

**3745-81-27 Analytical techniques.**

- (A) Inorganic chemical analyses conducted to determine compliance with rules 3745-81-11, 3745-81-23, 3745-81-80 to 3745-81-86, 3745-81-88, and 3745-83-01 of the Administrative Code shall be performed by a laboratory certified by the director pursuant to Chapter 3745-89 of the Administrative Code unless otherwise specified and shall be made in accordance with methods listed in this rule for the chemicals being analyzed. Inorganic chemical analyses required by rule 3745-81-87 of the Administrative Code also shall be made in accordance with methods listed in this rule for the chemicals being analyzed but do not require that the laboratory be certified pursuant to Chapter 3745-89 of the Administrative Code. Many of these inorganic chemical analysis methods are described in books and manuals referred to in this paragraph as "Standard Methods," "Standard Methods Online," "Technical Notes," EMSL94, and EMSL93. The United States environmental protection agency (or USEPA) books and manuals are available from the "National Technical Information Service (or NTIS), United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161," with telephone number 800-553-6847. USEPA books and manuals are also available from the "National Service Center for Environmental Publications (or NSCEP), P.O. Box 42419, Cincinnati, Ohio 45242-0419," or <http://www.epa.gov/nscep>.

"Standard Methods" stands for the eighteenth, nineteenth, twentieth, twenty-first or twenty-second editions of "Standard Methods for the Examination of Water and Wastewater, by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 1992, 1995, 1998, 2006 and 2012, respectively." "Standard Methods Online" stands for online versions of "Standard Methods for the Examination of Water and Wastewater." These methods can be found at [www.standardmethods.org](http://www.standardmethods.org). The year in which each method was approved by the standard methods committee is designated by the last two digits in the method number. Frequently quoted methods of analysis for metals include method 3111 (atomic absorption spectrometry-direct aspiration flame), method 3113 (electrothermal atomic absorption spectrometry), method 3120 (inductively coupled plasma-emission spectroscopy), and method 4110 B (anion chromatography).

"Technical Notes" stands for "Technical Notes on Drinking Water Methods," dated October 1994 and designated EPA/600/R-94/173, by the "United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268," available from NTIS as PB95-104766. "Technical Notes" contains mandatory and recommended modifications for some analytical methods included in this paragraph; criteria for analyzing arsenic, barium, beryllium, cadmium, calcium, chromium, copper, lead, nickel, selenium, sodium, and thallium with digestion or directly without digestion; and additional information pertinent to analysis of contaminants in drinking water.

"EMSL94" stands for "Methods for the Determination of Metals in Environmental Samples - Supplement I," dated May 1994 and designated EPA-600/R-94/111, by

the "United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory-Cincinnati," available to government agencies from "ORD Publications, 26 West MLK Drive, Cincinnati Ohio 45268-1072," with telephone number 513-569-7562, and generally available from the NTIS with designation PB94-18942. Frequently quoted methods of analyses for metals include method 200.7 Rev. 4.4 (1994) (inductively coupled plasma-atomic emission spectrometry), method 200.8 Rev. 5.4 (1994) (inductively coupled plasma-mass spectrometry), and method 200.9 Rev. 2.2 (1994) (stabilized temperature graphite furnace atomic absorption spectrometry).

"EMSL93" stands for "Methods for the Determination of Inorganic Substances in Environmental Samples," dated August 1993 and designated EPA/600/R-93/100, by the "United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, Ohio 45268," available from NTIS as PB94-120821. Method 300.0 (inorganic anion determination by ion chromatography) is frequently quoted.

"EPA method 335.4" stands for "USEPA Method 335.4, Determination of Total Cyanide by Semi-Automated Colorimetry, Revision 1.0," dated August 1993 and designated EPA/600/R-93/100, available from NTIS as PB94-120821.

"Methods for the Determination of Inorganic Substances in Environmental Samples," dated August 1993, designated EPA/600/R-93/100 and available from NTIS as PB94-120821. This manual includes methods 353.2 and 335.4.

"EPA method 200.5" stands for "USEPA Method 200.5, Determination of Trace Elements in Drinking Water by Axially Viewed Inductively Coupled Plasma - Atomic Emission Spectrometry (AVICP-AES), Revision 4.2," dated October 2003 and designated EPA/600/R-06/115, available from USEPA's, "National Exposure Research Laboratory (NERL)."

Methods which have been determined to be equivalent to an approved method, by "USEPA Alternative Test Procedure (ATP) program at the Office of Ground Water and Drinking Water's Technical Support Center (OGWDW/TSC)," may be used for compliance monitoring. Equivalent methods will be referenced as the method is listed in rule 3745-81-27 with no special notation. The letter of equivalence issued by USEPA's ATP program at OGWDW/TSC must be maintained by the certified laboratory and be available for verification.

- (1) Aluminum: "Standard Methods" section 3111 D (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 D-99 or 3113 B-10 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (2) Antimony: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or "Standard Methods Online" section 3113 B-10

- or EMSL94 method 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (3) Arsenic: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) (atomic absorption furnace) or 3114 B (eighteenth, nineteenth, twenty-first, twenty-second) (hydride atomic absorption) as modified in "Technical Notes" or "Standard Methods Online" section 3113 B10 or 3114 B-97 or EMSL94 method 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (4) Asbestos: "Technical Notes" method 100.1 and "Analytical Method for Determination of Asbestos Fibers in Water," EPA-600/4-83-043, September 1983, "United States Environmental Research Laboratory, Athens, Georgia 30613," available from NTIS as PB83-260471, or method 100.2, "Determination of Asbestos Structures Over 10  $\mu$ M in Length in Drinking Water," EPA/600/R-94/134, June 1994, available from NTIS as PB94-201902.
  - (5) Barium: "Standard Methods" section 3111 D (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (twenty-first, twenty-second) or "Standard Methods Online" section 3111 D-99 or 3113 B-10 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (6) Beryllium: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3113 B-10 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (7) Bromate: EPA method 300.1 Rev. 1.0 or 317.0 Rev. 2.0 or 302.0 or 326.0 Rev. 1.0 or 321.8 or 557. EPA methods 300.1 Rev. 1.0 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 Rev 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 Rev 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 302.0, "Determination of Bromate in Drinking Waters using Two-Dimensional Ion Chromatography with Suppressed Conductivity Detection," September 2009 (EPA 815-B-09-014) and EPA method 557, "Determination of Haloacetic Acids, Bromate and Dalapon in Drinking Water by Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry," August 2009 (EPA 815-B-09-012) may be used for the routine determination of bromate in drinking water and for reduced bromate monitoring. Copies of EPA method 302.0 and

- EPA method 557 can be accessed and downloaded on-line at [http://epa.gov/safewater/methods/analyticalmethods\\_ogwdw.html](http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html). EPA methods 317.0 Rev 2.0, or 326.0 or 321.8 must be used for monitoring of bromate for purposes of demonstrating eligibility of reduced monitoring, as prescribed in paragraph (L)(6) of rule 3745-81-23 of the Administrative Code. EPA method 321.8 samples must be preserved at the time of sampling with fifty milligrams of ethylenediamine (EDA)/L of sample and must be analyzed within twenty-eight days. EPA method 317.0 Rev. 2.0, 326.0 Rev. 1.0 or 321.8 shall be used to qualify for reduced monitoring according to paragraph (L)(5) of rule 3745-81-23 of the Administrative Code, and laboratories using these methods must be able to meet minimum reporting limits as listed in Appendix B to rule 3745-89-03 of the Administrative Code.
- (8) Bromide: EMSL93 method 300.0 Rev. 2.1 or EPA method 300.1 Rev. 1.0 or EPA method 317.0 Rev 2.0 or EPA method 326.0 Rev. 1.0. "EPA method 300.1" stands for "USEPA Method 300.1, Determination of Inorganic Anions in Drinking Water by Ion Chromatography, Revision 1.0," dated 1997 and designated EPA/600/R-98/118, available from NTIS as PB98-169196.
  - (9) Cadmium: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or "Standard Methods Online" section 3113 B-10 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (10) Calcium: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 3500 Ca D (eighteenth, nineteenth, twentieth) (EDTA titrimetric method) or 3500 Ca B (twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-99 or 3120 B-99 or 3500 Ca D-97 or EMSL94 method 200.7 Rev. 4.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (11) Chloride: "Standard Methods" section 4500-Cl<sup>-</sup> B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second)(argentometric) or 4110 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-Cl<sup>-</sup> D (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (potentiometric) or "Standard Methods Online" 4500-CIB-97 or 4110 B-00 or 4500 CID-97 or EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0.
  - (12) Chlorite: "Standard Methods" section 4500-ClO<sub>2</sub> E (nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 4500-ClO<sub>2</sub> E-00 or EPA method 327.0 Rev. 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 may be used for routine daily monitoring of chlorite at the entrance of the distribution system. This analysis shall be performed by persons acceptable to the director. "ChlordioX Plus, Chlorine Dioxide and Chlorite in Drinking Water by Amperometry using Disposable Senosrs," November

2013. This analysis may be used for routine daily monitoring of chlorite at the entrance of the distribution system. EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0 or 317.0 Rev. 2.0 or 326.0 Rev. 1.0 shall be used for routine monthly monitoring of chlorite and additional monitoring of chlorite in the distribution system. This analysis shall be performed by a laboratory certified by the director according to Chapter 3745-89 of the Administrative Code.

- (13) Chromium: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) as modified in "Technical Notes" or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3113 B-10 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (14) Copper: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-10 or 3113 B-99 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994). In addition, untreated raw water may be analyzed by "Standard Methods" section 3500-Cu E (eighteenth, nineteenth, twentieth) or "Standard Methods Online" 3500-Cu E-99) (bathocuproine) or EPA method 200.5 Rev. 4.2 (2003).
- (15) Cyanide: manual distillation by "Standard Methods" section 4500-CN<sup>-</sup> C (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) followed by "Standard Methods" section 4500-CN<sup>-</sup> E (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (colorimetric) or 4500-CN<sup>-</sup> F (eighteenth, nineteenth, twentieth, twenty-first, twenty-second)(selective electrode) or 4500-CN<sup>-</sup> G (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (amenable to chlorination) or "Standard Methods Online" section 4500-CN<sup>-</sup> E-99 or 4500-CN<sup>-</sup> F-99 or 4500-CN<sup>-</sup> G-99 or EPA method 335.4 Rev. 1.0 or Lachat QuikChem 10-204-00-1-X or Kelada 01 Rev. 1.2 or OIA-1677, DW. Some mandatory method modifications are given in "Technical Notes."
- (16) Fluoride: "Standard Methods" section 4110 B (eighteenth, nineteenth, twentieth, twenty-first) or 4500-F<sup>-</sup> C (eighteenth, nineteenth, twentieth, twenty-first) (ion-selective electrode) or 4500-F<sup>-</sup> E (eighteenth, nineteenth, twentieth, twenty-first)(automated Alizarin), or "Standard Methods Online" section 4110 B-00 or 4500-F<sup>-</sup> C-97 or 4500-F<sup>-</sup> E-97 or EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0, or "Technicon Industrial Systems" method 380-75WE (February 1976) or 129-71W (December 1972), available from "Technicon Industrial Systems, Tarrytown NY 10591."
- (17) Iron: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first) or 3500-Fe D (eighteenth, nineteenth, twentieth) (phenanthroline) or "Standard Methods

- Online" section 3111 B-99 or 3113 B-10 or 3120 B-99 or 3500-Fe D-97 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (18) Lead: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or "Standard Methods Online" section 3113 B-10 or EMSL94 method 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (19) Manganese: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 3500-Mn D (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (persulfate) or "Standard Methods Online" section 3111 B-99 or 3113 B-10 or 3120 B-99 or 3500-Mn D-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (20) Magnesium: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 3500-Mg B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-99 or 3120 B-99 or 3500-Mg B-97 or EMSL 94 method 200.7 Rev. 4.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (21) Mercury: "Standard Methods" section 3112 B (eighteenth, nineteenth, twenty-first, twenty-second) (cold-vapor atomic absorption spectrometry) or "Standard Methods Online" section 3112 B-99 or EMSL94 method 200.8 Rev. 5.4 (1994) or 245.1 Rev. 3.0 (manual cold vapor technique) or EMSL93 method 245.2 (automated cold vapor technique).
- (22) Nickel: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-99 or 3113 B-10 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (23) Nitrate: "Standard Methods" section 4110 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (ion chromatography) or 4500-NO<sub>3</sub><sup>-</sup> D (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (nitrate electrode) or 4500-NO<sub>3</sub><sup>-</sup> E (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (cadmium reduction) or 4500-NO<sub>3</sub><sup>-</sup> F (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (automated cadmium reduction), or "Standard Methods Online" section 4110 B-00 or 4500-NO<sub>3</sub><sup>-</sup> D-00 or 4500-NO<sub>3</sub><sup>-</sup> E-00 or 4500-NO<sub>3</sub><sup>-</sup> F-00, or EPA Method 300.0 Rev. 2.1 or 300.1 Rev. 1.0 or 353.2 Rev. 2.0 (cadmium reduction automated colorimetric), or method B-1011, "Waters Test Method for Determination of Nitrite/Nitrate in Water

- Using Single Column Ion Chromatography, August 1987." Copies may be obtained from Waters Corporation, Technical Services Division, 34 Maple Street, Millford, MA 01757-3696, 800-252-4752, or D6508 Rev. 2.0, "Waters Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte." Copies may be obtained from Waters Corp, 34 Maple St., Milford, MA, 01757-3696, 800-252-4752. "Systea Easy (1-Reagent) Nitrate Method" can be downloaded from the "National Environmental Methods Index (NEMI)" at <http://www.nemi.gov>, or obtained from "Systea Scientific, LLC, 900 Jorie Blvd., Suite 35, Oaks Brook, IL 60523, or by telephone at 630-645-0600."
- (24) Nitrite: "Standard Methods" section 4110 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (ion chromatography) or 4500-NO<sub>2</sub><sup>-</sup>B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (colorimetric) or 4500-NO<sub>3</sub><sup>-</sup>E (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (cadmium reduction) or 4500-NO<sub>3</sub><sup>-</sup>F (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (automated cadmium reduction), or "Standard Methods Online" section 4110 B-00 or 4500-NO<sub>2</sub><sup>-</sup> B-00 or 4500-NO<sub>3</sub><sup>-</sup> E-00 or 4500-NO<sub>3</sub><sup>-</sup> F-00, or EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0 or 353.2 Rev. 2.0 (cadmium reduction automated colorimetric), or method B-1011, "Waters Test Method for Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography, August 1987." Copies may be obtained from "Waters Corporation, Technical Services Division, 34 Maple Street, Millford, MA 01757-3696, 800-252-4752, or D6508 Rev. 2.0," "Waters Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte." Copies may be obtained from "Waters Corp, 34 Maple St., Milford, MA, 01757-3696, 800-252-4752." "Systea Easy (1-Reagent) Nitrate Method, February 4, 2009" can be downloaded from the "National Environmental Methods Index (NEMI)" at <http://www.nemi.gov>, or obtained from "Systea Scientific, LLC, 900 Jorie Blvd., Suite 35, Oaks Brook, IL 60523, or by telephone at 630-645-0600."
- (25) Orthophosphate: "Standard Methods" section 4110 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-P E (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) (ascorbic acid) or 4500-P F (eighteenth, nineteenth, twentieth, twenty-first, twenty-second)(automated ascorbic acid reduction), or "Standard Methods Online" section 4110 B-00 or 4500-P E-99 or 4500 P F-99 or EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0 or method D6508 Rev. 2.0, "Waters Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte". Copies may be obtained from Waters Corp, 34 Maple St., Milford, MA, 01757-3696, 800-252-4752."
- (26) Selenium: "Standard Methods" section 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3114 B (eighteenth, nineteenth, twenty-first, twenty-second) (hydride generation/atomic absorption spectrometric) as modified in "Technical Notes" or "Standard Methods Online" 3113 B-10 or

- 3114 B-99 or EMSL94 method 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (27) Silica: "Standard Methods" section 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-Si D (eighteenth, nineteenth) (molybdosilicate) or 4500-Si E (eighteenth, nineteenth) (heteropoly blue) or 4500-Si F (eighteenth, nineteenth) (automated for molybdate-reactive silica) or 4500 SiO<sub>2</sub>-C (twentieth, twenty-first, twenty-second) or 4500 SiO<sub>2</sub>-D (twentieth, twenty-first, twenty-second) or 4500 SiO<sub>2</sub>-E (twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3120 B-99 or 4500 SiO<sub>2</sub> C-97 or 4500 SiO<sub>2</sub> D-97 or 4500 SiO<sub>2</sub> E-97 or EMSL94 method 200.7 Rev. 4.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (28) Silver: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3113 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-99, 3113 B-10 or 3120 B-99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994) or EPA method 200.5 Rev. 4.2 (2003).
- (29) Sodium: "Standard Methods" section 3111 B (twenty-first, twenty-second) or EPA method 200.5 Rev. 4.2 (2003).
- (30) Sulfate: "Standard Methods" section 4110 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-SO<sub>4</sub><sup>2-</sup> C and D (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-SO<sub>4</sub><sup>2-</sup> F (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or 4500-SO<sub>4</sub><sup>2-</sup> E (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 4110 B-00 or 4500 SO<sub>4</sub> C-97 or 4500 SO<sub>4</sub> D-97 or 4500 SO<sub>4</sub> F-97 or 4500 SO<sub>4</sub> E-97 or EPA method 300.0 Rev. 2.1 or 300.1 Rev. 1.0, or 375.2 (automated colorimetry) or method D6508 Rev. 2.0, "Waters Test Method for Determination of Dissolved Inorganic Anions in Aqueous Matrices Using Capillary Ion Electrophoresis and Chromate Electrolyte." Copies may be obtained from "Waters Corp, 34 Maple St., Milford, MA, 01757-3696, 800-252-4752."
- (31) Temperature: "Standard Methods" section 2550 (twenty-first, twenty-second) or "Standard Methods Online" section 2550-10.
- (32) Thallium: EMSL94 method 200.8 Rev. 5.4 (1994) or 200.9 Rev. 2.2 (1994).
- (33) Total Phosphorous: "Standard Methods" section 4500-P B (eighteenth, nineteenth, twentieth, twenty-first) with 4500-P E (eighteenth, nineteenth, twentieth, twenty-first) or 4500-P F (eighteenth, nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 4500 P E-99 or 4500 P F-99.
- (34) Zinc: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first, twenty-second) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first, twenty-second) or "Standard Methods Online" section 3111 B-99 or 3120 B-

99 or EMSL94 method 200.7 Rev. 4.4 (1994) or 200.8 Rev. 5.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).

- (B) Organic chemical sampling and analyses, as required by rule 3745-81-24 of the Administrative Code, shall use the following procedures. Analyses shall be performed by a laboratory certified by the director pursuant to Chapter 3745-89 of the Administrative Code. Procedures for many of these specified organic chemical analyses are included in manuals prepared by the "Environmental Monitoring Systems Laboratory-Cincinnati of the United States Environmental Protection Agency (USEPA)." These manuals may be purchased from the "National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161," with telephone number 800-553-6847. They are also available to government agencies from "ORD Publications, 26 West MLK Drive, Cincinnati, Ohio 45268-1072," with telephone number 513-569-7562. USEPA books and manuals are also available from the "National Service Center for Environmental Publications (or NSCEP), P.O. Box 42419, Cincinnati, Ohio 45242-0419," or <http://www.epa.gov/nscep>.

Methods which have been determined to be equivalent to an approved method, by USEPA Alternative Test Procedure (ATP) program at the Office of Ground Water and Drinking Water's Technical Support Center (OGWDW/TSC), may be used for compliance monitoring. Equivalent methods will be referenced as the method is listed in this rule with no special notation. The letter of equivalence issued by USEPA's ATP program at OGWDW/TSC must be maintained by the certified laboratory and be available for verification.

One manual is "Methods for the Determination of Organic Compounds in Drinking Water, dated December 1988 (Revised July 1991), designated EPA/600/4-88/039R and available from NTIS as PB91-231480." This manual includes currently approved USEPA analysis methods 505, 507, 508, 508A, 515.1, and 531.1.

Another manual is "Methods for the Determination of Organic Compounds in Drinking Water-Supplement I, dated July 1990, designated EPA/600/4-90/020," and available from NTIS as PB91-146027. This manual includes currently approved USEPA analysis methods 547, 550, and 550.1.

A third manual is named "Methods for the Determination of Organic Compounds in Drinking Water-Supplement II," dated August 1992, designated EPA/600/R-92/129, available from NTIS as PB92-207703, and containing methods 515.2, 548.1, 549.1, 552.1 Rev. 1.0, and 555.

A fourth manual is named "Methods for the Determination of Organic Compounds in Drinking Water-Supplement III," dated August 1995, designated EPA/600/R-95/131, available from NTIS as PB95-261616, and containing methods 502.2 Rev. 2.1, 504.1, 508.1, 524.2, 525.2, 551.1 Rev. 1.0, and 552.2 Rev. 1.0.

A fifth manual is named "Methods for the Determination of Organic and Inorganic

Compounds in Drinking Water," dated August 2000, designated EPA 815-R-00-014, available from the "National Service Center for Environmental Publications (NSCEP)," P.O. Box 42419, Cincinnati, OH 45242-0419, telephone number 800-490-9198. This manual includes currently approved USEPA methods 515.3 and 549.2.

"Technical Notes" stands for "Technical Notes on Drinking Water Methods", dated October 1994 and designated "EPA/600/R-94/173, by the United States Environmental Protection Agency, Environmental Monitoring Systems Laboratory, Cincinnati, OH 45268," available from NTIS as PB95-104766. "Technical Notes" contains mandatory and recommended modifications for some of the analytical methods referred to in this paragraph and also includes additional information pertinent to analysis of contaminants in drinking water.

USEPA method 1613, "Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope-Dilution HRGC/HRMS," designated EPA-821-B-94-005 and dated October 1994, available from NTIS as PB95-104774. Copies may be obtained from NTIS, 5285 Port Royal Road, Springfield, VA 22161, Phone: 703-605-6000 or 800-553-6847.

USEPA method 524.3 Version 1.0, "Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry," designated EPA 815-B-09-009 and dated June 2009, available at [http://epa.gov/safewater/methods/analyticalmethods\\_ogwdw.html](http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html).

Other sources of methods are the eighteenth, nineteenth, twentieth, twenty-first and twenty-second editions of "Standard Methods For the Examination of Water and Wastewater; by American Public Health Association, American Water Works Association, and Water Environment Federation"; dated 1992, 1995, 1998, 2006 and 2012, respectively; designated "Standard Methods"; and containing method 6651 which is pertinent to this paragraph. The eighteenth edition supplement was copyrighted in 1994 and contains method 6610 which is pertinent to this paragraph. Also, "Standard Methods Online" stands for online versions of "Standard Methods for the Examination of Water and Wastewater." These methods can be found at [www.standardmethods.org](http://www.standardmethods.org). The year in which each method was approved by the standard methods committee is designated by the last two digits in the method number.

- (1) Sampling and analyses for total trihalomethanes made to determine compliance with rules 3745-81-12 and 3745-81-24 of the Administrative Code shall be conducted by a method listed in paragraphs (B)(1)(a) to (B)(1)(c) of this rule. Samples for total trihalomethanes shall be dechlorinated upon collection to prevent further production of trihalomethanes, according to the procedures described in the following methods.
  - (a) USEPA method 502.2 Rev. 2.1, "Volatile Organic Compounds in Water by Purge and Trap Capillary Gas Chromatography with Photoionization and Electrolytic Conductivity Detector in Series." A photoionization

detector (PID) is not required if total trihalomethanes are the only analytes measured in the sample.

- (b) USEPA method 524.2 Rev. 4.1, 524.3 Version 1.0 or 524.4, "Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry."
  - (c) USEPA method 551.1 Rev. 1.0, "Determination of Chlorination Disinfection Byproducts, Chlorinated Solvents and Halogenated Pesticides/Herbicides in Drinking Water by Liquid-Liquid Extraction and Gas Chromatography with Electron-Capture Detection."
- (2) Sampling and analysis for haloacetic acids (five) made to determine compliance with rules 3745-81-12 and 3745-81-24 of the Administrative Code shall be conducted by one of the following methods:
- (a) USEPA method 552.1 Rev. 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Ion Exchange Liquid-Solid Extraction and Gas Chromatography with Electron Capture Detection." The samples must be extracted within fourteen days of sample collection.
  - (b) USEPA method 552.2 Rev. 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Extraction, Derivatization and Gas Chromatography with Electron Capture Detection."
  - (c) USEPA method 552.3, Rev 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.
  - (d) USEPA method 557, "Determination of Haloacetic Acids, Bromate and Dalapon in Drinking Water by Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (USEPA 2009e)," may be used for determining HAA5 in drinking water. A copy of this method can be accessed and downloaded on-line at [http://epa.gov/safewater/methods/analyticalmethods\\_ogwdw.html](http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html).
  - (e) "Standard Methods," 6251 B (nineteenth, twentieth, twenty-first, twenty-second). The samples must be extracted within fourteen days of sample collection.
  - (f) "Standard Methods Online," 6251 B-07.
- (3) Organic chemical analyses required by rule 3745-81-24 of the Administrative Code shall be conducted using the following United States environmental protection agency methods or their equivalent as approved by the United States environmental protection agency and the director. The following methods are contained in one of the manuals listed in paragraph (B) of this rule:

- (a) USEPA method 502.2 Rev. 2.1, "Volatile Organic Compounds in Water by Purge and Trap Capillary Gas Chromatography with Photoionization and Electrolytic Conductivity Detector in Series," as modified in "Technical Notes," may be used for analyzing for all the compounds referred to in paragraph (B)(3) of this rule.
  - (b) USEPA method 524.2 Rev. 4.1, "Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry," as modified in "Technical Notes" or USEPA method 524.3 Version 1.0 or USEPA method 524.4, may be used for analyzing for all the compounds referred to in paragraph (B)(3) of this rule.
  - (c) USEPA method 504.1, "1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (123TCP) in Water By Microextraction and Gas Chromatography," may be used for analyzing 1,2,3-trichloropropane.
  - (d) USEPA method 551.1 Rev. 1.0, "Determination of Chlorination Disinfection Byproducts, Chlorinated Solvents and Halogenated Pesticides/Herbicides in Drinking Water by Liquid-Liquid Extraction and Gas Chromatography with Electron-Capture Detection," may be used for analyzing bromodichloromethane, bromoform, carbon tetrachloride, chlorodibromomethane, chloroform, tetrachloroethylene, 1,1,1-trichloroethane, and trichloroethylene.
- (4) Organic chemical analyses required in rule 3745-81-24 of the Administrative Code shall be conducted using the following approved methods:
- (a) USEPA method 314.0, "Determination of Perchlorate in Drinking Water using Ion Chromatography." Method 314.0 may be used for the determination of perchlorate in reagent water, surface water, ground water, and finished drinking water using ion chromatography.
  - (b) USEPA method 504.1, "1,2-Dibromoethane (EDB), 1,2-Dibromo-3-chloropropane (DBCP), and 1,2,3-Trichloropropane (123TCP) in Water by Microextraction and Gas Chromatography." Method 504.1 may be used to measure 1,2-dibromo-3-chloropropane (dibromochloropropane or DBCP) and 1,2-dibromoethane (ethylene dibromide or EDB).
  - (c) USEPA method 505, "Analysis of Organohalide Pesticides and Commercial Polychlorinated Biphenyl Products (Aroclors) in Water by Microextraction and Gas Chromatography." Method 505 may be used to measure alachlor, atrazine, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene, lindane, methoxychlor, simazine, and toxaphene. Method 505 may also be used as a screen for polychlorinated biphenyls (PCBs). When any aroclor (PCB) listed in rule 3745-81-24 of the Administrative Code is found to be present in a concentration of 0.0001 milligram per liter or more, the

sample shall be reanalyzed by method 508A to provide quantitative results for polychlorinated biphenyl concentrations in the water sample.

- (d) USEPA method 507, "Determination of Nitrogen- and Phosphorus-Containing Pesticides in Ground Water by Gas Chromatography with a Nitrogen-Phosphorus Detector." Method 507 may be used to measure alachlor, atrazine, and simazine.
- (e) USEPA method 508, "Determination of Chlorinated Pesticides in Water by Gas Chromatography with an Electron Capture Detector." Method 508 may be used to measure chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene (when "Technical Notes" requirement is met), lindane, methoxychlor, and toxaphene. Method 508 may also be used as a screen for polychlorinated biphenyls (PCBs). When any aroclor (PCB) listed in rule 3745-81-24 of the Administrative Code is found to be present in a concentration of 0.0001 milligram per liter or more, the sample shall be reanalyzed by method 508A to provide quantitative results for polychlorinated biphenyl concentrations in the water sample.
- (f) USEPA method 508.1, "Determination of Chlorinated Pesticides, Herbicides, and Organohalides by Liquid-Solid Extraction and Electron Capture Gas Chromatography." Method 508.1 may be used to measure alachlor, aldrin, atrazine, chlordane, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene, lindane, methoxychlor, and simazine.
- (g) USEPA method 508A, "Screening for Polychlorinated Biphenyls by Perchlorination and Gas Chromatography." Method 508A is used to quantitate polychlorinated biphenyls as decachlorobiphenyl if one or more aroclor(s) (or PCBs) are detected in analysis by method 505, 508, or 508.1.
- (h) USEPA method 515.1, "Determination of Chlorinated Acids in Water by Gas Chromatography with an Electron Capture Detector" as revised May 1991. An alternate derivatization is given in "Technical Notes." Method 515.1 may be used to measure 2,4-D, dalapon, dinoseb, pentachlorophenol, picloram, and 2,4,5-TP (Silvex).
- (i) USEPA method 515.2, "Determination of Chlorinated Acids in Water Using Liquid-Solid Extraction and Gas Chromatography With an Electron Capture Detector." An alternate derivatization is given in "Technical Notes." Method 515.2 may be used to measure 2,4-D, dinoseb, pentachlorophenol, picloram, and 2,4,5-TP (Silvex).
- (j) USEPA method 515.3, "Determination of Chlorinated Acids in Drinking Water by Liquid-Liquid Extraction, Derivatization and Gas Chromatography with Electron-Capture Detection" may be used to

measure 2,4-D, 2,4,5-TP, dalapon, dinoseb, pentachlorophenol, and picloram.

- (k) USEPA method 525.2, "Determination of Organic Compounds in Drinking Water by Liquid-Solid Extraction and Capillary Column Gas Chromatography/Mass Spectrometry" as revised March 1994. Method 525.2 may be used to measure alachlor, atrazine, chlordane, di(2-ethylhexyl) adipate, di(2-ethylhexyl) phthalate, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene, lindane, methoxychlor, pentachlorophenol, polynuclear aromatic hydrocarbons (including benzo(a)pyrene), simazine, and toxaphene.
- (l) USEPA method 531.1, "Measurement of N-Methyl Carbamoyloximes and N-Methyl Carbamates in Water by Direct Aqueous Injection HPLC with Post-Column Derivatization." Sample storage requirements are modified in "Technical Notes." Method 531.1 may be used to measure carbofuran and oxamyl.
- (m) USEPA method 531.2, "Measurement of N-Methylcarbamoyloximes and N-Methylcarbamates in Water by Direct Aqueous Injection HPLC with Postcolumn Derivatization."
- (n) USEPA method 547, "Determination of Glyphosate in Drinking Water by Direct-Aqueous-Injection HPLC, Post-Column Derivatization, and Fluorescence Detection." Method 547 may be used to measure glyphosate.
- (o) USEPA method 548.1, "Determination of Endothall in Drinking Water by Aqueous Derivatization, Liquid-Solid Extraction, and Gas Chromatography with Electron-Capture Detection." Method 548.1 may be used to measure endothall.
- (p) USEPA method 549.2, "Determination of Diquat and Paraquat in Drinking Water by Liquid-Solid Extraction and HPLC with Ultraviolet Detection." Sample bottle requirements are modified in "Technical Notes." Method 549.2 may be used to measure diquat.
- (q) USEPA method 550, "Determination of Polycyclic Aromatic Hydrocarbons in Drinking Water by Liquid-Liquid Extraction and HPLC with Coupled Ultraviolet and Fluorescence Detection." Method 550 may be used to measure polynuclear aromatic hydrocarbons, including benzo(a)pyrene.
- (r) USEPA method 550.1, "Determination of Polycyclic Aromatic Hydrocarbons in Drinking Water by Liquid-Solid Extraction and HPLC with Coupled Ultraviolet and Fluorescence Detection." Method 550.1 may be used to measure polynuclear aromatic hydrocarbons, including benzo(a)pyrene.

- (s) USEPA method 551.1, "Determination of Chlorination Disinfection Byproducts, Chlorinated Solvents and Halogenated Pesticides/Herbicides in Drinking Water by Liquid-Liquid Extraction and Gas Chromatography with Electron-Capture Detection." Method 551.1 may be used to measure 1,2-dibromo-3-chloropropane (dibromochloropropane or DBCP), 1,2-dibromoethane (ethylene dibromide or EDB), alachlor, atrazine, endrin, heptachlor, heptachlor epoxide, hexachlorobenzene, hexachlorocyclopentadiene, lindane, methoxychlor and simazine.
- (t) USEPA method 552.1 Rev. 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Ion Exchange Liquid-Solid Extraction and Gas Chromatography With Electron Detection." Method 552.1 may be used to measure dalapon.
- (u) USEPA 552.2 Rev. 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Extraction, Derivatization and Gas Chromatography with Electron-Capture Detection," may be used to measure dalapon.
- (v) USEPA 552.3 Rev. 1.0, "Determination of Haloacetic Acids and Dalapon in Drinking Water by Liquid-Liquid Microextraction, Derivatization, and Gas Chromatography with Electron Capture Detection."
- (w) USEPA method 555, "Determination of Chlorinated Acids in Water by High Performance Liquid Chromatography With a Photodiode Array Ultraviolet Detector." Method 555 may be used to measure 2,4-D, dicamba, dinoseb, pentachlorophenol, picloram, and 2,4,5-TP (Silvex).
- (x) USEPA method 1613, "Tetra- through Octa-Chlorinated Dioxins and Furans by Isotope-Dilution HRGC/HRMS." Method 1613 may be used to measure the compounds in its title, including 2,3,7,8-TCDD (2,3,7,8-tetrachlorodibenzo-p-dioxin or dioxin).
- (y) "Standard Methods" and "Standard Methods Online" supplement method 6610 (nineteenth, twentieth, twenty-first, twenty-second), "Carbamate Pesticides High-Performance Liquid Chromatographic Method." Sample storage requirements are modified in "Technical Notes." This method 6610 may be used to measure carbofuran and oxamyl.
- (z) "Standard Methods" section 6651 (nineteenth, twentieth, twenty-first, twenty-second) and "Standard Methods Online" 6551 B-10, "Glyphosate Herbicide Liquid Chromatographic Postcolumn Fluorescence Method." Method 6651 may be used to measure glyphosate.
- (aa) "Standard Methods" section 6440 B (twenty-first and twenty-second) and "Standard Methods Online" 6440 B-06 may be used to measure 2, 4-D, 2, 4, 5-TP (silvex), dalapon, dinoseb, pentachlorophenol and picloram.

- (bb) "Syngenta" method AG-625, "Atrazine in Drinking Water by Immunoassay." Copies may be obtained from "Syngenta Crop Protection, P.O. Box 18300, Greensboro, NC, 27419, 800-334-9481 x2368."
- (C) Analyses conducted to determine compliance with rules 3745-81-10, 3745-81-43, 3745-81-70 to 3745-81-74, and 3745-83-01 of the Administrative Code shall use the following methods. The analytical methods referred to as "Standard Methods" sections in paragraphs (C)(1) to (C)(3) of this rule are printed in the indicated sections of the nineteenth, twentieth and twenty-first editions of "Standard Methods for the Examination of Water and Wastewater, by the American Public Health Association, American Water Works Association, and Water Pollution Control Association, dated 1992, 1995, 1998 and 2006 respectively." "Standard Methods Online" stands for online versions of "Standard Methods for the Examination of Water and Wastewater." These methods can be found at [www.standardmethods.org](http://www.standardmethods.org). 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 method referred to as EMSL93 method 300.0 in paragraph (C)(4) of this rule may be found in the manual defined in paragraph (A) of this rule as EMSL93.

Methods which have been determined to be equivalent to an approved method, by "USEPA Alternative Test Procedure (ATP) program at the Office of Ground Water and Drinking Water's Technical Support Center (OGWDW/TSC)," may be used for compliance monitoring. Equivalent methods will be referenced as the method is listed in this rule with no special notation. The letter of equivalence issued by USEPA's ATP program at OGWDW/TSC must be maintained by the certified laboratory and be available for verification.

- (1) Residual disinfectant concentrations shall be analyzed by the following methods from "Standard Methods", subject to some corrections published in "Technical Notes" (defined in paragraph (A) of this rule):
- (a) Residual disinfectant concentrations for free chlorine and combined chlorine (chloramines) shall be measured by persons acceptable to the director. Residual disinfectant concentrations shall be measured by a method in section 4500-CI D (nineteenth, twentieth, twenty-first) (amperometric titration method) for free, combined, or total chlorine, section 4500-CI E (nineteenth, twentieth, twenty-first) for total chlorine (low-level amperometric titration method), section 4500-CI F (nineteenth, twentieth, twenty-first) (DPD ferrous titrimetric method) for free, combined or total chlorine, section 4500-CI G (nineteenth, twentieth, twenty-first) (DPD colorimetric method) for free, combined or total chlorine, section 4500-CI H (nineteenth, twentieth, twenty-first) (syringaldazine (FACTS) method) for free chlorine, section 4500-CI I (nineteenth, twentieth, twenty-first) (iodometric electrode technique) for total chlorine, or "Standard Methods Online" section 4500-CI D-00, section 4500-CI E-00, section 4500-CI F-00 section 4500-CI G-00,

section 4500-CI H-00, section 4500-CI I-00. Residual disinfectant concentrations may also be measured by Hach method 10260 (DPD colorimetric method) for free, total or combined chlorine. Hach method 10260, "Determination of Chlorinated Oxidants (Free and Total) in Water Using Disposable Planar Reagent-filled Cuvettes and Mesofluidic Channel Colorimetry," April 2013 is available from "Hach Company, 5600 Lindbergh Drive, P.O. Box 389, Loveland CO 80539" or at <http://www.hach.com>. Residual disinfectant concentrations for free chlorine and combined chlorine may also be measured by using DPD colorimetric test kits. A DPD colorimetric test kit acceptable to the director is one that uses electronic measurement of the color development. It shall also have a digital display of the result. DPD colorimetric test kits with an analog display are not acceptable for use. An acceptable DPD colorimetric test kit shall have a method detection limit of 0.1 mg/L. A written protocol for quantitative dilution of samples shall be kept on file. This protocol shall be approved by the director before a colorimeter is approved for use for determining compliance with the MRDL for total chlorine. Free or total chlorine must be measured for demonstrating compliance with the chlorine MRDL and combined chlorine, or total chlorine must be measured for demonstrating compliance with the chloramine MRDL.

- (b) Residual disinfectant concentrations for free and total chlorine may be measured by EPA method 334.0, "Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer," August 2009 (EPA 815-B-09-013). A copy of this method can be accessed and downloaded on-line at [http://epa.gov/safewater/methods/analyticalmethods\\_ogwdw.html](http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html). Residual disinfectant concentrations may also be measured by, "ChloroSense, Measurement of Free and Total Chlorine in Drinking Water," September 2009. A copy of this method can be downloaded from NEMI at <http://www.nemi.gov> or from "Palintest Ltd, 21 Kenton Lands Road, PO Box 18395, Erlanger, KY 41018."
- (c) Residual disinfectant concentrations for chlorine dioxide shall be measured by persons acceptable to the director and using a method in section 4500-CIO<sub>2</sub> C (nineteenth, twentieth, twenty-first) (amperometric method I) or section 4500-CIO<sub>2</sub> D (nineteenth, twentieth) (DPD method) or section 4500-CIO<sub>2</sub> E (nineteenth, twentieth, twenty-first)(amperometric method II), or "Standard Methods Online" section 4500-CIO<sub>2</sub> C-00 or 4500-CIO<sub>2</sub> E-00, or EPA Method 327.0 Rev. 1.1, or "ChlordioX Plus, Chlorine Dioxide and Chlorite in Drinking Water by Amperometry using Disposable Sensors," November 2013. "Available from Palintest Ltd., 1455 Jamike Avenue (Suite 100), Erlanger, KY 41014." An acceptable DPD colorimetric test kit may be used for determining chlorine dioxide by "Standard Methods" 4500-CIO<sub>2</sub>.

- (d) Residual disinfectant concentrations for ozone shall be measured by the method in section 4500-O<sub>3</sub> B (indigo colorimetric method) (twenty-first), or "Standard Methods Online" section 4500-O<sub>3</sub> B-97, or automated methods which are calibrated in reference to the results obtained by the indigo method on a regular basis, if approved by the director.
  - (2) Measurements of the plant control tests shall be conducted by a person designated on a valid laboratory certificate of approval as required under rule 3745-89-03 of the Administrative Code and using the following methods:
    - (a) Alkalinity: "Standard Methods" section 2320 (eighteenth, nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 2320 B-97 (alkalinity).
    - (b) Alkalinity Stability: "Standard Methods" section 2330 (eighteenth, nineteenth, twentieth) (Langelier's Index).
    - (c) pH: "Standard Methods" section 4500-H<sup>+</sup> B (eighteenth, nineteenth, twentieth, twenty-first), or "Standard Methods Online" section 4500-H<sup>+</sup> B-00 (pH value), or EPA method 150.1 (electrometric) or 150.2 (continuous monitoring electrometric).
    - (d) Total dissolved solids: "Standard Methods" section 2540 C (eighteenth, nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 2540 C-97 (total dissolved solids dried at one hundred eighty degrees Celsius).
- (3) Turbidity shall be measured by a person designated on a valid certificate of approval as required under rule 3745-89-03 of the Administrative Code and using "Standard Methods" section 2130 B (eighteenth, nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 2130 B-01 (nephelometric method); USEPA method 180.1 Rev. 2.0 (nephelometric) as described in "Methods for the Determination of Inorganic Substances in Environmental Samples, EPA-600/R-93-100, August 1993," which is available from the "National Technical Information Service (NTIS)" as PB94-120821; or "Great Lakes Instruments Method 2," November 2, 1992, with information available from "GLI International, Inc., P.O. Box 389, Loveland, Colorado 80539-0389, telephone number 800-227-4224." "Thermo Scientific's Orion Method AQ4500 (May 8, 2009)" can be downloaded from "National Environmental Methods Index (NEMI)" at <http://www.nemi.gov> or obtained from "Thermo Scientific, 166 Cummings Center, Beverly, MA 01915," 800-225-1480. "Mitchell Method M5271 and Mitchell Method M5331 (March 5, 2009)" can be downloaded from NEMI at <http://www.nemi.gov> or obtained from "Leck Mitchell, PHD, PE, 656 Independence Valley Dr., Grand Junction, CO 81507." "Hach" FilterTrak 10133 Rev 2.0, "Determination of Turbidity by Laser Nephelometry." Copies may be obtained from "Hach Co., P.O. Box 389, Loveland, CO 80539-0389, 800-227-4224." "AMI Turbiwell Method (SWAN Analytische Instrumente)," August 2009. A copy of the "AMI Turbiwell

Method" can be downloaded from NEMI at <http://www.nemi.gov> or obtained by contacting "Markus Bernasconi, SWAN Analytische Instrumente AG, Studbachstrasse 13, CH-8340 Hinwil, Switzerland." Some additional calibration information is given in "Technical Notes." Styrene divinyl benzene beads (e.g., AMCO-AEPA-1 or equivalent) and stabilized formazin (e.g., Hach StablCal™ or equivalent) are acceptable substitutes for formazin.

- (4) Analysis to determine compliance with rule 3745-81-77 of the Administrative Code shall be conducted by a person designated on a valid laboratory certificate of approval as required under rule 3745-89-03 of the Administrative Code and using the following methods:
- (a) Alkalinity: "Standard Methods" section 2320 B or U.S. geological survey method I-1030-85.
  - (b) Magnesium: "Standard Methods" section 3111 B (eighteenth, nineteenth, twenty-first) or 3120 B (eighteenth, nineteenth, twentieth, twenty-first) or 3500 Mg B (twenty-first) or 3500-Mg E (eighteenth, nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 3111 B-99 or 3120 B-99 or 3500-Mg E-97 or EMSL 94 method 200.7 Rev. 4.4 (1994) or EPA method 200.5 Rev. 4.2 (2003).
  - (c) Total organic carbon (TOC) or dissolved organic carbon (DOC): supplement to "Standard Methods" section 5310 B (nineteenth, twentieth, twenty-first) (high-temperature combustion method) or 5310 C (nineteenth, twentieth, twenty-first) (persulfate-ultraviolet or heated-persulfate oxidation method) or 5310 D (nineteenth, twentieth, twenty-first) (wet-oxidation method), or "Standard Methods Online" section 5310 B-00 or 5310 C-00 or 5310 D-00, or EPA method 415.3 Rev. 1.2, "Determination of Total Organic Carbon and Specific UV Absorbance at 254 nm in Source Water and Drinking Water," August 2009 (EPA/600/R-09/122) can be accessed and downloaded on-line at <http://epa.gov/nerlcww/ordmeth.htm>. TOC samples must not be filtered prior to any analysis. Inorganic carbon must be removed from the samples prior to analysis. TOC samples must be acidified at the time of sample collection to achieve pH less than or equal to two with minimal addition of the acid specified in the method or by the instrument manufacturer. Acidified TOC samples must be analyzed within twenty-eight days. DOC samples must be filtered through the 0.45 micrometer pore-diameter filter as soon as practical after sampling, not to exceed forty-eight hours. After filtration, DOC samples must be acidified to achieve pH less than or equal to two with minimal addition of the acid specified in the method or by the instrument manufacturer. Acidified DOC samples must be analyzed within twenty-eight days of sample collection. Water passed through the filter prior to filtration of the sample must serve as the filtered blank. This filtered blank must be analyzed using the procedures identical to those used for analysis of the samples and must meet the following criteria: DOC is less than 0.5 milligrams per

liter.

- (d) Ultraviolet absorption at two hundred fifty-four nanometers (UV<sub>254</sub>). "Standard Methods" 5910 B (nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 5910 B-11 (ultraviolet absorption method), or EPA method 415.3 Rev. 1.2, "Determination of Total Organic Carbon and Specific UV Absorbance at 254 nm in Source Water and Drinking Water (USEPA 2009f), can be accessed and downloaded on-line at <http://www.epa.gov/nerlcww/ordmeth.htm>. UV absorption must be measured at 253.7 nanometers, which may be rounded off to two hundred fifty-four nanometers. Prior to analysis, UV<sub>254</sub> samples must be filtered through a 0.45 micrometer pore-diameter filter. The pH of the UV<sub>254</sub> sample may not be adjusted. Samples must be analyzed as soon as practical after sampling, not to exceed forty-eight hours.
  - (e) pH: "Standard Methods" section 4500-H<sup>+</sup> B (nineteenth, twentieth, twenty-first) or "Standard Methods Online" section 4500-H<sup>+</sup> B-00 (pH value).
- (D) Analyses conducted to determine compliance with rules 3745-81-14, 3745-81-21, 3745-81-42, 3745-81-43, and 3745-81-50 to 3745-81-55 of the Administrative Code shall be conducted by a person designated on a valid laboratory certificate of approval as required under rule 3745-89-03 of the Administrative Code. The laboratory used by the system shall be certified for each method (and any associated contaminant) used for compliance monitoring analyses under rules 3745-81-50 to 3745-81-55 of the Administrative Code.

Unless otherwise noted, the following approved analytical methods are in the twenty-first or twenty-second edition of "Standard Methods for the Examination of Water and Wastewater, by the American Public Health Association, American Water Works Association, and Water Environment Control Federation, 2012," referred to as "Standard Methods":

- (1) The standard sample volume required for a total coliform analysis is one hundred milliliters. The time from sample collection to initiation of test medium incubation shall not exceed thirty hours.
  - (a) Systems are encouraged but not required to hold samples below ten degrees Celsius during transit.
  - (b) Systems need only determine the presence or absence of total coliform and *E. coli*; a determination of density is not required.
- (2) If water having residual chlorine (measured as free, combined or total chlorine) is to be analyzed, sufficient sodium thiosulfate must be added to the sample bottle before sterilization to neutralize any residual chlorine in the water sample. Dechlorination procedures are addressed in section 9060A.2 of "Standard Methods."

- (3) Total coliform analyses shall be conducted in accordance with one of the following methods:
- (a) Membrane filter (MF) technique, as set forth in "Standard Methods" section 9222 B (twenty-first edition).
  - (b) Enzyme substrate coliform test (MMO-MUG), as partially described set forth in "Standard Methods" section 9223 B and further explained in the twentieth (1998) edition of "Standard Methods" section 9223 or "Standard Methods Online" 9223 B-04. Colilert-18 is referenced as 9223 B Colilert-18 for certification purposes. Colilert-18 is available from "IDEXX Laboratories by phone at 1-800-321-0207 or online at <https://www.idexx.com/corporate/home.html>."
  - (c) Colitag, "Colitag™ Test Method for Simultaneous Detection of E.coli and other Total Coliforms in Water (ATP D-05-0035)," August 28, 2009. A copy of this method can be downloaded from NEMI at <http://www.nemi.gov> or obtained by contacting, "CPI International, 580 Skyline Boulevard, Santa Rosa, CA 95403."
  - (d) EPA method 1604, EPA 821-R-02-024, "EPA Method 1604: Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)," September 2002. A copy of this method can be downloaded from U.S. EPA at <http://www.epa.gov/microbes/documents/1604sp02.pdf>.
  - (e) "Tecta EC/TC, Presence/Absence Method for Simultaneous Detection of Total Coliforms and E. coli in Drinking Water," April 2014. Available from "Veolia Water Solutions and Technologies, Suite 4697, Biosciences Complex, 116 Barrie Street, Kinston, Ontario, Canada K7L 3N6."
  - (f) Total coliform fermentation technique, as set forth in "Standard Methods" section 9221 A, B, C (twenty-first and twenty-second editions) or "Standard Methods Online" 9221 A, B, C-06.
- (4) Until March 31, 2016, fecal coliform analysis, for cases in which membrane filter analysis gives total coliform-positive results, shall use EC medium. Nutrient EC medium preparation as set forth in "Standard Methods" section 9221 E or "Standard Methods Online" 9221 E-06.

The total coliform-positive culture is transferred by the following method:

- (a) Swab the entire membrane filter surface with a sterile swab and transfer the inoculum to EC medium (do not leave the swab in the EC medium).
- (b) Gently shake the inoculated tubes of EC medium to ensure adequate mixing and incubate in a waterbath at  $44.5 \pm 0.2$  degrees Celsius for twenty-four plus or minus two hours. Gas production of any amount in the inner fermentation tube of the EC medium indicates a positive fecal

coliform test. Public water systems need only determine the presence or absence of fecal coliforms; a determination of fecal coliform density is not required.

- (5) *Escherichia coli* (*E. coli*) analysis shall be conducted by a method identified in this paragraph. The methods identified in paragraphs (D)(5)(b) and (D)(5)(c) of this rule are the same as those identified in paragraphs (D)(3)(b) and (D)(3)(c) of this rule for total coliform analysis and allow simultaneous determination of the presence or absence of total coliforms and *E. coli* when applied to drinking water samples, but they are not approved for determining whether bacteria samples resulting from membrane filter tests contain *E. coli*.
- (a) When membrane filter analysis conducted in accordance with paragraph (D)(3)(a) of this rule results in total coliform-positive results, *E. coli* analysis shall be conducted using either a nutrient EC-MUG or NA-MUG preparation as set forth in "Standard Methods" sections 9222 G.1c(2) or 9222 G.1c(1), respectively.
- (b) Enzyme substrate coliform test (MMO-MUG), as set forth in "Standard Methods" section 9223-B. Colilert-18 is referenced as 9223-B Colilert-18 for certification purposes. Colilert-18 is available from "IDEXX Laboratories by phone at 1-800-321-0207 or online at <https://www.idexx.com/corporate/home.html>."
- (c) Colitag, "Colitag™ Test Method for Simultaneous Detection of *E. coli* and other Total Coliforms in Water (ATP D-05-0035)," August 28, 2009. A copy of this method can be downloaded from NEMI at <http://www.nemi.gov> or obtained by contacting, "CPI International, 580 Skyland Boulevard, Santa Rosa, CA 95403."
- (d) EPA method 1604, EPA 821-R-02-024, "EPA Method 1604: Total Coliforms and *Escherichia coli* in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)," September 2002. A copy of this method can be downloaded from U.S. EPA at <http://www.epa.gov/microbes/documents/1604sp02.pdf>.
- (E) The methods listed in Table A shall be used to determine compliance with rules 3745-81-15 and 3745-81-26 of the Administrative Code (radioactivity) except in cases where alternative approaches have been approved by the United States environmental protection agency and the director.

<b>Table A. Radionuclide analytical methods.</b>						
Contaminant	Methodology	Reference (method or page number)				
		EPA <sup>1</sup>	EPA <sup>2</sup>	EPA <sup>3</sup>	EPA <sup>4</sup>	SM <sup>5</sup>
Gross alpha <sup>6</sup>	Evaporation	900.0	p 1	00-01	p 1	302, 7110

and beta.						B, 7110 B-00
Gross alpha <sup>6</sup>	Co-precipitation			00-02		7110 C, 7110 C-00
Radium 226	Radon emanation	903.1	p 16	Ra-04	p 19	7500-Ra C, 305
	Radio chemical	903.0	p 13	Ra-03		304, 7500-Ra B
Radium 228	Radio chemical	904.0	p 24	Ra-05	p 19	7500-Ra D, 7500_Ra D-01
Uranium <sup>7</sup>	Radio chemical	908.0				7500-U B, 7500-U B-00
	Fluorometric	908.1				7500-U C
	Alpha spectrometry			00-07	p 33	7500-U C, 7500-U C-00
Radioactive cesium	Radio chemical	901.0	p 4			7500-Cs B, 7500-Cs B-00
	Gamma ray spectrometry	901.1			p 92	7120, 7120-97
Radioactive iodine	Radio chemical	902.0	p 6 p 9			7500-I B, 7500-I C, 7500 I-D, 7500-I D-00
	Gamma ray spectrometry	901.1			p 92	7120, 7120-97
Radioactive Strontium 89, 90	Radio chemical	905.0	p 29	Sr-04	p 65	303, 7500-Sr BH B-00
Tritium	Liquid scintillation	906.0	p 34	H-02	p 87	306, 7500- <sup>3</sup> H B, 7500- <sup>3</sup> H B-00
Gamma emitters	Gamma ray Spectrometry	901.1			p 92	7120,7120-97
		902.0 901.0				7500-Cs B, 7500-I B

- <sup>1</sup> "Prescribed Procedures for Measurement of Radioactivity in Drinking Water," EPA 600/4-80-032, August 1980. Available at "U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (Telephone 800-553-6847), PB 80-224744."
  - <sup>2</sup> "Interim Radiochemical Methodology for Drinking Water," EPA 600/4-75-008 (revised), March 1976. Available at NTIS, *ibid.* PB 253258.
  - <sup>3</sup> "Radiochemistry Procedures Manual," EPA 520/5-84-006, December 1987. Available at NTIS, *ibid.* PB 84-215581.
  - <sup>4</sup> "Radiochemical Analytical Procedures for Analysis of Environmental Samples," March 1979. Available at NTIS, *ibid.* EMSL LV 053917.
  - <sup>5</sup> "Standard Methods for the Examination of Water and Wastewater," thirteenth, seventeenth, eighteenth, nineteenth, twentieth, twenty-first and twenty-second editions, 1971, 1989, 1992, 1995, 1998, 2006 and 2012. Available at "American Public Health Association, 1015 Fifteenth Street N.W., Washington, D.C. 20005." Online versions of "Standard Methods for the Examination of Water and Wastewater" are available at <http://www.standardmethods.org/>. The approval year assigned by the "Standard Methods Committee" is designated by the last two digits of the method number. All methods are in the seventeenth, eighteenth, nineteenth and twentieth editions except 7500-U C Fluorometric Uranium was discontinued after the seventeenth edition, 7120 Gamma Emitters is only in the nineteenth and twentieth editions, and 302, 303, 304, 305 and 306 are only in the thirteenth edition.
  - <sup>6</sup> Natural uranium and thorium-230 are approved as gross alpha calibration standards for gross alpha with co-precipitation and evaporation methods; americium-241 is approved with co-precipitation methods.
  - <sup>7</sup> If uranium (U) is determined by mass, a 0.67 pCi/μg of uranium conversion factor must be used. This conversion factor is based on the 1:1 activity ratio of U-234 to U-238 that is characteristic of naturally occurring uranium.
- (F) Analyses for water quality parameters required by rule 3745-81-87 of the Administrative Code shall be made in accordance with methods listed in paragraph (A) of this rule for calcium, orthophosphate, and silica and shall be made in accordance with methods listed in paragraph (C) of this rule for alkalinity, conductivity, pH, and temperature. As long as the methods are properly followed, these analyses do not have to be performed in a laboratory approved by the director nor does the person performing these analyses have to be designated on a valid laboratory certificate of approval.
- (G) Analytical techniques alternative to those of this rule may be used only with the written approval of the director, concurred in by the administrator of the United States environmental protection agency. An alternative technique shall be acceptable only if it is substantially equivalent to the prescribed test in both precision and accuracy as it relates to the determination of compliance with any

maximum contaminant level or monitoring requirements. The use of an alternative analytic technique shall not decrease the frequency of monitoring required by this chapter.

- (H) Cryptosporidium. The following requirements apply to source water monitoring conducted in accordance with rules 3745-81-64 to 3745-81-69 of the Administrative Code.

Systems shall analyze for Cryptosporidium using method 1623: "Cryptosporidium and Giardia in Water by Filtration/IMS/FA," 2005, United States environmental protection agency, EPA-815-R-05-002, method 1623.1: "Cryptosporidium and Giardia in Water by Filtration/IMS/FA," 2012, United States environmental protection agency, EPA 816-R-12-001, or method 1622, "Cryptosporidium in Water by Filtration/IMS/FA," 2005, United States environmental protection agency, EPA-815-R-05-001, which 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 C.F.R. part 51. A copy of these methods may be obtained online from <http://www.epa.gov/safewater/disinfection/lt2> or from the United States environmental protection agency, office of ground water and drinking water, 1201 Constitution Ave., NW, Washington, DC 20460 (Telephone: 800-426-4791). A copy may be inspected at the "Water Docket in the EPA Docket Center, 1301 Constitution Ave., NW, Washington, DC, (Telephone: 202-566-2426)" 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](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html).

- (1) Systems shall analyze at least a ten liter sample or a packed pellet volume of at least two milliliters as generated by the methods listed in paragraph (H) of this rule. Systems unable to process a ten liter sample must analyze as much sample volume as can be filtered by two filters approved by EPA for the methods listed in paragraph (H) of this rule, up to a packed pellet volume of a least two milliliters.
- (2) Matrix spike (MS) samples, as required by the methods in paragraph (H) of this rule, shall be spiked and filtered by a laboratory approved for Cryptosporidium analysis in accordance with rule 3745-89-11 of the Administrative Code.
- (3) If the volume of the MS sample is greater than ten liters, the system may filter all but ten liters of the MS sample in the field, and ship the filtered sample and the remaining ten liters of source water to the laboratory. In this case, the laboratory shall spike the remaining ten liters of water and filter it through the filter used to collect the balance of the sample in the field.
- (4) Flow cytometer-counted spiking suspensions shall be used for MS samples and ongoing precision and recovery (OPR) samples.

- (I) E. coli. The following requirements apply to source water monitoring conducted in accordance with rules 3745-81-64 to 3745-81-69 of the Administrative Code:

Systems shall use methods for enumeration of E. coli in source water as approved in 40 C.F.R. 136.3(a).

- (1) The time from sample collection to initiation of analysis shall not exceed eight hours unless the system meets the condition of paragraph (I)(2) of this rule.
  - (2) The director may accept on a case-by-case basis the holding of an E. coli sample for up to forty-eight hours between sample collection and initiation of analysis if the director determines that analyzing an E. coli sample within thirty hours is not feasible. E. coli samples held between thirty to forty-eight hours shall be analyzed by the Colilert reagent version of standard method 9223 B as listed in 40 C.F.R. 136.3(a).
  - (3) Systems shall maintain samples between zero degrees Celsius and ten degrees Celsius during storage and transit to the laboratory.
- (J) Turbidity. Source water monitoring conducted in accordance with rules 3745-81-64 to 3745-81-69 of the Administrative Code, shall use methods for turbidity measurement approved in paragraph (C)(3) of this rule.
- (K) Ground water rule, assessment source water monitoring. The methods listed in Table B shall be used to determine compliance with rule 3745-81-42 of the Administrative Code (ground water source microbial monitoring and analytical methods).

**Table B. Analytical methods for assessment source water monitoring.**

Fecal Indicator <sup>1</sup>	Methodology	Method Citation
E.coli	Colilert <sup>3</sup>	9223 B <sup>2</sup>
	Colisure <sup>3</sup>	9223 B <sup>2</sup>
	Membrane Filter Method with MI Agar	EPA Method 1604 <sup>4</sup>
	m-ColiBlue24 Test <sup>6</sup>	
	E*Colite Test <sup>6</sup>	
	EC-MUG <sup>7</sup>	9221 F <sup>2</sup>
	NA-MUG <sup>7</sup>	9222 G <sup>2</sup>
	Readycult <sup>12</sup>	
	Colitag <sup>TM, 13</sup>	
	Chromocult <sup>14</sup>	
	Tecta EC/TC <sup>15</sup>	

**Table B. Analytical methods for assessment source water monitoring.**

Enterococci	Multiple-Tube Technique	9230 B <sup>2</sup>
	Membrane Filter Technique	9230 C <sup>2</sup>
	Membrane Filter Technique	EPA Method 1600 <sup>8</sup>
	Enterolert <sup>9</sup>	
Coliphage	Two-Step Enrichment Presence-Absence Procedure	EPA Method 1601 <sup>10</sup>
	Single Agar Layer Procedure	EPA Method 1602 <sup>11</sup>

(Analyses using methods in Table B shall be conducted in accordance with the documents listed below.)

- <sup>1</sup> The time from sample collection to initiation of analysis may not exceed thirty hours. The ground water system is encouraged but is not required to hold samples below ten degrees Celsius during transit.
- <sup>2</sup> Methods are described in "Standard Methods for the Examination of Water and Wastewater," twentieth, twenty-first and twenty-second editions, published 1998, 2006 and 2012, respectively. Copies may be obtained from the "American Public Health Association, 1015 Fifteenth Street, NW, Washington, DC 20005-2605." Online versions of "Standard Methods" are available at <http://www.standardmethods.org/>.
- <sup>3</sup> Medium is available through "IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092."
- <sup>4</sup> EPA method 1604: "Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium); September 2002, EPA 821-R-02-024." Method is available at <http://www.epa.gov/microbes/documents/1604sp02.pdf> or from "EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW, Washington DC 20460."
- <sup>5</sup> A description of the m-ColiBlue24 Test, "Total Coliforms and E. coli Membrane Filtration Method with m-ColiBlue24 Broth," method number 10029 Rev.2, August 17, 1999, is available from "Hach Company, 100 Dayton Ave., Ames, IA 50010" or from "EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460."
- <sup>6</sup> A description of the E\*Colite Test, "Charm E\*Colite Presence/Absence Test for Detection and Identification of Coliform Bacteria and Escherichia coli in Drinking

Water," January 9, 1998 is available from "Charm Sciences, Inc., 659 Andover St., Lawrence, MA 01843-1032 or from EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW., Washington, DC 20460."

- <sup>7</sup> EC-MUG (method 9221 F) or NA-MUG (method 9222 G) can be used for E. coli testing steps as described in 40 C.F.R 141.21 (f)(6)(i) and 40 C.F.R. 141.21 (f)(6)(ii) after use of standard methods 9221 B, 9221 D, 9222 B, or 9222 C.
- <sup>8</sup> EPA method 1600: "Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-beta-D-Glucoside Agar (mEI) EPA 821-R-02-022 (September 2002)" is an approved variation of standard method 9230 C. The method is available at <http://www.epa.gov/nerlcwww/1600sp02.pdf> or from "EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460." The holding time and temperature for ground water samples are specified in footnote 1 above, rather than as specified in Section 8 of EPA Method 1600.
- <sup>9</sup> Medium is available through "IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092." Preparation and use of the medium is set forth in the article "Evaluation of Enterolert for Enumeration of Enterococci in Recreational Waters," by Budnick, G.E., Howard, R.T., and Mayo, D.R., 1996 "Applied and Environmental Microbiology, 62:3881-2884."
- <sup>10</sup> EPA method 1601: "Male-specific (F+) and Somatic Coliphage in Water by Two-step Enrichment Procedure; April 2001, EPA 821-R-01-030." Method is available at <http://www.epa.gov/nerlcwww/1601ap01.pdf> or from "EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460."
- <sup>11</sup> EPA method 1602: "Male-specific (F+) and Somatic Coliphage in Water by Single Agar Layer (SAL) Procedure; April 2001, EPA 821-R-01-029." Method is available at <http://www.epa.gov/nerlcwww/1602ap01.pdf> or from "EPA's Water Resource Center (RC-4100T), 1200 Pennsylvania Avenue, NW, Washington, DC 20460."
- <sup>12</sup> Readycult method, "Readycult Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and Escherichia coli in Finished Waters," January, 2007. Version 1.1. Available from "EMD Chemicals (affiliate of Merck KGaA, Darmstadt, Germany), 480 S Democrat road, Gibbstown, NJ 08027-1297."
- <sup>13</sup> Colitag™; method, "Colitag™ Test Method for the Simultaneous Detection of E. coli and other Total Coliforms in Water (ATP D05-0035)," August 28, 2009. Available at <http://www.nemi.gov> or from "CPI international, 5580 Skylane Boulevard, Santa Rosa, CA 95403."
- <sup>14</sup> Chromocult method, "Chromocult Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and Escherichia coli in Finished Waters," November, 2000. Version 1.0. "EMD chemicals (affiliate of Merck KGaA, Darmstadt, Germany), 480 S. Democrat

road, Gibbstown, NJ 08027-1297."

- <sup>15</sup> "Tecta EC/TC, Presence/Absence Method for Simultaneous Detection of Total Coliforms and E. coli in Drinking Water," April 2014. Available from "Veolia Water Solutions and Technologies, Suite 4697, Biosciences Complex, 116 Barrie Street, Kingston, Ontario, Canada K7L 3N6."

[Comment: The inorganic chemical analysis methods are described in books and manuals referred to in this rule as "Standard Methods," "Technical Notes," EMSL94, and EMSL93. The United States environmental protection agency books and manuals are available from the "National Technical Information Service (or NTIS), United States Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161," with telephone number 800-553-6847. A copy of the eighteenth, nineteenth, twentieth, twenty-first or twenty-second edition of standard methods may be obtained from "AWWA Bookstore, 6666 W Quincy Avenue, Denver, CO, 80235-3098," telephone number 303-795-7711. These documents are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215-3425." USEPA books and manuals are also available from the "National Service Center for Environmental Publications (or NSCEP), P.O. Box 42419, Cincinnati, Ohio 45242-0419," or <http://www.epa.gov/nscep>.]

[Comment: The organic chemical analysis methods referred to in this rule are included in manuals prepared by the "United States Environmental Protection Agency (USEPA) National Exposure Research Laboratory (NERL) - Cincinnati." These manuals may be purchased from the "National Technical Information Service (NTIS), U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161," with telephone number 800-553-6847. They are also available to government agencies from "ORD Publications, 26 West MLK Drive, Cincinnati, Ohio 45268-1072," with telephone number 513-569-7562 or 800-490-9198. These documents are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215-3425." USEPA books and manuals are also available from the "National Service Center for Environmental Publications (or NSCEP), P.O. Box 42419, Cincinnati, Ohio 45242-0419," or <http://www.epa.gov/nscep>.]

[Comment: Except as otherwise noted in this rule, the approved microbiological analytical methods referred to in this rule are the eighteenth, nineteenth, twentieth, twenty-first or twenty-second edition of "Standard Methods for the Examination of Water and Wastewater, by the American Public Health Association, American Water Works Association, and Water Pollution Control Federation," dated 1992, 1995 and 1998 respectively. A copy of the eighteenth, nineteenth, twentieth, twenty-first or twenty-second edition of Standard Methods may be obtained from "AWWA Bookstore, 6666 W Quincy Avenue, Denver, CO, 80235-3098," (303) 795-2114. These documents are available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215-3425." A copy of the colisure test may be obtained from "Millipore Corporation, Technical Services Department, 80 Ashby Road, P.O. Box 9125, Bedford, Massachusetts 01730-9125," 800-645-5476. This document is available for review at "Ohio EPA, Lazarus Government Center, 50 West Town Street, Suite 700, Columbus, OH, 43215-3425."]

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