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ENVIRONMENTAL PROTECTION AGENCY

40 CFR Part 141

[EPA-HQ-OW-2016-0281; FRL-9948-54-OW]

Expedited Approval of Alternative Test Procedures for the Analysis of Contaminants under the Safe Drinking Water Act; Analysis and Sampling Procedures

AGENCY: Environmental Protection Agency (EPA).

ACTION: Final rule.

SUMMARY: This action announces the U.S. Environmental Protection Agency's (EPA's) approval of alternative testing methods for use in measuring the levels of contaminants in drinking water and determining compliance with national primary drinking water regulations. The Safe Drinking Water Act authorizes EPA to approve the use of alternative testing methods through publication in the Federal Register. EPA is using this streamlined authority to make 16 additional methods available for analyzing drinking water samples. This expedited approach provides public water systems, laboratories, and primacy agencies with more timely access to new measurement techniques and greater flexibility in the selection of analytical methods, thereby reducing monitoring costs while maintaining public health protection.

DATES: This action is effective **[Insert date of publication in the Federal Register]**.

ADDRESSES: The EPA has established a docket for this action under Docket ID No. EPA-HQ-2016-0281. All documents in the docket are listed on the http://www.regulations.gov website. Although listed in the index, some information is not publicly available, e.g., CBI or other information whose disclosure is restricted by statute. Certain other material, such as copyrighted material, is not placed on the Internet and will be publicly available only in hard copy form. Publicly available docket materials are available electronically through http://www.regulations.gov.

FOR FURTHER INFORMATION CONTACT: The Safe Drinking Water Hotline (800) 426-4791 or Glynda Smith, Technical Support Center, Standards and Risk Management Division, Office of Ground Water and Drinking Water (MS 140), Environmental Protection Agency, 26 West Martin Luther King Drive, Cincinnati, OH 45268; telephone number: (513) 569-7652; e-mail address: smith.glynda@epa.gov.

SUPPLEMENTARY INFORMATION:

I. General Information

A. *Does this Action Apply to Me?*

Public water systems are the regulated entities required to measure contaminants in drinking water samples. In addition, EPA Regions as well as states and tribal governments with authority to administer the regulatory program for public water systems under the Safe Drinking Water Act (SDWA) may measure contaminants in water samples. When EPA sets a monitoring requirement in its national primary drinking water regulations for a given contaminant, the Agency also establishes in the regulations standardized test procedures for analysis of the contaminant. This action makes alternative testing methods available for particular drinking water contaminants beyond the testing methods currently established in the regulations. EPA is providing public water systems required to test water samples with a choice of using either a test procedure already established in the existing regulations or an alternative test procedure that has been approved in this action or in prior expedited approval actions. Categories and entities that may ultimately be affected by this action include:

Category	Examples of potentially regulated entities	NAICS[1]
State, local, & tribal governments	State, local and tribal governments that analyze water samples on behalf of public water systems required to conduct such analysis; state, local and tribal governments that directly operate community and non-transient non-community water systems required to monitor.	924110
Industry	Private operators of community and non-transient non-community water systems required to monitor.	221310
Municipalities	Municipal operators of community and non-transient non-community water systems required to monitor.	924110

[1]North American Industry Classification System.

This table is not intended to be exhaustive, but rather provides a guide for readers regarding entities likely to be affected by this action. This table lists the types of entities that EPA is now aware could potentially be affected by this action. Other types of entities not listed in the table could also be impacted. To determine whether your facility is affected by this action, you should carefully examine the applicability language in the Code of Federal Regulations (CFR) at 40 CFR 141.2 (definition of public water system). If you have questions regarding the applicability of this action to a particular entity, consult the person listed in the preceding **FOR FURTHER INFORMATION CONTACT** section.

Abbreviations and Acronyms Used in this Action

APHA: American Public Health Association

ATP: Alternate Test Procedure

CFR: Code of Federal Regulations

DPD: N,N-diethyl-p-phenylenediamine

EPA: United States Environmental Protection Agency

LED: Light Emitting Diode

NAICS: North American Industry Classification System

NEMI: National Environmental Methods Index

NTU: Nephelometric Turbidity Unit

QC: Quality Control

SDWA: The Safe Drinking Water Act

TOC: Total Organic Carbon

VCSB: Voluntary Consensus Standard Bodies

II. Background

A. What is the Purpose of This Action?

In this action, EPA is approving 16 analytical methods for determining contaminant concentrations in drinking water samples collected under SDWA. Regulated parties required to sample and monitor may use either the testing methods already established in existing regulations or the alternative testing methods being approved in this action or in prior expedited approval actions. The new methods are listed along with other methods similarly approved through previous expedited actions in 40 CFR part 141, appendix A to subpart C and on EPA's drinking water methods website at https://www.epa.gov/dwanalyticalmethods.

B. What is the Basis for This Action?

When EPA determines that an alternative analytical method is "equally effective" (i.e., as effective as a method that has already been promulgated in the regulations), SDWA allows EPA to approve the use of the alternative method through publication in the Federal Register (see Section 1401(1) of SDWA). EPA is using this streamlined approval authority to make 16 additional methods available for determining contaminant concentrations in drinking water samples collected under SDWA. EPA has determined that, for each contaminant or group of contaminants listed in Section III, the additional testing methods being approved in this action are as effective as one or more of the testing methods already approved in the regulations for those contaminants. Section 1401(1) of SDWA states that the newly approved methods "shall be treated as an alternative for public water systems to the quality control and testing procedures listed in the regulation." Accordingly, this action makes these additional 16 analytical methods legally available as options for meeting EPA's monitoring requirements.

This action does not add regulatory language, but does, for informational purposes, update an appendix to the regulations at 40 CFR Part 141 that lists all methods approved under Section 1401(1) of SDWA. Accordingly, while this action is not a rule, it is updating CFR text and therefore is being published in the "Final Rules" section of the Federal Register.

III. Summary of Approvals

EPA is approving 16 methods that are equally effective relative to methods previously promulgated in the regulations. By means of this rule, these 16 methods are added to appendix A to subpart C of 40 CFR part 141.

A. *Methods developed by Voluntary Consensus Standard Bodies (VCSB)*

ASTM International. EPA compared the most recent versions of seven ASTM International methods to the earlier versions of those methods that are currently approved in 40 CFR part 141. Changes between the earlier approved version and the most recent version of each method are summarized in Smith (2015). The revisions primarily involve editorial changes (e.g., updated references, definitions, terminology, procedural clarifications, and reorganization of text). The revised methods are the same as the approved versions with respect to sample collection and handling protocols, sample preparation, analytical methodology, and method performance data; thus, EPA finds they are equally effective relative to the approved methods. EPA is thus approving the use of the following ASTM methods for the contaminants and their respective regulations listed in the following table:

ASTM Revised Version	Approved Method	Contaminant	Regulation
D 1253-14 (ASTM 2014a)	D 1253-03 (ASTM 2003a)	Free Chlorine; Total Chlorine	40 CFR 141.74(a)(2); 40 CFR 141.131(c)(1)
D 1253-14 (ASTM 2014a)	D 1253-03 (ASTM 2003a)	Combined Chlorine	40 CFR 141.131(c)(1)
D 1125-14 A (ASTM 2014b)	D 1125-95 A (ASTM 1995)	Conductivity	40 CFR 141.23(k)(1)
D 511-14 A (ASTM 2014c)	D 511-03 A (ASTM 2003b)	Calcium; Magnesium	40 CFR 141.23(k)(1)
D 511-14 B (ASTM 2014c)	D 511-03 B (ASTM 2003b)	Calcium; Magnesium	40 CFR 141.23(k)(1)
D 1688-12 A (ASTM 2012a)	D 1688-02 A (ASTM 2002a)	Copper	40 CFR 141.23(k)(1)
D 1688-12 C (ASTM 2012a)	D 1688-02 C (ASTM 2002a)	Copper	40 CFR 141.23(k)(1)
D 3697-12 (ASTM 2012b)	D 3697-02 (ASTM 2002b)	Antimony	40 CFR 141.23(k)(1)

The ASTM methods are available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or http://www.astm.org.

B. *Methods Developed by Vendors*

1. Hach Method 10241 – Spectrophotometric Measurement of Free Chlorine (Cl_2) in Finished Drinking Water (Hach Company 2015a). In Hach Method 10241, free chlorine is converted to monochloramine by addition of an ammonia solution to a drinking water sample. In the presence of a cyanoferrate catalyst, monochloramine reacts with a substituted phenol to form an intermediate monoamine compound. The intermediate monoamine compound couples with excess substituted phenol to form a green indophenol compound. Spectrophotometric measurement of absorbance at 655 nm (610 nm for colorimeters) is directly proportional to the concentration of free chlorine in the sample.

The currently approved methods for free chlorine in drinking water are listed in the tables at 40 CFR 141.74(a)(2) and 40 CFR 141.131(c)(1). One of the most widely used approved methods is Standard Method 4500-Cl G-00 (APHA 2000a), which uses a N,N-diethyl-p-phenylenediamine (DPD) indicator for spectrophotometric determination of residual chlorine concentrations in drinking water. The DPD methodology can be subject to interferences associated with the presence of manganese, chloramines, and other oxidants. Hach Method 10241 is not subject to such interferences.

A multi-laboratory study compared the performance characteristics of Hach Method 10241 to the performance characteristics of the approved Standard Method 4500-Cl G-00. A variety of samples, including drinking water samples from both surface water and ground water sources, were fortified with known chlorine concentrations and analyzed by each method. The results are summarized in the validation study report (Hach Company 2015b). EPA has determined that Hach Method 10241 is equally as effective as the approved Standard Method 4500-Cl G-00. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 10241 for determining free chlorine concentrations in drinking water. Hach Method 10241 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com.)

2. Hach Method 8026 – Spectrophotometric Measurement of Copper in Finished Drinking Water (Hach Company 2015c). In Hach Method 8026, cuprous copper is measured colorimetrically by complexation with bicinchoninic acid. The intensity in color is proportional to the copper concentration, and spectrophotometer measurements are taken at 560 nm. Cupric copper present in samples is chemically reduced to cuprous copper. Metal and hardness interferences in samples are mitigated through the use of a chelating agent. The method is performed by the addition of powder pillows containing reagents to the water samples.

The currently approved methods for the analysis of copper in drinking water are listed in the table at 40 CFR 141.23(k)(1). The approved methods are based on atomic spectroscopy technologies. Hach Method 8026 employs a spectrophotometer, and is based on known complexation principles and simple color/absorbance measurements to determine copper concentrations.

A multi-laboratory validation study was conducted to compare the performance of Hach Method 8026 to EPA Method 200.7 (USEPA 1994), one of the approved methods for the analysis of copper in drinking water. Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of copper standards. The results are summarized in the validation study report (Hach Company 2015d). EPA has determined that Hach Method 8026 is equally as effective as the approved EPA Method 200.7. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 8026 for the analysis of copper in drinking water. Hach Method 8026 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com).

3. Hach Method 10261 – Total Organic Carbon in Finished Drinking Water by Catalyzed Ozone Hydroxyl Radical Oxidation Infrared Analysis (Hach Company 2015e). Hach Method 10261 is a method for the determination of total organic carbon (TOC) in drinking water using an advanced oxidation process and non-dispersive infrared spectroscopy. In this method, ozone and a base are added to water to produce hydroxyl radicals. The hydroxyl radicals oxidize organic carbon to produce carbon dioxide and sodium oxalate. The sodium oxalate is further oxidized to carbon dioxide using acidification and a manganese catalyst. The carbon dioxide

produced by both oxidation processes is then measured using non-dispersive infrared spectroscopy.

The currently approved methods for the analysis of TOC in drinking water are listed in 40 CFR 141.131(d)(3). The approved oxidation method, Standard Method 5310 C-00 (APHA 2000b), may not completely oxidize certain organic compounds. Hach Method 10261 uses a more efficient advanced oxidation process to ensure more complete oxidation.

A multi-laboratory validation study was conducted to compare the performance of Hach Method 10261 to the approved Standard Method 5310 C-00. Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of TOC. The results are summarized in the validation study report (Hach Company 2015f). EPA has determined that Hach Method 10261 is equally as effective as the approved Standard Method 5310 C-00. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 10261 for the analysis of TOC in drinking water. Hach Method 10261 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com).

4. Hach Method 10267 – Spectrophotometric Measurement of Total Organic Carbon (TOC) in Finished Drinking Water (Hach Company 2015g). Hach Method 10267 is used for the determination of TOC in drinking water using acid persulfate digestion and visible spectrum spectrophotometry. In this method, samples are oxidized using acid persulfate digestions to convert TOC into carbon dioxide. The generated carbon dioxide is passed through a gas-permeable membrane into an indicator solution that is measured spectrophotometrically at 435

nm. Hach Method 10267 uses pre-packaged reagents to simplify sample preparation and quickly perform the analysis. Interfering inorganic carbon is removed from the sample prior to digestion by acidification and agitation.

The currently approved methods for the analysis of TOC in drinking water are listed in 40 CFR 141.131(d)(3). A multi-laboratory validation study was conducted to compare the performance of Hach Method 10267 to the approved Standard Method 5310 C-00 (APHA 200b). Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of TOC. The results are summarized in the validation study report (Hach Company 2015h). EPA has determined that Hach Method 10267 is equally as effective as the approved Standard Method 5310 C-00. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 10267 for the analysis of TOC in drinking water. Hach Method 10267 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com).

5. Hach Method 10272 – Spectrophotometric Measurement of Copper in Finished Drinking Water (Hach Company 2015i). In Hach Method 10272, cuprous copper is measured colorimetrically by complexation with bicinchoninic acid. The intensity in color is proportional to the copper concentration, and spectrophotometer measurements are taken at 560 nm. Cupric copper present in samples is chemically reduced to cuprous copper. Metal and hardness interferences in samples are mitigated through the use of a chelating agent. The method is performed through the use of a copper Chemkey and portable analyzer.

The currently approved methods for the analysis of copper in drinking water are listed in the table at 40 CFR 141.23(k)(1). The approved methods are based on atomic spectroscopy technologies. Hach Method 10272 uses a spectrophotometer, simple color/absorbance measurements to determine copper concentrations, and incorporates portability and streamlining into the analysis.

A multi-laboratory validation study was conducted to compare the performance of Hach Method 10272 to EPA Method 200.7 (USEPA 1994), one of the approved methods for the analysis of copper in drinking water. Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of copper standards. The results are summarized in the validation study report (Hach Company 2015j). EPA has determined that Hach Method 10272 is equally as effective as the approved EPA Method 200.7. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 10272 for the analysis of copper in drinking water. Hach Method 10272 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com).

6. Hach Method 10258 – Determination of Turbidity by 360^{o} Nephelometry (Hach Company 2016). In Hach Method 10258 turbidity is determined in conventional-filtered and membrane-filtered treated drinking water using a 360 degree nephelometer. In this method, a non-incandescent light source operates at a wavelength of 660 $\pm$ 30 nm and light scattered by the sample is collected and detected at an angle 90 degrees to the incident light, 360 degrees around the sample vial. This design offers improved sensitivity (minimum quantitation limit of 0.0005 Nephelometric Turbidity Units (NTU) and resolution (0.0001 NTU) relative to the approved methods.

The currently approved methods for the analysis of turbidity in treated drinking water are listed in the regulations at 40 CFR 141.74(a)(1). A multi-facility validation study was conducted to compare the performance of Hach Method 10258 to the approved Hach FilterTrak Method 10133 (Hach Company 2000) for the analysis of turbidity in treated drinking water. Seven public drinking water facilities participated in the study. Three facilities produced treated water using both conventional-filtration and membrane-filtration, two facilities produced only conventional-filtration treated water, and two facilities produced only membrane-filtration treated water. Source waters encompassed both surface waters and ground waters under the direct influence of surface water. Turbidity comparison data were collected at each facility by operating the instrument collecting the Hach Method 10258 turbidity data in parallel with an instrument collecting turbidity data using the approved Hach FilterTrack Method 10133. Precision and accuracy (based on recovery of matrix spike injections) data were collected over a range of spike levels (0.0015 – 0.500 NTU) and calibration verification data were collected from each facility. The results are summarized in the validation study report (Hach Company 2014). EPA has determined that Hach Method 10258 is equally as effective as the approved Hach FilterTrak Method 10133. The basis for this determination is discussed in Adams and Smith (2016). Therefore, EPA is approving Hach Method 10258 for the analysis of turbidity in treated drinking water. Hach Method 10258 can be obtained from Hach Company, 5600 Lindbergh Drive, Loveland, Colorado 80539. (http://www.hach.com).

7. Nitrate Elimination Company, Inc. (NECi) – Method for Nitrate Reductase Nitrate-Nitrogen Analysis of Drinking Water (NECi 2016a). The NECi nitrate reductase method is used for the determination of nitrate plus nitrite (as nitrogen) in drinking water. In this method, a eukaryotic nitrate reductase is used to catalyze the conversion of nitrate to nitrite in the presence

of nicotinamide adenine dinucleotide as a reductant in a buffer with a near neutral pH. The combined nitrite (both the original and reduced nitrate) is reacted with sulfanilamide and N-(1-napthyl) ethylenediamine dihydrochloride to produce a chromophore. The combined nitrite concentration is then measured spectrophotometrically at ~540 nm. The method entails the use of a discrete analyzer that incorporates a spectrophotometric detector.

The currently approved methods for the analysis of nitrate and nitrite in drinking water are listed in 40 CFR 141.23(k)(1). The approved EPA Method 353.2 (USEPA 1993a) uses cadmium to reduce nitrate to nitrite and subsequently measures the combined nitrite colorimetrically. The NECi nitrate reductase method provides an environmentally friendly approach to nitrate-nitrogen analysis by eliminating the use of toxic cadmium and requires only a fraction of the sample volume used in the approved EPA method.

A multi-laboratory validation study was conducted to compare the performance of the NECi nitrate reductase method to the approved EPA Method 353.2. Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of nitrate standards. The results are summarized in the validation study report (NECi 2016b). EPA has determined that the NECi nitrate reductase method is equally as effective as the approved EPA Method 353.2. The basis for this determination is discussed in Adams and Wendelken (2016). Therefore, EPA is approving the NECi nitrate reductase method for the analysis of nitrate and nitrite in drinking water. The NECi nitrate reductase method can be obtained from the Nitrate Elimination Company, Inc. (NECi) at Superior Enzymes, Inc., 334 Hecla St., Lake Linden, Michigan 49945.

8. Thermo Fisher Scientific Drinking Water Orthophosphate Method for Thermo

Scientific Gallery Discrete Analyzer (Thermo Fisher 2016a). The Thermo Fisher orthophosphate drinking water method employing Thermo Scientific Gallery discrete analyzers is used for the colorimetric determination of orthophosphate in drinking water. In this method, orthophosphate is reacted with ammonium molybdate and antimony potassium tartrate in an acidic medium to form an antimony-phospho-molybdate complex. The complex is subsequently reduced by ascorbic acid to form an intensely blue complex that can be measured spectrophotometrically at 880 nm.

The currently approved methods for the analysis of orthophosphate in drinking water are listed in 40 CFR 141.23(k)(1). Standard Methods 4500-P E (APHA, 1995) is an approved method that uses ascorbic acid to reduce reacted orthophosphate into a complex that can be measured spectrophotometrically. The Thermo Fisher orthophosphate method incorporates an automated discrete analyzer, which minimizes the use of chemical reagents, generation of waste and human handling errors.

A validation study was conducted to compare the performance of the automated Thermo Fisher orthophosphate discrete analyzer method to the approved Standard Method 4500-P E. Multiple finished drinking water samples drawn from both ground water and surface water sources were used in the validation study. Precision, accuracy and sensitivity data were collected by analyzing drinking water samples fortified with varying concentrations of orthophosphate standards. The results are summarized in the validation study report (Thermo Fisher 2016b). EPA has determined that the Thermo Fisher discrete analyzer method for orthophosphate is equally as effective as the approved Standard Method 4500-P E. Therefore, EPA is approving the Thermo Fisher method for the analysis of orthophosphate in treated drinking water. The basis for this determination is discussed in Adams (2016). The Thermo Fisher discrete analyzer method for orthophosphate can be obtained from Thermo Fisher Scientific, Ratastie 2, 01620 Vantaa, Finland.

9. Mitchell Method M5331, Revision 1.2 – Determination of Turbidity by LED or Laser Nephelometry (Mitchell 2016). Mitchell Method M5331, Revision 1.1 (Mitchell 2009) was approved for the determination of turbidity in drinking water by light emitting diode (LED) nephelometry in the August 2009 expedited methods approval action (USEPA 2009). The currently approved methods for turbidity are listed in 40 CFR 141.74(a)(1) and different sources, including lasers, have been approved. The Mitchell Method M5331 has been updated to incorporate the option of using a solid-state laser in place of a LED as the light source for the turbidimeter. The vendor cites multiple advantages associated with the use of lasers relative to LEDs (Mitchell 2015). Mitchell Method M5331, Revision 1.1 specifies a light source of 525 ± 15 nm, and now lasers at 520 nm and 532 nm are readily available. In addition to meeting the specified wavelength range, solid-state lasers can offer longer source lifetimes, greater stability, and improved stray light rejection. The updated method is the same as the approved Mitchell Method M5331, Revision 1.1 relative to the divergence of the light source measurement area, the detector, and all other instrumental features. EPA has determined that the updated method is equally as effective as the promulgated EPA Method 180.1 (USEPA 1993b), which established the criteria for nephelometric determination of turbidity. The basis for this determination is discussed in Wendelken and Smith (2016). Therefore, EPA is approving Mitchell Method M5331, Revision 1.2 for the determination of turbidity in drinking water. Mitchell Method M5331, Revision 1.2 can be obtained from Leck Mitchell, PhD, PE, 656 Independence Valley Drive, Grand Junction, Colorado 81507.

IV. Statutory and Executive Order Reviews

As noted in Section II, under the terms of SDWA Section 1401(1), this streamlined method approval action is not a rule. Accordingly, the Congressional Review Act, 5 U.S.C. 801 et seq., as added by the Small Business Regulatory Enforcement Fairness Act of 1996, does not apply because this action is not a rule for purposes of 5 U.S.C. 804(3). Similarly, this action is not subject to the Regulatory Flexibility Act because it is not subject to notice and comment requirements under the Administrative Procedure Act or any other statute. In addition, because this approval action is not a rule but simply makes alternative testing methods available as options for monitoring under SDWA, EPA has concluded that other statutes and executive orders generally applicable to rulemaking do not apply to this approval action.

V. References

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List of Subjects in 40 CFR Part 141

Environmental protection, Chemicals, Indians-lands, Intergovernmental relations, Reporting and recordkeeping requirements, Water supply.

Dated: July 7, 2016.

Peter Grevatt,

Director, Office of Ground Water and Drinking Water.

For the reasons stated in the preamble, 40 CFR part 141 is amended as follows:

PART 141 - NATIONAL PRIMARY DRINKING WATER REGULATIONS

1. The authority citation for part 141 continues to read as follows:

   Authority: 42 U.S.C. 300f, 300g-1, 300g-2, 300g-3, 300g-4, 300g-5, 300g-6, 300j-4, 300j-9, and 300j-11**.**

2. Appendix A to subpart c of part 141 is amended as follows:

   a. By revising entries for “Antimony,” “Calcium,” “Copper,” “Conductivity,” “Magnesium,” “Nitrate,” “Nitrite,” and “Orthophosphate,” in the table entitled “ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.23(k)(1).”

   b. By revising the entry for “Turbidity” in the table entitled “ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.74(a)(1).”

   c. By revising entries for “Free Chlorine” and “Total Chlorine” in the table entitled “ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.74(a)(2).”

   d. By revising the entries for “Free Chlorine”, “Combined Chlorine,” and “Total Chlorine” in the table entitled “ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.131(c)(1).”

   e. By revising the entire table entitled “ALTERNATIVE TESTING METHODS FOR PARAMETERS LISTED AT 40 CFR 141.131(d).”

   f. By revising footnotes 2, 9, 14, 16, 18, 19, 24-27, 29, and 33.

   g. By adding footnotes 34 – 42 to the table.

The revisions and additions read as follows:

APPENDIX A TO SUBPART C OF PART 141 - ALTERNATIVE TESTING METHODS APPROVED FOR ANALYSES UNDER THE SAFE DRINKING WATER ACT

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ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.23 (k)(1)							
Contaminant	Methodology	EPA Method	SM 21st Edition [1]	SM 22nd Edition [28]	SM Online [3]	ASTM [4]	Other
* * * * * * *							
Antimony	Hydride – Atomic Absorption					D 3697-07, -12	
	Atomic Absorption; Furnace		3113 B	3113 B	3113 B-04, B-10		
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]					
* * * * * * *							
Calcium	EDTA Titrimetric		3500-Ca B	3500-Ca B		D 511-09, -14 A	
	Atomic Absorption; Direct Aspiration		3111 B	3111 B		D 511-90, -14 B	
	Inductively Coupled Plasma		3120 B	3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)	200.5, Revision 4.2 [2]					

	Ion Chromatography					D 6919-09	
* * * * * * *							
Copper	Atomic Absorption; Furnace		3113 B	3113 B	3113 B-04, B-10	D 1688-07, -12 C	
	Atomic Absorption; Direct Aspiration		3111 B	3111 B		D 1688-07, -12 A	
	Inductively Coupled Plasma		3120 B	3120 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 [2]					
	Colorimetric						Hach Method 8026 [35] Hach Method 10272 [36]
Conductivity	Conductance		2510 B	2510 B		D 1125-14 A	
* * * * * * *							
Magnesium	Atomic Absorption		3111 B	3111 B		D 511-09, -14 B	
	Inductively Coupled Plasma		3120 B	3120 B			
	Complexation Titrimetric Methods		3500-Mg B	3500-Mg B		D 511-09, -14 A	
	Axially viewed inductively coupled plasma-atomic emission spectrometry	200.5, Revision 4.2 [2]					

	(AVICP–AES)						
	Ion Chromatography					D 6919-09	
* * * * * * *							
Nitrate	Ion Chromatography		4110 B	4110 B		D 4327-11	
	Automated Cadmium Reduction		4500-NO_3^- F	4500-NO_3^- F			
	Manual Cadmium Reduction		4500-NO_3^- E	4500-NO_3^- E			
	Ion Selective Electrode		4500-NO_3^- D	4500-NO_3^- D			
	Reduction/Colorimetric						Systea Easy (1-Reagent) [8] NECi Nitrate-Reductase [40]
	Colorimetric; Direct						Hach TNTplus™ 835/836 Method 10206 [23]
Nitrite	Ion Chromatography		4110 B	4110 B		D 4327-11	
	Automated Cadmium Reduction		4500-NO_3^- F	4500-NO_3^- F			
	Manual Cadmium Reduction		4500-NO_3^- E	4500-NO_3^- E			
	Spectrophotometric		4500-NO_2^- B	4500-NO_2^- B			
	Reduction/Colorimetric						Systea Easy (1-Reagent) [8] NECi Nitrate-Reductase [40]

Orthophosphate	Ion Chromatography		4110 B	4110 B		D 4327-11	
	Colorimetric, ascorbic acid, single reagent		4500-P E	4500-P E	4500- P E-99		
	Colorimetric, Automated, Ascorbic Acid		4500-P F	4500-P F	4500-P F-99		Thermo-Fisher Discrete Analyzer [41]
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ALTERNATIVE TESTING METHODS FOR CONTAMINANTS LISTED AT 40 CFR 141.74(a)(1)					
Organism	Methodology	SM 21st Edition [1]	SM 22nd Edition [28]	SM Online [3]	Other
* * * * * * *					
Turbidity	Nephelometric Method	2130 B	2130 B		
	Laser Nephelometry (on-line)				Mitchell M5271 [10] Mitchell M5331, Rev. 1.2 [42]
	LED Nephelometry (on-line)				Mitchell M5331 [11] Mitchell M5331, Rev. 1.2 [42]
	LED Nephelometry (on-line)				AMI Turbiwell [15]
	LED Nephelometry (portable)				Orion AQ4500 [12]
	360° Nephelometry				Hach Method 10258 [39]

ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.74(a)(2)					
Residual	Methodology	SM 21st Edition [1]	SM 22nd Edition [28]	ASTM [4]	Other
Free Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	

	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Syringaldazine (FACTS)	4500-Cl H	4500-Cl H		
	On-line Chlorine Analyzer				EPA 334.0 [16]
	Amperometric Sensor				ChloroSense [17]
	Indophenol Colorimetric				Hach Method 10241 [34]
Total Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	Amperometric Titration (Low level measurement)	4500-Cl E	4500-Cl E		
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Iodometric Electrode	4500-Cl I	4500-Cl I		
	On-line Chlorine Analyzer				EPA 334.0 [16]
	Amperometric Sensor				ChloroSense [17]
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ALTERNATIVE TESTING METHODS FOR DISINFECTANT RESIDUALS LISTED AT 40 CFR 141.131(c)(1)					
Residual	Methodology	SM 21st Edition [1]	SM 22nd Edition [28]	ASTM [4]	Other
Free Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		

	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Syringaldazine (FACTS)	4500-Cl H	4500-Cl H		
	Amperometric Sensor				ChloroSense [17]
	On-line Chlorine Analyzer				EPA 334.0 [16]
	Indophenol Colorimetric				Hach Method 10241 [34]
Combined Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
Total Chlorine	Amperometric Titration	4500-Cl D	4500-Cl D	D 1253-08, -14	
	Low level Amperometric Titration	4500-Cl E	4500-Cl E		
	DPD Ferrous Titrimetric	4500-Cl F	4500-Cl F		
	DPD Colorimetric	4500-Cl G	4500-Cl G		Hach Method 10260 [31]
	Iodometric Electrode	4500-Cl I	4500-Cl I		
	Amperometric Sensor				ChloroSense [17]
	On-line Chlorine Analyzer				EPA 334.0 [16]
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ALTERNATIVE TESTING METHODS FOR PARAMETERS LISTED AT 40 CFR 141.131(d)

Parameter	Methodology	SM 21st Edition [1]	SM 22nd Edition [28]	SM Online [3]	EPA	Other

Total Organic Carbon (TOC)	High Temperature Combustion	5310 B	5310 B		415.3, Rev 1.2 [19]	
	Persulfate-Ultraviolet or Heated Persulfate Oxidation	5310 C	5310 C		415.3, Rev 1.2 [19]	Hach Method 10267 [38]
	Wet Oxidation	5310 D	5310 D		415.3, Rev 1.2 [19]	
	Ozone Oxidation					Hach Method 10261 [37]
Specific Ultraviolet Absorbance (SUVA)	Calculation using DOC and UV_{254} data				415.3, Rev 1.2 [19]	
Dissolved Organic Carbon (DOC)	High Temperature Combustion	5310 B	5310 B		415.3, Rev 1.2 [19]	
	Persulfate-Ultraviolet or Heated Persulfate Oxidation	5310 C	5310 C		415.3, Rev 1.2 [19]	
	Wet Oxidation	5310 D	5310 D		415.3, Rev 1.2 [19]	
Ultraviolet absorption at 254 nm (UV_{254})	Spectrophotometry	5910 B	5910 B	5910 B-11	415.3, Rev 1.2 [19]	

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[1] Standard Methods for the Examination of Water and Wastewater, 21st edition (2005). Available from American Public Health Association, 800 I Street, NW, Washington, DC 20001-3710.

[2] EPA Method 200.5, Revision 4.2. “Determination of Trace Elements in Drinking Water by Axially Viewed Inductively Coupled Plasma-Atomic Emission Spectrometry.” 2003. EPA/600/R-06/115. (Available at http://www.epa.gov/water-research/epa-drinking-water-research-methods.)

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[9] EPA Method 524.3, Version 1.0. "Measurement of Purgeable Organic Compounds in Water by Capillary Column Gas Chromatography/Mass Spectrometry," June 2009. EPA 815-B-09-009. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "815B09009".

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[11] Mitchell Method M5331, Revision 1.1. "Determination of Turbidity by LED Nephelometry," March 5, 2009. Available at https://www.nemi.gov or from Leck Mitchell, Ph.D., PE, 656 Independence Valley Dr., Grand Junction, CO 81507.

[12] Orion Method AQ4500, Revision 1.0. "Determination of Turbidity by LED Nephelometry," May 8, 2009. Available at https://www.nemi.gov or from Thermo Scientific, 166 Cummings Center, Beverly, MA 01915, http://www.thermo.com.

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[14] EPA Method 557. "Determination of Haloacetic Acids, Bromate, and Dalapon in Drinking Water by Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)," September 2009. EPA 815-B-09-012. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "815B09012".

[15] AMI Turbiwell, "Continuous Measurement of Turbidity Using a SWAN AMI Turbiwell Turbidimeter," August 2009. Available at https://www.nemi.gov or from Markus Bernasconi, SWAN Analytische Instrumente AG, Studbachstrasse 13, CH-8340 Hinwil,

Switzerland.

[16] EPA Method 334.0. "Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer," September 2009. EPA 815-B-09-013. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "815B09013".

[17] ChloroSense. "Measurement of Free and Total Chlorine in Drinking Water by Palintest ChloroSense," August 2009. Available at https://www.nemi.gov or from Palintest Ltd, 1455 Jamike Avenue (Suite 100), Erlanger, KY 41018.

[18] EPA Method 302.0. "Determination of Bromate in Drinking Water using Two-Dimensional Ion Chromatography with Suppressed Conductivity Detection," September 2009. EPA 815-B-09-014. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "815B09014".

[19] EPA 415.3, Revision 1.2. "Determination of Total Organic Carbon and Specific UV Absorbance at 254 nm in Source Water and Drinking Water," September 2009. EPA/600/R-09/122. Available at http://www.epa.gov/water-research/epa-drinking-water-research-methods.

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[23] Hach Company. "Hach Company TNTplus™ 835/836 Nitrate Method 10206 – Spectrophotometric Measurement of Nitrate in Water and Wastewater," January 2011. 5600 Lindbergh Drive, P.O. Box 389, Loveland, Colorado 80539. (Available at http://www.hach.com.)

[24] EPA Method 525.3. "Determination of Semivolatile Organic Chemicals in Drinking Water by Solid Phase Extraction and Capillary Column Gas Chromatography/Mass Spectrometry (GC/MS)," February 2012. EPA/600/R-12/010. Available at http://www.epa.gov/water-research/epa-drinking-water-research-methods.

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[26] EPA Method 523. "Determination of Triazine Pesticides and their Degradates in Drinking Water by Gas Chromatography/Mass Spectrometry (GC/MS)," February 2011. EPA 815-R-11-002. Available at the National Service Center for Environmental

Publications (www.epa.gov/nscep). Search "815R11002".

[27] EPA Method 1623.1. "*Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA," 2012. EPA-816-R-12-001. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "816R12001".

[28] Standard Methods for the Examination of Water and Wastewater, 22nd edition (2012). Available from American Public Health Association, 800 I Street, NW, Washington, DC 20001-3710.

[29] EPA Method 524.4, Version 1.0. "Measurement of Purgeable Organic Compounds in Water by Gas Chromatography/Mass Spectrometry using Nitrogen Purge Gas," May 2013. EPA 815-R-13-002. Available at the National Service Center for Environmental Publications (www.epa.gov/nscep). Search "815R13002".

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[31] Hach Company. "Hach Method 10260 - Determination of Chlorinated Oxidants (Free and Total) in Water Using Disposable Planar Reagent-filled Cuvettes and Mesofluidic Channel Colorimetry," April 2013. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[33] Tecta EC/TC. "Techta™ EC/TC Medium and Techta™ Instrument: A Presence/Absence Method for the Simultaneous Detection of Total Coliforms and Escherichia coli (E. coli) in Drinking Water," version 1.0, May 2014. Available from Veolia Water Solutions and Technologies, Suite 4697, Biosciences Complex, 116 Barrie Street, Kingston, Ontario, Canada, K7L 3N6.

[34] Hach Company. "Hach Method 10241 – Spectrophotometric Measurement of Free Chlorine (Cl_2) in Finished Drinking Water," November 2015. Revision 1.2. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[35] Hach Company. "Hach Method 8026 – Spectrophotometric Measurement of Copper in Finished Drinking Water," December 2015. Revision 1.2. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[36] Hach Company. "Hach Method 10272 – Spectrophotometric Measurement of Copper in Finished Drinking Water," December 2015. Revision 1.2. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[37] Hach Company. "Hach Method 10261 – Total Organic Carbon in Finished Drinking Water by Catalyzed Ozone Hydroxyl Radical Oxidation Infrared Analysis," December 2015. Revision 1.2. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available

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[38] Hach Company. “Hach Method 10267 – Spectrophotometric Measurement of Total Organic Carbon (TOC) in Finished Drinking Water,” December 2015. Revision 1.2. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[39] Hach Company. “Hach Method 10258 – Determination of Turbidity by 360^{o} Nephelometry,” January 2016. 5600 Lindbergh Drive, P.O. Box 389, Loveland, CO 80539. (Available at http://www.hach.com.)

[40] Nitrate Elimination Company, Inc. (NECi). “Method for Nitrate Reductase Nitrate-Nitrogen Analysis of Drinking Water,” February 2016. Superior Enzymes, Inc., 334 Hecla Street, Lake Linden, Michigan 49945.

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