regulated under paragraph (a) of this section must be operated by qualified personnel who meet the requirements specified by the State and are included in a State register of qualified operators.

(d) *Control of disinfectant residuals*. Notwithstanding the MRDLs in § 141.65, systems may increase residual disinfectant levels in the distribution system of chlorine or chloramines (but not chlorine dioxide) to a level and for a time necessary to protect public health, to address specific microbiological contamination problems caused by circumstances such as, but not limited to, distribution line breaks, storm run-off events, source water contamination events, or cross-connection events.

[63 FR 69466, Dec. 16, 1998, as amended at 66 FR 3776, Jan. 16, 2001]

§ 141.131 Analytical requirements.

(a) *General*. (1) Systems must use only the analytical methods specified in this section, or their equivalent as approved by EPA, to demonstrate compliance with the requirements of this subpart and with the requirements of subparts U and V of this part. These methods are effective for compliance monitoring February 16, 1999, unless a different effective date is specified in this section or by the State.

(2) The following documents are incorporated by reference. The Director of the Federal Register approves this incorporation by reference in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be inspected at EPA's Drinking Water Docket, 1301 Constitution Avenue, NW., EPA West, Room B102, Washington, DC 20460, or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html. EPA Method 552.1 is in Methods for the Determination of Organic Compounds in Drinking Water—Supplement II, USEPA, August 1992, EPA/600/R-92/129 (available through National Information Technical Service (NTIS), PB92-207703). EPA Methods

502.2, 524.2, 551.1, and 552.2 are in Methods for the Determination of Organic Compounds in Drinking Water-Supplement III, USEPA, August 1995, EPA/600/R-95/131 (available through NTIS, PB95-261616). EPA Method 300.0 is in Methods for the Determination of Inorganic Substances in Environmental Samples, USEPA, August 1993, EPA/600/R-93/100 (available through NTIS, PB94-121811). EPA Methods 300.1 and 321.8 are in Methods for the Determination of Organic and Inorganic Compounds in Drinking Water, Volume 1, USEPA, August 2000, EPA 815-R-00-014 (available through NTIS, PB2000-106981). EPA Method 317.0, Revision 2.0, "Determination of Inorganic Oxyhalide Disinfection By-Products in Drinking Water Using Ion Chromatography with the Addition of a Postcolumn Reagent for Trace Bromate Analysis," USEPA, July 2001, EPA 815-B-01-001, EPA Method 326.0, Revision 1.0, "Determination of Inorganic Oxyhalide Disinfection By-Products in Drinking Water Using Ion Chromatography Incorporating the Addition of a Suppressor Acidified Postcolumn Reagent for Trace Bromate Analysis," USEPA, June 2002, EPA 815-R-03-007, EPA Method 327.0, Revision 1.1, "Determination of Chlorine Dioxide and Chlorite Ion in Drinking Water Using Lissamine Green B and Horseradish Peroxidase with Detection by Visible Spectrophotometry," USEPA, May 2005, EPA 815-R-05-008 and EPA Method 552.3, Revision 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-liquid Microextraction, Derivatization, and Gas Chromatography with Electron Capture Detection," USEPA, July 2003, EPA-815-B-03-002 can be accessed and downloaded directly on-line at <http://www.epa.gov/safewater/methods/sourcalt.html>. EPA Method 415.3, Revision 1.1, "Determination of Total Organic Carbon and Specific UV Absorbance at 254 nm in Source Water and Drinking Water," USEPA, February 2005, EPA/600/R-05/055 can be accessed and downloaded directly on-line at www.epa.gov/nerlcwww/ordmeth.htm. Standard Methods 4500-Cl D, 4500-Cl E, 4500-Cl F, 4500-Cl G, 4500-Cl H, 500-Cl I, 4500-ClO₂ D, 4500-ClO₂ E, 6251 B, and 5910 B shall be followed in accordance

with Standard Methods for the Examination of Water and Wastewater, 19th or 20th Editions, American Public Health Association, 1995 and 1998, respectively. The cited methods published in either edition may be used. Standard Methods 5310 B, 5310 C, and 5310 D shall be followed in accordance with the Supplement to the 19th Edition of Standard Methods for the Examination of Water and Wastewater, or the Standard Methods for the Examination of Water and Wastewater, 20th Edition, American Public Health Association, 1996 and 1998, respectively. The cited methods published in either edition may be used. Copies may be obtained from the American Public Health Association, 1015 Fifteenth Street, NW., Washington, DC 20005. Standard Methods 4500-Cl D-00, 4500-Cl E-00, 4500-Cl F-00, 4500-Cl G-00, 4500-Cl H-00, 4500-Cl I-00, 4500-ClO₂ E-00, 6251 B-94, 5310 B-00, 5310 C-00, 5310 D-00 and 5910 B-00 are available at <http://www.standardmethods.org> or at EPA's Water Docket. The year in which each method was approved by the Standard Methods Committee is designated by the last two digits in the method number. The methods listed are the only Online versions that are IBR-approved. ASTM Methods D 1253-86 and D 1253-86 (Reapproved 1996) shall be followed in accordance with the Annual Book of ASTM Standards, Volume 11.01, American Society for Testing and Materials International, 1996 or any ASTM edition containing the IBR-approved version of the method may be used. ASTM Method D1253-03 shall be followed in accordance with the Annual Book of ASTM Standards, Volume 11.01, American Society for Testing and Materials International, 2004 or any ASTM edition containing the IBR-approved version of the method may be used. ASTM Method D 6581-00 shall be followed in accordance with the Annual Book of ASTM Standards, Volume 11.01, American Society for Testing and Materials International, 2001 or any ASTM edition containing the IBR-approved version of the method may be used; copies may be obtained from the American Society for Testing and Materials International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959.

(b) *Disinfection byproducts.* (1) Systems must measure disinfection byproducts by the methods (as modified by the footnotes) listed in the fol-

lowing table or one of the alternative methods listed in appendix A to subpart C of this part:

APPROVED METHODS FOR DISINFECTION BYPRODUCT COMPLIANCE MONITORING

| Contaminant and methodology ¹ | EPA method | Standard method ² | SM online ⁹ | ASTM method ³ |
|---|--|--|---|--------------------------|
| TTHM | | | | |
| P&T/GC/ECD & PID | 502.2 ⁴ ..... | ..... | ..... |  |
| P&T/GC/MS | 524.2 ..... | ..... | ..... |  |
| LLE/GC/ECD | 551.1 ..... | ..... | ..... |  |
| HAA5 | | | | |
| LLE (diazomethane)/GC/ECD ..... | ..... | 6251 B ⁵ | 6251 B–94 | |
| SPE (acidic methanol)/GC/ECD | 552.1 ⁵ ..... | ..... | ..... |  |
| LLE (acidic methanol)/GC/ECD | 552.2, 552.3 ..... | ..... | ..... |  |
| Bromate | | | | |
| Ion chromatography | 300.1 ..... | ..... | ..... | D 6581–00 |
| Ion chromatography & post column reaction | 317.0 Rev 2.0 ⁶ , 326.0 ⁶ ..... | ..... | ..... |  |
| IC/ICP–MS | 321.8 ^{6,7} ..... | ..... | ..... |  |
| Chlorite | | | | |
| Amperometric titration ..... | ..... | 4500–ClO ₂ E ⁸ | 4500–ClO ₂ E–00 ⁸ | |
| Spectrophotometry | 327.0 Rev 1.1 ⁸ ..... | ..... | ..... |  |
| Ion chromatography | 300.0, 300.1, 317.0 Rev 2.0, 326.0 ..... | ..... | ..... | D 6581–00 |

¹ P&T = purge and trap; GC = gas chromatography; ECD = electrolytic conductivity detector; PID = photoionization detector; MS = mass spectrometer; LLE = liquid/liquid extraction; ECD = electron capture detector; SPE = solid phase extraction; IC = ion chromatography; ICP–MS = inductively coupled plasma/mass spectrometer.

² 19th and 20th editions of Standard Methods for the Examination of Water and Wastewater, 1995 and 1998, respectively, American Public Health Association; either of these editions may be used.

³ Annual Book of ASTM Standards, 2001 or any year containing the cited version of the method, Vol 11.01.

⁴ If TTHMs are the only analytes being measured in the sample, then a PID is not required.

⁵ The samples must be extracted within 14 days of sample collection.

⁶ Ion chromatography & post column reaction or IC/ICP–MS must be used for monitoring of bromate for purposes of demonstrating eligibility of reduced monitoring, as prescribed in § 141.132(b)(3)(ii).

⁷ Samples must be preserved at the time of sampling with 50 mg ethylenediamine (EDA)/L of sample and must be analyzed within 28 days.

⁸ Amperometric titration or spectrophotometry may be used for routine daily monitoring of chlorite at the entrance to the distribution system, as prescribed in § 141.132(b)(2)(i)(A). Ion chromatography must be used for routine monthly monitoring of chlorite and additional monitoring of chlorite in the distribution system, as prescribed in § 141.132(b)(2)(i)(B) and (b)(2)(ii).

⁹ The Standard Methods Online version that is approved is indicated by the last two digits in the method number which is the year of approval by the Standard Method Committee. Standard Methods Online are available at <http://www.standardmethods.org>.

(2) Analyses under this section for disinfection byproducts must be conducted by laboratories that have received certification by EPA or the State, except as specified under paragraph (b)(3) of this section. To receive certification to conduct analyses for the DBP contaminants in §§ 141.64, 141.135, and subparts U and V of this part, the laboratory must:

(i) Analyze Performance Evaluation (PE) samples that are acceptable to EPA or the State at least once during each consecutive 12 month period by each method for which the laboratory desires certification.

(ii) Until March 31, 2007, in these analyses of PE samples, the laboratory must achieve quantitative results within the acceptance limit on a minimum of 80% of the analytes included in each PE sample. The acceptance limit is defined as the 95% confidence interval calculated around the mean of the PE study between a maximum and minimum acceptance limit of $\pm 50\%$ and $\pm 15\%$ of the study mean.

(iii) Beginning April 1, 2007, the laboratory must achieve quantitative results on the PE sample analyses that are within the following acceptance limits:

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| DBP | Acceptance limits (percent of true value) | Comments | DBP | Acceptance limits (percent of true value) | Comments |
|------------------------|---|--|--|---|----------|
| TTHM | | | Dichloroacetic Acid. | ±40 | |
| Chloroform | ±20 | Laboratory must meet all 4 individual THM acceptance limits in order to successfully pass a PE sample for TTHM | Trichloroacetic Acid. | ±40 | |
| Bromodichloromethane. | ±20 | | Monobromoacetic Acid. | ±40 | |
| Dibromochloromethane. | ±20 | | Dibromoacetic Acid. | ±40 | |
| Bromoform | ±20 | | Chlorite | ±30 | |
| HAA5 | | | Bromate | ±30 | |
| Monochloroacetic Acid. | ±40 | Laboratory must meet the acceptance limits for 4 out of 5 of the HAA5 compounds in order to successfully pass a PE sample for HAA5 | (iv) Beginning April 1, 2007, report quantitative data for concentrations at least as low as the ones listed in the following table for all DBP samples analyzed for compliance with §§141.64, 141.135, and subparts U and V of this part: | | |

| DBP | Minimum reporting level (mg/L) ¹ | Comments |
|-----------------------------|---|---|
| TTHM ² | | |
| Chloroform | 0.0010 | |
| Bromodichloromethane | 0.0010 | |
| Dibromochloromethane | 0.0010 | |
| Bromoform | 0.0010 | |
| HAA5 ² | | |
| Monochloroacetic Acid | 0.0020 | |
| Dichloroacetic Acid | 0.0010 | |
| Trichloroacetic Acid | 0.0010 | |
| Monobromoacetic Acid | 0.0010 | |
| Dibromoacetic Acid | 0.0010 | |
| Chlorite | 0.020 | Applicable to monitoring as prescribed in § 141.132(b)(2)(1)(B) and (b)(2)(ii). |
| Bromate | 0.0050 or 0.0010 | Laboratories that use EPA Methods 317.0 Revision 2.0, 326.0 or 321.8 must meet a 0.0010 mg/L MRL for bromate. |

¹ The calibration curve must encompass the regulatory minimum reporting level (MRL) concentration. Data may be reported for concentrations lower than the regulatory MRL as long as the precision and accuracy criteria are met by analyzing an MRL check standard at the lowest reporting limit chosen by the laboratory. The laboratory must verify the accuracy of the calibration curve at the MRL concentration by analyzing an MRL check standard with a concentration less than or equal to 110% of the MRL with each batch of samples. The measured concentration for the MRL check standard must be ±50% of the expected value, if any field sample in the batch has a concentration less than 5 times the regulatory MRL. Method requirements to analyze higher concentration check standards and meet tighter acceptance criteria for them must be met in addition to the MRL check standard requirement.

² When adding the individual trihalomethane or haloacetic acid concentrations to calculate the TTHM or HAA5 concentrations, respectively, a zero is used for any analytical result that is less than the MRL concentration for that DBP, unless otherwise specified by the State.

(3) A party approved by EPA or the State must measure daily chlorine samples at the entrance to the distribution system.

(c) *Disinfectant residuals.* (1) Systems must measure residual disinfectant

concentration for free chlorine, combined chlorine (chloramines), and chlorine dioxide by the methods listed in the following table or one of the alternative methods listed in appendix A to subpart C of this part:

| Methodology | SM (19th or 20th ed) | SM Online ² | ASTM method | EPA method | Residual measured ¹ | | | |
|-------------------------------------|-------------------------|----------------------------|--------------------|---------------|--------------------------------|--------------------------|-----------------------|------------------|
| | | | | | Free Cl ₂ | Combined Cl ₂ | Total Cl ₂ | ClO ₂ |
| Amperometric Titration | 4500–Cl D | 4500–Cl D–00 | D 1253–86 (96), 03 | | X | X | X | |
| Low Level Amperometric Titration. | 4500–Cl E | 4500–Cl E–00 | | | | | X | |
| DPD Ferrous Titrimetric | 4500–Cl F | 4500–Cl F–00 | | | X | X | X | |
| DPD Colorimetric | 4500–Cl G | 4500–Cl G–00 | | | X | X | X | |
| Syringaldazine (FACTS) | 4500–Cl H | 4500–Cl H–00 | | | X | | | |
| Iodometric Electrode | 4500–Cl I | 4500–Cl I–00 | | | | | X | |
| DPD | 4500–ClO ₂ D | | | | | | | X |
| Amperometric Method II | 4500–ClO ₂ E | 4500–ClO ₂ E–00 | | 327.0 Rev 1.1 | | | | X |
| Lissamine Green Spectrophotometric. | | | | | | | | X |

¹ X indicates method is approved for measuring specified disinfectant residual. Free chlorine or total chlorine may be measured for demonstrating compliance with the chlorine MRDL and combined chlorine, or total chlorine may be measured for demonstrating compliance with the chloramine MRDL.

² The Standard Methods Online version that is approved is indicated by the last two digits in the method number which is the year of approval by the Standard Method Committee. Standard Methods Online are available at <http://www.standardmethods.org>.

(2) If approved by the State, systems may also measure residual disinfectant concentrations for chlorine, chloramines, and chlorine dioxide by using DPD colorimetric test kits.

(3) A party approved by EPA or the State must measure residual disinfectant concentration.

(d) *Additional analytical methods.* Systems required to analyze parameters not included in paragraphs (b) and (c) of this section must use the following methods or one of the alternative methods listed in appendix A to subpart C of this part. A party approved by EPA or the State must measure these parameters.

(1) *Alkalinity.* All methods allowed in § 141.89(a) for measuring alkalinity.

(2) *Bromide.* EPA Methods 300.0, 300.1, 317.0 Revision 2.0, 326.0, or ASTM D 6581–00.

(3) *Total Organic Carbon (TOC).* Standard Method 5310 B or 5310 B–00 (High-Temperature Combustion Method) or Standard Method 5310 C or 5310 C–00 (Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method) or Standard Method 5310 D or 5310 D–00 (Wet-Oxidation Method) or EPA Method 415.3 Revision 1.1. Inorganic carbon must be removed from the samples prior to analysis. TOC samples may not be filtered prior to analysis. TOC samples must be acidified at the time of sample collection to achieve pH less than or equal to 2 with minimal addition of the acid specified in the method or by the instrument manufacturer. Acidified

TOC samples must be analyzed within 28 days.

(4) *Specific Ultraviolet Absorbance (SUVA).* SUVA is equal to the UV absorption at 254nm (UV₂₅₄) (measured in m^{–1} divided by the dissolved organic carbon (DOC) concentration (measured as mg/L). In order to determine SUVA, it is necessary to separately measure UV₂₅₄ and DOC. When determining SUVA, systems must use the methods stipulated in paragraph (d)(4)(i) of this section to measure DOC and the method stipulated in paragraph (d)(4)(ii) of this section to measure UV₂₅₄. SUVA must be determined on water prior to the addition of disinfectants/oxidants by the system. DOC and UV₂₅₄ samples used to determine a SUVA value must be taken at the same time and at the same location.

(i) *Dissolved Organic Carbon (DOC).* Standard Method 5310 B or 5310 B–00 (High-Temperature Combustion Method) or Standard Method 5310 C or 5310 C–00 (Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method) or Standard Method 5310 D or 5310 D–00 (Wet-Oxidation Method) or EPA Method 415.3 Revision 1.1. DOC samples must be filtered through the 0.45 µm pore-diameter filter as soon as practical after sampling, not to exceed 48 hours. After filtration, DOC samples must be acidified to achieve pH less than or equal to 2 with minimal addition of the acid specified in the method or by the instrument manufacturer. Acidified DOC samples must be analyzed within 28

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days of sample collection. Inorganic carbon must be removed from the samples prior to analysis. Water passed through the filter prior to filtration of the sample must serve as the filtered blank. This filtered blank must be analyzed using procedures identical to those used for analysis of the samples and must meet the following criteria: DOC < 0.5 mg/L.

(ii) *Ultraviolet Absorption at 254 nm* (UV₂₅₄). Standard Method 5910 B or 5910 B-00 (Ultraviolet Absorption Method) or EPA Method 415.3 Revision 1.1. UV absorption must be measured at 253.7 nm (may be rounded off to 254 nm). Prior to analysis, UV₂₅₄ samples must be filtered through a 0.45 µm pore-diameter filter. The pH of UV₂₅₄ samples may not be adjusted. Samples must be analyzed as soon as practical after sampling, not to exceed 48 hours.

(5) *pH*. All methods allowed in § 141.23(k)(1) for measuring pH.

(6) *Magnesium*. All methods allowed in § 141.23(k)(1) for measuring magnesium.

[63 FR 69466, Dec. 16, 1998, as amended at 66 FR 3776, Jan. 16, 2001; 71 FR 479, Jan. 4, 2006; 71 FR 37168, June 29, 2006; 74 FR 30958, June 29, 2009]

§ 141.132 Monitoring requirements.

(a) *General requirements*. (1) Systems must take all samples during normal operating conditions.

(2) Systems may consider multiple wells drawing water from a single aquifer as one treatment plant for determining the minimum number of TTHM and HAA5 samples required, with State approval in accordance with criteria developed under § 142.16(h)(5) of this chapter.

(3) Failure to monitor in accordance with the monitoring plan required under paragraph (f) of this section is a monitoring violation.

(4) Failure to monitor will be treated as a violation for the entire period covered by the annual average where compliance is based on a running annual average of monthly or quarterly samples or averages and the system's failure to monitor makes it impossible to determine compliance with MCLs or MRDLs.

(5) Systems may use only data collected under the provisions of this subpart to qualify for reduced monitoring.

(b) *Monitoring requirements for disinfection byproducts*—(1) *TTHMs and HAA5*—(i) *Routine monitoring*. Systems must monitor at the frequency indicated in the following table:

ROUTINE MONITORING FREQUENCY FOR TTHM AND HAA5

| Type of system | Minimum monitoring frequency | Sample location in the distribution system |
|---|--|--|
| Subpart H system serving at least 10,000 persons. | Four water samples per quarter per treatment plant. | At least 25 percent of all samples collected each quarter at locations representing maximum residence time. Remaining samples taken at locations representative of at least average residence time in the distribution system and representing the entire distribution system, taking into account number of persons served, different sources of water, and different treatment methods. ¹ |
| Subpart H system serving from 500 to 9,999 persons. | One water sample per quarter per treatment plant. | Locations representing maximum residence time. ¹ |
| Subpart H system serving fewer than 500 persons. | One sample per year per treatment plant during month of warmest water temperature. | Locations representing maximum residence time. ¹ If the sample (or average of annual samples, if more than one sample is taken) exceeds the MCL, the system must increase monitoring to one sample per treatment plant per quarter, taken at a point reflecting the maximum residence time in the distribution system, until the system meets criteria in paragraph (b)(1)(iv) of this section. |
| System using only ground water not under direct influence of surface water using chemical disinfectant and serving at least 10,000 persons. | One water sample per quarter per treatment plant ² . | Locations representing maximum residence time. ¹ |