**Section 611.381 Analytical Requirements**

a) A supplier must use only the analytical methods this Section specifies, each incorporated by reference in Section 611.102, or alternative methods that the Agency approved under Section 611.480 to demonstrate that it complies with this Subpart I and Subparts W and Y.

b) Disinfection Byproducts (DBPs)

1) Methods for Disinfection Byproducts (DBPs)

A) TTHM

i) By Purge and Trap, Gas Chromatography, Electrolytic Conductivity Detector, and Photoionization Detector. USEPA 502.2 (95). If TTHMs are the only analytes the laboratory measures in the sample, it needs not use a photoionization detector.

ii) By Purge and Trap, Gas Chromatography-Mass Spectrometer. USEPA 524.2 (95) or USEPA 524.3 (09), or USEPA 524.4 (13).

iii) By Liquid-Liquid Extraction, Gas Chromatography, Electron Capture Detector. USEPA 551.1 (95).

B) HAA5

i) Liquid-Liquid Extraction (Diazomethane), Gas Chromatography, Electron Capture Detector. SM 6251 B (94) or SM 6251 B (07).

ii) Solid Phase Extractor (Acidic Methanol), Gas Chromatography, Electron Capture Detector. USEPA 552.1 (92).

iii) Liquid-Liquid Extraction (Acidic Methanol), Gas Chromatography, Electron Capture Detector. USEPA 552.2 (95) or 552.3 (03).

iv) Ion Chromatography, Electrospray Ionization, Tandem Mass Spectrometry. USEPA 557 (09).

v) Two-Dimensional Ion Chromatography (IC) with Suppressed Conductivity Detection. Thermo-Fisher 557.1 (17).

C) Bromate

i) Ion Chromatography. ASTM D6581-00 or USEPA 300.1 (97).

ii) Ion Chromatography and Post-Column Reaction. USEPA 317.0 (01) or USEPA 326.0 (02).

iii) Inductively Coupled Plasma-Mass Spectrometer. USEPA 321.8 (97).

iv) Two-Dimensional Ion Chromatography. USEPA 302.0 (09).

v) Ion Chromatography, Electrospray Ionization, Tandem Mass Spectrometry. USEPA 557 (09).

vi) Chemically Suppressed Chromatography. ASTM D6581-08 A.

vii) Electrolytically Suppressed Chromatography. ASTM D6581-08 B.

BOARD NOTE: The supplier must use ion chromatography and post column reaction or inductively coupled plasma-mass spectrometry to monitor bromate to demonstrate eligibility for reduced monitoring under Section 611.382(b)(3)(B). For inductively coupled plasma-mass spectrometry, the supplier must preserve samples at the time of sampling with 50 mg ethylenediamine (EDA) per liter of sample, and the supplier must analyze the samples within 28 days.

D) Chlorite

i) Amperometric Titration for Daily Monitoring Under Section 611.382(b)(2)(A)(i). SM 4500-ClO2 E (93) or 4500-ClO2 E (00).

ii) Amperometric Sensor for Daily Monitoring Under Section 611.382(b)(2)(A)(i). Palintest ChlordioX Plus (13) or Palintest ChlordioX Plus (20).

iii) Spectrophotometry. USEPA 327.0 (05).

iv) Ion Chromatography. USEPA 300.0 (09), USEPA 300.1 (97), USEPA 317.0 (01), USEPA 326.0 (02), or ASTM D6581-00.

v) Chemically Suppressed Chromatography. ASTM D6581-08 A.

vi) Electrolytically Suppressed Chromatography. ASTM D6581-08 B.

BOARD NOTE: The supplier may use amperometric titration or spectrophotometry for routine daily monitoring of chlorite at the entrance to the distribution system under Section 611.382(b)(2)(A)(i). The supplier must use ion chromatography for routine monthly chlorite monitoring and additional chlorite monitoring in the distribution system, as Section 611.382(b)(2)(A)(ii) and (b)(2)(B) require.

2) Only a certified laboratory in one of the categories in Section 611.490(a) may conduct analyses for DBPs under this Section except as subsection (b)(3) specifies otherwise. To receive certification to conduct analyses for the DBP contaminants in Sections 611.312 and 611.381 and Subparts W and Y, the laboratory must fulfill the specific conditions in subsections (b)(2)(A), (b)(2)(C), and (b)(2)(D).

A) The laboratory must analyze performance evaluation (PE) samples acceptable to the Agency at least once during each consecutive 12-month period by each method for which the laboratory seeks certification.

B) This subsection corresponds with 40 CFR 141.131(b)(2)(ii), which has expired by its own terms. This statement maintains structural consistency with the corresponding federal rule.

C) The laboratory must achieve quantitative results on the PE sample analyses within the acceptance limits in subsections (b)(2)(C)(i) through (b)(2)(B)(xi), subject to subsections (b)(2)(C)(xii) and (b)(2)(C)(xiii):

i) Chloroform (a THM): ± 20% of true value;

ii) Bromodichloromethane (a THM): ± 20% of true value;

iii) Dibromochloromethane (a THM): ± 20% of true value;

iv) Bromoform (a THM): ± 20% of true value;

v) Monochloroacetic Acid (an HAA5): ± 40% of true value;

vi) Dichloroacetic Acid (an HAA5): ± 40% of true value;

vii) Trichloroacetic Acid (an HAA5): ± 40% of true value;

viii) Monobromoacetic Acid (an HAA5): ± 40% of true value;

ix) Dibromoacetic Acid (an HAA5): ± 40% of true value;

x) Chlorite: ± 30% of true value; and

xi) Bromate: ± 30% of true value.

xii) The laboratory must meet all four of the individual THM acceptance limits in subsections (b)(2)(B)(i) through (b)(2)(B)(iv) to successfully pass a PE sample for TTHM.

xiii) The laboratory must meet the acceptance limits for four out of the five HAA5 compounds in subsections (b)(2)(B)(v) through (b)(2)(B)(ix) to successfully pass a PE sample for HAA5.

D) The laboratory must report quantitative data for concentrations at least as low as the minimum reporting levels (MRLs) in subsections (b)(2)(D)(i) through (b)(2)(D)(xi), subject to subsections (b)(2)(D)(xii) and (b)(2)(D)(xiii), for all DBP samples it analyzes to comply with Sections 611.312 and 611.385 and Subparts W and Y:

i) Chloroform (a THM): 0.0010 mg/L;

ii) Bromodichloromethane (a THM): 0.0010 mg/L;

iii) Dibromochloromethane (a THM): 0.0010 mg/L;

iv) Bromoform (a THM): 0.0010 mg/L;

v) Monochloroacetic Acid (an HAA5): 0.0020 mg/L;

vi) Dichloroacetic Acid (an HAA5): 0.0010 mg/L;

vii) Trichloroacetic Acid (an HAA5): 0.0010 mg/L;

viii) Monobromoacetic Acid (an HAA5): 0.0010 mg/L;

ix) Dibromoacetic Acid (an HAA5): 0.0010 mg/L;

x) Chlorite: 0.020 mg/L, applicable to monitoring as required by Section 611.382(b)(2)(A)(ii) and (b)(2)(B); and

xi) Bromate: 0.0050, or 0.0010 mg/L if the laboratory uses USEPA 317.0 (01), USEPA 321.8 (97), or USEPA 326.0 (02).

xii) The calibration curve must encompass the regulatory MRL concentration. The laboratory may report data for concentrations lower than the regulatory MRL if the laboratory meets the precision and accuracy criteria by analyzing an MRL check standard at the lowest reporting limit the laboratory chooses. 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 five times the regulatory MRL. The laboratory must analyze higher concentration check standards and meet tighter acceptance criteria in addition to the MRL check standard.

xiii) When adding the individual trihalomethane or haloacetic acid concentrations for the compounds listed in subsections (b)(2)(D)(v) through (b)(2)(D)(ix) to calculate the TTHM or HAA5 concentrations, a zero is used for any analytical result that is less than the MRL concentration for that DBP, unless the Agency specifies otherwise.

3) A party must measure daily chlorite samples at the entrance to the distribution system as the Agency requires.

c) Disinfectant Residuals

1) A supplier must measure residual disinfectant concentrations for free chlorine, combined chlorine (chloramines), and chlorine dioxide using the methods in subsections (c)(1)(A) through (c)(1)(D), subject to subsection (c)(1)(E):

A) Free Chlorine

i) Amperometric Titration. ASTM D1253-86, ASTM D1253-96, ASTM D1253-03, ASTM D1253-08, ASTM D1253-14, SM 4500-Cl D (93), or SM 4500- Cl D (00).

ii) DPD Ferrous Titration. SM 4500-Cl F (93) or SM 4500-Cl F (00).

iii) DPD Colorimetric. Hach 10260 (13), SM 4500-Cl G (93), or SM 4500-Cl G (00).

iv) Syringaldazine (FACTS). SM 4500-Cl H (93) or SM 4500-Cl H (00).

v) Test Strips. ITS D99-003 (03) if approved by the Agency under subsection (c)(2).

vi) Amperometric Sensor. Palintest ChloroSense (09) or Palintest ChloroSense (20).

vii) On-Line Chlorine Analyzer. USEPA 334.0 (09).

viii) Indenophenol Colorimetric. Hach 10241 (15).

B) Combined Chlorine

i) Amperometric Titration. ASTM D1253-86, ASTM D1253-96, ASTM D1253-03, ASTM D1253-08, or ASTM D1253-14, SM 4500-Cl D (93), or SM 4500-CL D (00).

ii) DPD Ferrous Titration. SM 4500-Cl F (93) or SM 4500-Cl F (00).

iii) DPD Colorimetric. Hach 10260 (13), SM 4500-Cl G (93), or SM 4500-Cl G (00).

C) Total Chlorine

i) Amperometric Titration. ASTM D1253-86, ASTM D1253-96, ASTM D1253-03, ASTM D1253-08, or ASTM D1253-14, SM 4500-Cl D (93), or SM 4500-Cl D (00).

ii) Low-Level Amperometric Titration. SM 4500-Cl E (93) or SM 4500-Cl E (00).

iii) DPD Ferrous Titration. SM 4500-Cl F (93) or SM 4500-Cl F (00).

iv) DPD Colorimetric. Hach 10260 (13), SM 4500-Cl G (93), or SM 4500-Cl G (00).

v) Iodometric Electrode. SM 4500-Cl I (93) or SM 4500-Cl I (00).

vi) Amperometric Sensor. Palintest ChloroSense (09) or Palintest ChloroSense (20).

vii) On-Line Chlorine Analyzer. USEPA 334.0 (09).

D) Chlorine Dioxide

i) DPD. SM 4500-ClO2 D (93) or SM 4500-ClO2 D (00).

ii) Amperometric Method II. SM 4500-ClO2 E (93) or SM 4500-ClO2 E (00).

iii) Amperometric Sensor. Palintest ChlordioX Plus (13) or Palintest ChlordioX Plus (20).

iv) Lissamine Green Spectrophotometric. USEPA 327.0 (05).

E) USEPA approved these methods for measuring the specified disinfectant residual. The supplier may measure free chlorine or total chlorine for the chlorine MRDL and combined chlorine. The supplier may measure total chlorine for the chloramine MRDL.

2) Alternative Methods Available Only upon Specific Agency Approval

A) Test Strips. ITS Method D99-003 (03).

BOARD NOTE: USEPA added ITS Method D99-003 (03) as an approved alternative method, contingent upon specific State approval. The Agency may issue a SEP approving this method on a case-by-case basis.

B) If the Agency approves in a SEP, a supplier may also measure residual disinfectant concentrations for chlorine, chloramines, and chlorine dioxide using DPD colorimetric test kits.

3) An Agency-approved party must measure residual disinfectant concentration.

d) A supplier that must analyze parameters not included in subsections (b) and (c) must use the methods in this subsection (d). An Agency-approved party must measure certain parameters:

1) Alkalinity. All methods in Section 611.611(a)(21) for alkalinity.

2) Bromide. Ion Chromatography. ASTM D6581-00, USEPA 300.0 (93), USEPA 300.1 (97), USEPA 317.0 (01), or USEPA 326.0 (02).

3) Total Organic Carbon (TOC), by any of the methods in subsection (d)(3)(A), subject to subsection (d)(3)(B).

A) Analytical Methods

i) High-Temperature Combustion. SM 5310 B (92), SM 5310 B (96), SM 5310 B (00), SM 5310 B (14), USEPA 415.3 (05), or USEPA 415.3 (09).

ii) Persulfate-Ultraviolet or Heated-Persulfate Oxidation. Hach 10267 (15), SM 5310 C (92), SM 5310 C (96), SM 5310 C (00), SM 5310 C (14), USEPA 415.3 (05), or USEPA 415.3 (09).

iii) Wet Oxidation Method. SM 5310 D (92), SM 5310 D (96), SM 5310 D (00), SM 5310 D (14), USEPA 415.3 (05), or USEPA 415.3 (09).

iv) Ozone Oxidation. Hach 10261 (15).

B) The supplier must remove inorganic carbon from the samples prior to analysis. The supplier and supplier must not filter TOC samples prior to analysis. The supplier must acidify TOC samples at the time of sample collection to achieve pH less than or equal to 2 with minimal addition of the acid the method specifies or instrument manufacturer recommends. The supplier must analyze acidified TOC samples within 28 days.

4) Specific Ultraviolet Absorbance (SUVA). SUVA is equal to the UV absorption at 254 nm (UV254) (measured in m-1) divided by the dissolved organic carbon (DOC) concentration (measured as mg/L). To determine SUVA, the supplier must separately measure UV254 and DOC. When determining SUVA, a supplier must use the methods in subsection (d)(4)(A) for DOC and the method in subsection (d)(4)(B) for UV254. The supplier must determine SUVA on water prior to the supplier adding disinfectants or oxidants. The supplier must take DOC and UV254 samples for a SUVA value at the same time and at the same location.

A) Dissolved Organic Carbon (DOC). Prior to analysis, the supplier must filter DOC samples through the 0.45 μm pore-diameter filter as soon as practical after sampling, not to exceed 48 hours. After filtration, the supplier must acidify DOC samples to achieve pH less than or equal to 2 with minimal addition of the acid the method or instrument manufacturer specifies. The supplier must analyze acidified DOC samples within 28 days after sample collection. The supplier must remove inorganic carbon from the samples prior to analysis. The supplier must use water passed through the filter as the filtered blank. The supplier must analyze this filtered blank using procedures identical to those it used for analysis of the samples, and the blank must less than 0.5 mg/L DOC.

i) High-Temperature Combustion Method. SM 5310 B (92), SM 5310 B (96), SM 5310 B (00), SM 5310 B (14), USEPA 415.3 (05), or USEPA 415.3 (09).

ii) Persulfate-Ultraviolet or Heated-Persulfate Oxidation Method. SM 5310 C (92), SM 5310 C (96), SM 5310 C (00), SM 5310 C (14), USEPA 415.3 (05), or USEPA 415.3 (09).

iii) Wet-Oxidation Method. SM 5310 D (92), (96), SM 5310 D (00), USEPA 415.3 (05), or USEPA 415.3 (09).

B) Ultraviolet Absorption at 254 nm (UV254) by Spectrometry. SM 5910 B (94), SM 5910 B (00), 5910 B (11), 5910 B (13), USEPA 415.3 (05), or USEPA 415.3 (09). The supplier must measure UV absorption at 253.7 nm (may be rounded off to 254 nm). Prior to analysis, the supplier must filter UV254 samples through a 0.45 μm pore-diameter filter. The supplier must not adjust pH of UV254 samples. The supplier must analyze samples as soon as practical after sampling, not to exceed 48 hours.

5) pH. All methods in Section 611.611(a)(17) for pH.

6) Magnesium. All methods in Section 611.611(a) for magnesium.

BOARD NOTE: This Section derives from 40 CFR 141.131 and appendix A to 40 CFR 141. The Board did not separately list approved alternative methods from Standard Methods Online that are the same version as a method appearing in a printed edition of Standard Methods. Using the Standard Methods Online copy is acceptable.

Standard Methods Online, Methods 4500‑Cl D-93, 4500‑Cl E-93, 4500‑Cl F-93, 4500‑Cl G-93, 4500‑Cl H-93, and 4500‑Cl I-93 appear in the 19th and 20th editions as Methods 4500‑Cl D, 4500‑Cl E, 4500‑Cl F, 4500‑Cl G, 4500‑Cl H, and 4500‑Cl I. These appear in this Section as SM 4500‑Cl D (93), SM 4500‑Cl E (93), SM 4500‑Cl F (93), SM 4500‑Cl G (93), SM 4500‑Cl H (93), and SM 4500‑Cl I (93).

Standard Methods Online, Methods 4500‑Cl D-00, 4500‑Cl E-00, 4500‑Cl F-00, 4500‑Cl G-00, 4500‑Cl H-00, and 4500‑Cl I-00 appear in the 21st, 22nd, and 23rd editions as Methods 4500‑Cl D, 4500‑Cl E, 4500‑Cl F, 4500‑Cl G, 4500‑Cl H, and 4500‑Cl I. These appear in this Section as SM 4500‑Cl D (00), 4500‑Cl E (00), 4500‑Cl F (00), 4500‑Cl G (00), 4500‑Cl H (00), and 4500‑Cl I (00).

Standard Methods Online, Methods 4500‑ClO2 D-93 and 4500‑ClO2 E-93 appear in the 19th and 20th editions as Methods 4500‑ClO2 D and 4500‑ClO2 E. These appear in this Section as SM 4500‑ClO2 D (93) and SM 4500‑ClO2 E (93).

Standard Methods Online, Methods 4500‑ClO2 D-00 and 4500‑ClO2 E-00 appear in the 21st, 22nd, and 23rd editions as Methods 4500‑ClO2 D and 4500‑ClO2 E. These appear in this Section as SM 4500‑ClO2 D (00) and SM 4500‑ClO2 E (00).

Standard Methods Online, Methods 5310 B-00, 5310 C-00, and 5310 D-00 appear in the 21st and 22nd editions as Methods 5310 B, 5310 C, and 5310 D. These appear in this Section as SM 5310 B (00), SM 5310 C (00), and SM 5310 D (00).

Standard Methods Online, Method 5910 B-00 appears in the 21st edition as Method 5910 B. This appears in this Section as SM 5910 B (00).

Standard Methods Online, Method 5910 B-11 appears in the 22nd edition as Method 5910 B. This appears in this Section as SM 5910 B (11).

Standard Methods Online, Method 6251 B-94 appears in the 19th, 20th, and 21st editions as Method 6251 B. This appears in this Section as SM 6251 B (94).

Standard Methods Online, Method 6251 B-07 appears in the 22nd and 23rd editions as Method 5910 B. This appears in this Section as SM 6251 B (07).

(Source: Amended at 47 Ill. Reg. 16486, effective November 2, 2023)