

DEPARTMENT OF PUBLIC HEALTH AND ENVIRONMENT

Water Quality Control Commission

COLORADO PRIMARY DRINKING WATER REGULATIONS

5 CCR 1003-1

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1.6 Common Provisions

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1.6.3 Recordkeeping

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(e) ~~In addition to the requirements of section 1.6.3(a) — (n), a groundwater system regulated under Article 13 must maintain the following information in its records:~~

(1) ~~Documentation of corrective actions. Documentation shall be kept for a period of not less than ten years.~~

(2) ~~Documentation of notice to the public as required under sections 9.1.3(h) and 9.2.13. Documentation shall be kept for a period of not less than three years.~~

(3) ~~Records of decisions under section 13.3(a)(5)(ii) and records of invalidation of fecal indicator positive groundwater source samples under section 13.3(d). Documentation shall be kept for a period of not less than five years.~~

(4) ~~For consecutive systems, documentation of notification to the wholesale system(s) of total coliform positive samples that are not invalidated under section 5.3. Documentation shall be kept for a period of not less than five years.~~

(5) ~~For systems, including wholesale systems, that are required to perform compliance monitoring under section 13.4(c):~~

(i) ~~Records of the Department-specified minimum disinfectant residual. Documentation shall be kept for a period of not less than ten years.~~

(ii) ~~Records of the lowest daily residual disinfectant concentration and records of the date and duration of any failure to maintain the Department-prescribed minimum residual disinfectant concentration for a period of more than four hours. Documentation shall be kept for a period of not less than five years.~~

(iii) ~~Records of Department-specified compliance requirements for membrane filtration and of parameters specified by the Department for Department-approved alternative treatment and records of the date and duration of any failure to meet the membrane operating, membrane integrity, or alternative treatment operating requirements for more than four hours. Documentation shall be kept for a period of not less than five years.~~

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1.6.4 Reporting Requirements

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- (e) ~~In addition to the requirements of section 1.6.4(a) — (d), groundwater systems regulated under Article 13 must provide the following information to the Department:~~
- (1) ~~A groundwater system conducting compliance monitoring under section 13.4(c) must notify the Department any time the system fails to meet any Department-specified requirements including, but not limited to, minimum residual disinfectant concentration, membrane operating criteria or membrane integrity, and alternative treatment operating criteria, if operation in accordance with the criteria or requirements is not restored within four hours. The groundwater system must notify the Department as soon as possible, but in no case later than the end of the next business day.~~
 - (2) ~~After completing any corrective action under section 13.4(a)(3) or 11.4, a groundwater system must notify the Department within 30 days of completion of the corrective action.~~
 - (3) ~~If a groundwater system subject to the requirements of section 13.3(a) does not conduct source water monitoring under section 13.3(a)(5)(ii), the system must provide documentation to the Department within 30 days of the total coliform positive sample that it met the Department's criteria for distribution system conditions that will cause total coliform positive samples.~~

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1.9 Consecutive Systems

1.9.1 Monitoring and Reporting Requirements

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- (b) ~~Consecutive public water systems that sell water as a secondary aspect of their business only to recover costs, such as apartment buildings and commercial establishments, are exempt from the requirements of this Section 1.9. If an entity that meets the above criteria is found to be selling water for profit any such entity shall, after notification from the Water Quality Control Division, meet all monitoring requirements as defined in this Section 1.9.~~

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1.12 Monitoring Plan

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In accordance with section 1.12.2 each public water system is required to submit ~~two copies~~ one copy of the monitoring plan to:

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3.4 Analytical Methods

Measurement of pH, copper and fluoride to determine compliance under section 3.3 may be conducted with one of the methods in section 10.2.2. Analyses of aluminum, chloride, foaming agents, iron, manganese, odor, silver, sulfate, total dissolved solids (TDS) and zinc to determine secondary contaminant concentrations under section 3.3 may be conducted with the methods in the following table or alternative methods listed in Appendix A to Subpart C of 40 CFR 141. Criteria for analyzing aluminum, copper, iron, manganese, silver and zinc samples with digestion or directly without digestion, and other analytical test procedures are contained in Technical Notes on Drinking Water Methods, EPA-600/R-94-173, October 1994, which is available at NTIS PB95-104766.

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5.1 Coliform Sampling

5.1.1 Routine Monitoring

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- (e) Non-community water systems must monitor for total coliform at frequencies as specified in the following paragraphs (1) – ~~(5)~~(6):

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(6) A non-community water system using hand pumped wells subject to section 13.2(e) must monitor for total coliforms on a monthly basis during any period of operation.

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7.7 Initial Distribution System Evaluations (IDSE)

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7.7.6 Section 7.8 compliance monitoring location recommendations

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- (b) ...

Table 7-29 Recommended Compliance Monitoring Locations and Frequencies

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2 Systems on quarterly monitoring must take dual sample sets every 90 days EACH CALENDAR QUARTER at each monitoring location, except for surface water and GWUDI systems serving 500 - 3,300. ~~Systems on annual monitoring and surface water and GWUDI systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location, and month, if monitored annually.~~ Groundwater systems serving 500–9,999 on annual monitoring must take dual sample sets at each monitoring location. All other systems on annual monitoring and surface water and GWUDI systems serving 500–3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. For systems serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location and month.

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7.8 Stage 2 Disinfection Byproducts Requirement

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7.8.2 Routine monitoring

(a) ...

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(2) ...

Table 7-33 Compliance Monitoring Locations and Frequencies

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2 Systems on quarterly monitoring must take dual sample sets every 90 days calendar quarter at each monitoring location, except for Surface Water and GWUDI systems serving 500-3,300. ~~Systems on annual monitoring and Surface Water and GWUDI systems serving 500-3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. Only one location with a dual sample set per monitoring period is needed if highest TTHM and HAA5 concentrations occur at the same location (and month, if monitored annually).~~ Groundwater systems serving 500–9,999 on annual monitoring must take dual sample sets at each monitoring location. All other systems on annual monitoring and surface water and GWUDI systems serving 500–3,300 are required to take individual TTHM and HAA5 samples (instead of a dual sample set) at the locations with the highest TTHM and HAA5 concentrations, respectively. For systems serving fewer than 500 people, only one location with a dual sample set per monitoring period is needed if the highest TTHM and HAA5 concentrations occur at the same location and month.

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9.2 Public Notification

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9.2.1 Introduction

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Table 9-2 Violation Categories and Other Situations Requiring a Public Notice

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(3)	Special public notices:	(vi) Groundwater systems with a waiver request that the Department has determined satisfies the criteria of section 13.2(d). <u>Groundwater systems with a waiver from disinfection requirements covered under section 13.2(d).</u>
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9.2.4 Tier 3 Public Notice Form, Manner, and Frequency of Notice

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Table 9-6 Violation Categories and Other Situations Requiring a Tier 3 Public Notice

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(6)	Failure to meet the monitoring requirements of section <u>sections 13.2(b), 13.3(a)-(f), 13.4 or 11.4.</u>

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9.2.12 Special notice for groundwater systems with a waiver request that the Department has determined satisfies the criteria of section 13.2(d) from disinfection requirements covered under section 13.2(d)

- (a) The groundwater system must notify persons served by the system in a manner prescribed by the Department no later than 30 days after the system has received notice of the Department's determination. Community water systems must provide annual public notice in order to inform consumers of the disinfection waiver. The Consumer Confidence Report (CCR) required under section 9.1 may be used as a vehicle for public notice.
- (b) Non-community water systems must continuously post the public notice in conspicuous locations in order to inform consumers of the disinfection waiver.
- (c) The public notice must contain the following language:
 - (1) [Name of groundwater system] has a waiver from disinfection requirements and serves well water that has not been chlorinated.
- ~~(b)~~(d) The groundwater system must present the notice in accordance with the requirements under section 9.2.5(c).
- ~~(c)~~(e) The Department may require the groundwater system to provide notice to new billing units or new customers in accordance with the requirements under section 9.2.6.

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9.2.14 Special notice to the public for groundwater systems with hand pumped wells subject to section 13.2(e)

- (a) The groundwater system must post notice on or within sight of the hand pumped well whenever the well is available for use to serve water to the public.
- (b) The notice must contain the following language:
 - (1) This hand pump serves unchlorinated well water. For more information, please contact [phone number of public water system owner, operator, or designee of the public water system].
- (c) The groundwater system must present the notice in accordance with the requirements in section 9.2.5(c)

9.2.15 List of Acronyms Used in Public Notification Regulation

<u>CCR</u>	<u>Consumer Confidence Report</u>
<u>CPDWR</u>	<u>Colorado Primary Drinking Water Regulation</u>
<u>CWS</u>	<u>Community Water System</u>
<u>DBP</u>	<u>Disinfection Byproduct</u>
<u>ESWTR</u>	<u>Enhanced Surface Water Treatment Rule</u>
<u>GWR</u>	<u>Groundwater Rule</u>
<u>HPC</u>	<u>Heterotrophic Plate Count</u>
<u>IOC</u>	<u>Inorganic Chemical</u>
<u>LCR</u>	<u>Lead and Copper Rule</u>
<u>MCL</u>	<u>Maximum Contaminant Level</u>
<u>MCLG</u>	<u>Maximum Contaminant Level Goal</u>

<u>MRDL</u>	<u>Maximum Residual Disinfectant Level</u>
<u>MRDLG</u>	<u>Maximum Residual Disinfectant Level Goal</u>
<u>NCWS</u>	<u>Non-Community Water System</u>
<u>NTNCWS</u>	<u>Non-transient, Non-Community Water System</u>
<u>NTU</u>	<u>Nephelometric Turbidity Unit</u>
<u>PN</u>	<u>Public Notification</u>
<u>PWS</u>	<u>Public Water System</u>
<u>SDWA</u>	<u>U.S. Safe Drinking Water Act</u>
<u>SMCL</u>	<u>Secondary Maximum Contaminant Level</u>
<u>SOC</u>	<u>Synthetic Organic Chemical</u>
<u>SWTR</u>	<u>Surface Water Treatment Rule</u>
<u>TCR</u>	<u>Total Coliform Rule</u>
<u>TT</u>	<u>Treatment Technique</u>
<u>TNCWS</u>	<u>Transient, Non-Community Water System</u>
<u>VOC</u>	<u>Volatile Organic Chemical</u>

Table 9-7 Table of CPDWR Violations and Other Situations Requiring Public Notice ¹

Contaminant	MCL/MRDL/TT violations ²		Monitoring & testing procedure violations	
	Tier of public notice required	Citation	Tier of public notice required	Citation
I. Violations of Colorado Primary Drinking Water Regulations (CPDWR): ³				
A. Microbiological Contaminants				
...
11. Groundwater Rule violations	2	<u>13.2(c)</u> , 13.4(a), 13.4(b), 11.4	3	11.4, <u>13.2(b)</u> , 13.3, 13.4
...				
H. Other Treatment Techniques				
...
2. Epichlorohydrin (TT)	2	2.9	N/A	N/A
...				
IV. Other Situations Requiring Public Notification:				
...
G Waiver of Disinfection	N/A	N/A	N/A	13.2 13.2(d)
...

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Table 9-8 Table of Standard Health Effects Language for Public Notification

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9.2.14 List of Acronyms Used in Public Notification Regulation

CCR	Consumer Confidence Report
CPDWR	Colorado Primary Drinking Water Regulation
CWS	Community Water System
DBP	Disinfection Byproduct
ESWTR	Enhanced Surface Water Treatment Rule
GWR	Groundwater Rule
HPC	Heterotrophic Plate Count
IOC	Inorganic Chemical
LCR	Lead and Copper Rule
MCL	Maximum Contaminant Level
MCLG	Maximum Contaminant Level Goal
MRDL	Maximum Residual Disinfectant Level
MRDLG	Maximum Residual Disinfectant Level Goal
NCWS	Non-Community Water System
NTNCWS	Non-transient, Non-Community Water System
NTU	Nephelometric Turbidity Unit
PN	Public Notification
PWS	Public Water System
SDWA	U.S. Safe Drinking Water Act
SMCL	Secondary Maximum Contaminant Level
SOC	Synthetic Organic Chemical
SWTR	Surface Water Treatment Rule
TCR	Total Coliform Rule
TT	Treatment Technique
TNCWS	Transient, Non-Community Water System
VOC	Volatile Organic Chemical

...

10.1 Bacteriological Analytical Requirements**10.1.1 Total Coliform Testing Requirements**

- (a) Public water systems must conduct total coliform analyses in accordance with one of the analytical methods in the following table or one of the alternative methods listed in Table 10-30.

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10.1.3 *Escherichia coli* Testing Requirements

- (a) Public water systems must conduct analysis of *Escherichia coli* in accordance with one of the following analytical methods or one of the alternative methods listed in Table 10-30:

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- (c) E. coli in Source Water. Systems must use methods for enumeration of E. coli in source water approved in 40 CFR 136.3 (a) or alternative methods listed in Table 10-30.

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10.1.4 *Cryptosporidium* Testing Requirements

- (a) *Cryptosporidium*. Systems must analyze for *Cryptosporidium* using either Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-002 or Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, 2005, United States Environmental Protection Agency, EPA-815-R-05-001, or alternative methods listed in Table 10-30.

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10.1.5 Groundwater Source Testing Requirements

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- (b) A groundwater system must analyze all groundwater source samples collected under section 13.3(a) using one of the analytical methods listed in Table 10-3 or one of the alternative methods listed in Table 10-30 for the presence of *E. coli*, enterococci, or coliphage.

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10.2 Inorganic Chemical Contaminants Analytical Requirements

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10.2.2 Inorganic Chemical Contaminants Analysis

- (a) Analysis for the following contaminants shall be conducted in accordance with the methods in the following table, or the alternative methods listed in Table 10-30. Criteria for analyzing arsenic, barium, beryllium, cadmium, calcium, chromium, copper, lead, nickel, selenium, sodium, and thallium with digestion or directly without digestion, and other analytical test procedures are contained in "Technical Notes on Drinking Water Methods," EPA-600/R-94-173, October 1994.

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10.3 Organic Chemical Analytical Requirements

Analyses for the organic chemical contaminants in this section shall be conducted using the following EPA methods, or the alternative methods listed in Table 10-30 or their equivalent as approved by EPA.

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10.4 Radionuclide Analytical Requirements

10.4.1 Sampling and Analytical Requirements

- (a) Analysis for the following Chemical contaminants shall be conducted to determine compliance with section 2.6 in accordance with the methods in the following table, or the alternative methods listed in Table 10-30 or their equivalent as determined by EPA in accordance with sections 10.9.1(a) and (b).

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10.5 Turbidity and Disinfectant Analytical Requirements

10.5.1 Turbidity, Heterotrophic Plate Count (HPC) and Disinfectant Testing Requirements

(a) . . .

- (1) Public water systems must conduct analysis of pH and temperature in accordance with one of the methods listed in Table 10-5. Public water systems must conduct analysis of heterotrophic bacteria and turbidity in accordance with one of the following analytical methods or one of the alternative methods listed in Table 10-30 and by using analytical test procedures contained in the U.S. Environmental Protection Agency's "*Technical Notes on Drinking Water Methods*," EPA-600/R-94-173, October 1994.

. . .

- (2) ~~Public water systems must measure residual disinfectant concentrations with one of the analytical methods in the following table. Except for the method for ozone residuals, the disinfectant residual methods are contained in the the American Public Health Association's "*Standard Methods for the Examination of Water and Wastewater*," 18th edition (1992), 19th edition (1995), and 20th edition (1998). The cited methods published in any of these three editions may be used. The ozone method, 4500-O₃-B, is contained in both the 18th and 19th editions. Either edition may be used. If approved by the Department, residual disinfectant concentrations for free chlorine and combined chlorine also may be measured by using DPD colorimetric test kits. Free and total chlorine residuals may be measured continuously by adapting a specified chlorine residual method for use with a continuous monitoring instrument provided the chemistry, accuracy, and precision are consistent with the referenced method. Instruments used for continuous monitoring must be verified with a grab sample measurement at least every five days, or with a protocol approved by the Department.~~

Table 10-15 — Disinfectant Residual Analytical Methods

Residual	Methodology	Methods
Free Chlorine	Amperometric Titration	4500-Cl-D
	DPD Ferrous Titrimetric	4500-Cl-F
	DPD Colorimetric	4500-Cl-G
	Syringaldazine (FACTS)	4500-Cl-H
Total Chlorine	Amperometric Titration	4500-Cl-D
	Amperometric Titration (low-level measurement)	4500-Cl-E
	DPD Ferrous Titrimetric	4500-Cl-F
	DPD Colorimetric	4500-Cl-G
	Iodometric Electrode	4500-Cl-I
Chlorine Dioxide	Amperometric Titration	4500-ClO ₂ -C
	DPD Method	4500-ClO ₂ -D
	Amperometric Titration	4500-ClO ₂ -E
Ozone	Indigo Method	4500-O ₃ -B

- (2) Public water systems must measure residual disinfectant concentrations with one of the analytical methods in the following table or one of the alternative methods listed in Table 10-30. If approved by the Department, residual disinfectant concentrations for free chlorine and combined chlorine also may be measured by using DPD colorimetric test kits. In addition the Department may approve the use of the ITS free chlorine test strip for the determination of free chlorine. Use of the test strips is described in Method D99-003, "Free Chlorine Species (HOCl- and OCl-) by Test Strip," Revision 3.0, November 21, 2003, available from Industrial Test Systems, Inc., 1875 Langston St., Rock Hill, SC 29730. Free and total chlorine residuals may be measured continuously by adapting a specified chlorine residual method for use with a continuous monitoring instrument provided the chemistry, accuracy, and precision remain the same. Instruments used for

10.7 Disinfectants, Disinfection Byproducts and Disinfection Byproduct Precursor Analytical Requirements

continuous monitoring must be calibrated with a grab sample measurement at least every five days, or with a protocol approved by the Department.

Table 10-15 Disinfection Residual Analytical Methods

Residual	Methodology	SM¹	SM Online²	Other
<u>Free Chlorine</u>	<u>Amperometric Titration</u>	<u>4500–Cl D</u>	<u>4500–Cl D–00</u>	<u>D1253–03³</u>
	<u>DPD Ferrous Titrimetric</u>	<u>4500–Cl F</u>	<u>4500–Cl F–00</u>	
	<u>DPD Colorimetric</u>	<u>4500–Cl G</u>	<u>4500–Cl G–00</u>	
	<u>Syringaldazine (FACTS)</u>	<u>4500–Cl H</u>	<u>4500–Cl H–00</u>	
	<u>Test Strips</u>			<u>Method D99-003</u>
<u>Total Chlorine</u>	<u>Amperometric Titration</u>	<u>4500–Cl D</u>	<u>4500–Cl D–00</u>	<u>D1253–03³</u>
	<u>Amperometric Titration (low level measurement)</u>	<u>4500–Cl E</u>	<u>4500–Cl E–00</u>	
	<u>DPD Ferrous Titrimetric</u>	<u>4500–Cl F</u>	<u>4500–Cl F–00</u>	
	<u>DPD Colorimetric</u>	<u>4500–Cl G</u>	<u>4500–Cl G–00</u>	
	<u>Iodometric Electrode</u>	<u>4500–Cl I</u>	<u>4500–Cl I–00</u>	
<u>Chlorine Dioxide</u>	<u>Amperometric Titration</u>	<u>4500–ClO₂ C</u>	<u>4500–ClO₂ C–00</u>	
	<u>DPD Method</u>	<u>4500–ClO₂ D</u>		
	<u>Amperometric Titration</u>	<u>4500–ClO₂ E</u>	<u>4500–ClO₂ E–00</u>	
	<u>Spectrophotometric</u>			<u>327.0, Revision 1.1⁴</u>
<u>Ozone</u>	<u>Indigo Method</u>	<u>4500–O₃ B</u>	<u>4500–O₃ B–97</u>	

1 All the listed methods are contained in the 18th, 19th, and 20th editions of *Standard Methods for the Examination of Water and Wastewater*, 1992, 1995, and 1998; the cited methods published in any of these three editions may be used.

2 Standard Methods Online are available at <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 methods listed are the only Online versions that may be used.

3 *Annual Book of ASTM Standards*, Vol. 11.01, 2004 ; ASTM International; any year containing the cited version of the method may be used. Copies of this method may be obtained from ASTM International, 100 Barr Harbor Drive, P.O. Box C700 West Conshohocken, PA 19428–2959.

4 EPA Method 327.0, Revision 1.1, "Determination of Chlorine Dioxide and Chlorite Ion in Drinking Water Using Lissamine Green B and Horseradish Peroxidase with Detection by Visible Spectrophotometry," USEPA, May 2005, EPA 815–R–05–008. Available online at <http://www.epa.gov/safewater/methods/sourcalt.html>.

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10.7 Disinfectants, Disinfection Byproducts and Disinfection Byproduct Precursor Analytical Requirements

10.7.2 Disinfection Byproduct Analytical Requirements

- (a) Systems must measure disinfection byproducts by the methods (as modified by the footnotes) listed in Table 10-24 or one of the alternative methods listed in Table 10-30:

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10.7.3 Disinfectant Residual Analytical Requirements

- (a) Systems shall measure residual disinfectant concentrations for free chlorine, combined chlorine (chloramines), and chlorine dioxide by the methods listed in Table 10-27 or one of the alternative methods listed in Table 10-30:

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10.7.4 Additional Analytical Methods

Systems required to analyze parameters not included in Tables 40-2310-24 and 40-2410-27 must use the following methods or one of the alternative methods listed in Table 10-30. A party approved by the Department must measure these parameters.

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10.11 Laboratory Compositing

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10.12 Alternative Testing Methods Approved for Analyses

Only the editions stated in the following table are approved.

Table 10-30

Table 10.1(a)

Alternative testing methods for contaminants listed in Section 10.1.1(a)						
Organism	Methodology	SM 21 st Edition ¹	Other			
Total Coliforms	Total Coliform Fermentation Technique	9221 A, B				
	Total Coliform Membrane Filter Technique	9222 A, B, C				
	Presence-Absence (P-A) Coliform Test	9221 D				
	ONPG-MUG Test	9223				
	Colitag™		Modified Colitag™ ¹³			
Alternative testing methods for contaminants listed in Section 10.1.3(a)						
Organism	Methodology	SM 20 th Edition ⁶	SM 21 st Edition ¹	SM Online ³	Other	
<i>E.coli</i>	ONPG-MUG Test	9223B	9223 B	9223 B-97		
					Modified Colitag™ ¹³	
Alternative testing methods for contaminants listed in Section 10.2.2(a)						
Contaminant	Methodology	EPA Method	SM 21 st Edition ¹	SM Online ³	ASTM ⁴	Other
Alkalinity	Titrimetric		2320 B			
Antimony	Hydride – Atomic Absorption				D 3697-07	
	Atomic Absorption; Furnace		3113 B			
	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 ²				
Arsenic	Atomic Absorption; Furnace		3113 B		D 2972-08 C	

	<u>Hydride Atomic Absorption</u>		<u>3114 B</u>		<u>D 2972-08 B</u>	
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Barium</u>	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Atomic Absorption: Direct</u>		<u>3111 D</u>			
	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Beryllium</u>	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>		<u>D 3645-08 B</u>	
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Cadmium</u>	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Calcium</u>	<u>EDTA titrimetric</u>		<u>3500-Ca B</u>		<u>D 511-09 A</u>	
	<u>Atomic Absorption: Direct Aspiration</u>		<u>3111 B</u>		<u>D 511-09 B</u>	
	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Chromium</u>	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>			

	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Copper</u>	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>		<u>D 1688-07 C</u>	
	<u>Atomic Absorption: Direct Aspiration</u>		<u>3111 B</u>		<u>D 1688-07 A</u>	
	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Conductivity</u>	<u>Conductance</u>		<u>2510 B</u>			
<u>Cyanide</u>	<u>Manual Distillation followed by</u>				<u>D2036-06 A</u>	
	<u>Spectrophotometric, Amenable</u>		<u>4500-CN⁻ G</u>		<u>D2036-06 B</u>	
	<u>Spectrophotometric Manual</u>		<u>4500-CN⁻ E</u>		<u>D2036-06 A</u>	
	<u>Selective Electrode</u>		<u>4500-CN⁻ F</u>			
	<u>Gas Chromatography/Mass Spectrometry Headspace</u>					<u>ME355.01 Z</u>
<u>Fluoride</u>	<u>Ion Chromatography</u>		<u>4110 B</u>			
	<u>Manual Distillation: Colorimetric SPADNS</u>		<u>4500-F⁻ B, D</u>			
	<u>Manual Electrode</u>		<u>4500-F⁻ C</u>		<u>D1179-04 B</u>	
	<u>Automated Alizarin</u>		<u>4500-F⁻ E</u>			
<u>Lead</u>	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>		<u>D 3559-08 D</u>	
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP-AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Magnesium</u>	<u>Atomic Absorption</u>		<u>3111 B</u>		<u>D 511-09 B</u>	
	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			

	<u>Complexation Titrimetric Methods</u>		<u>3500-Mg B</u>		<u>D 511- 09 A</u>	
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Mercury</u>	<u>Manual, Cold Vapor</u>		<u>3112 B</u>			
<u>Nickel</u>	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
	<u>Atomic Absorption: Direct</u>		<u>3111 B</u>			
	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Nitrate</u>	<u>Ion Chromatography</u>		<u>4110 B</u>			
	<u>Automated Cadmium Reduction</u>		<u>4500- NO₃⁻ F</u>			
	<u>Manual Cadmium Reduction</u>		<u>4500- NO₃⁻ E</u>			
	<u>Ion Selective Electrode</u>		<u>4500- NO₃⁻ D</u>			
	<u>Reduction/Colorimetric</u>					<u>Systea Easy (1- Reagent) B</u>
<u>Nitrite</u>	<u>Ion Chromatography</u>		<u>4110 B</u>			
	<u>Automated Cadmium Reduction</u>		<u>4500- NO₃⁻ F</u>			
	<u>Manual Cadmium Reduction</u>		<u>4500- NO₃⁻ E</u>			
	<u>Spectrophotometric</u>		<u>4500- NO₂⁻ B</u>			
	<u>Reduction/Colorimetric</u>					<u>Systea Easy (1- Reagent) B</u>
<u>Orthophosphate</u>	<u>Ion Chromatography</u>		<u>4110 B</u>			
	<u>Colorimetric, ascorbic acid, single reagent</u>		<u>4500-P E</u>	<u>4500-P E-99</u>		
	<u>Colorimetric, Automated, Ascorbic Acid</u>		<u>4500-P F</u>	<u>4500-P F-99</u>		

<u>pH</u>	<u>Electrometric</u>		<u>4500-H⁺ B</u>			
<u>Selenium</u>	<u>Hydride-Atomic Absorption</u>		<u>3114 B</u>		<u>D 3859- 08 A</u>	
	<u>Atomic Absorption: Furnace</u>		<u>3113 B</u>		<u>D 3859- 08 B</u>	
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Silica</u>	<u>Colorimetric</u>				<u>D859- 05</u>	
	<u>Molybdosilicate</u>		<u>4500- SiO₂ C</u>			
	<u>Heteropoly blue</u>		<u>4500- SiO₂ D</u>			
	<u>Automated for Molybdate-reactive Silica</u>		<u>4500- SiO₂ E</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>				
	<u>Inductively Coupled Plasma</u>		<u>3120 B</u>			
<u>Sodium</u>	<u>Atomic Absorption: Direct Aspiration</u>		<u>3111 B</u>			
	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>				
<u>Temperature</u>	<u>Thermometric</u>		<u>2550</u>			

Alternative testing methods for contaminants listed in Section 10.3

<u>Contaminant</u>	<u>Methodology</u>	<u>EPA Method</u>	<u>SM 21st Edition ¹</u>	<u>SM Online ³</u>
<u>Benzene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3 ⁹</u>		
<u>Carbon tetrachloride</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Chlorobenzene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,2-Dichlorobenzene</u>	<u>Purge & Trap/Gas Chromatography/Mass</u>	<u>524.3</u>		

	<u>Spectrometry</u>			
<u>1,4-Dichlorobenzene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,2-Dichloroethane</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>cis-Dichloroethylene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Trans-Dichloroethylene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Dichloromethane</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,2-Dichloropropane</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Ethylbenzene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Styrene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Tetrachloroethylene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,1,1-Trichloroethane</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Trichloroethylene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Toluene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,2,4-Trichlorobenzene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,1-Dichloroethylene</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>1,1,2-Trichloroethane</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Vinyl chloride</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Xylenes (total)</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		

<u>Carbofuran</u>	<u>High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection</u>		<u>6610 B</u>	<u>6610 B-04</u>
<u>Dibromochloropropane (DBCP)</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Ethyl dibromide (EDB)</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		
<u>Oxamyl</u>	<u>High-performance liquid chromatography (HPLC) with post-column derivatization and fluorescence detection</u>		<u>6610 B</u>	<u>6610 B-04</u>
<u>Total Trihalomethanes</u>	<u>Purge & Trap/Gas Chromatography/Mass Spectrometry</u>	<u>524.3</u>		

Alternative testing methods for contaminants listed in Section 10.4.1(a)

<u>Contaminant</u>	<u>Methodology</u>	<u>SM 21st Edition¹</u>	<u>ASTM⁴</u>
<u>Naturally Occurring:</u>			
<u>Gross alpha and beta</u>	<u>Evaporation</u>	<u>7110 B</u>	
<u>Gross alpha</u>	<u>Coprecipitation</u>	<u>7110 C</u>	
<u>Radium 226</u>	<u>Radon emanation</u>	<u>7500-Ra C</u>	
	<u>Radiochemical</u>	<u>7500-Ra B</u>	
<u>Radium 228</u>	<u>Radiochemical</u>	<u>7500-Ra D</u>	
<u>Uranium</u>	<u>Radiochemical</u>	<u>7500-U B</u>	
	<u>ICP-MS</u>		<u>D5673-05</u>
	<u>Alpha spectrometry</u>	<u>7500-U C</u>	
<u>Man-Made:</u>			
<u>Radioactive Cesium</u>	<u>Radiochemical</u>	<u>7500-Cs B</u>	
	<u>Gamma Ray Spectrometry</u>	<u>7120</u>	
<u>Radioactive Iodine</u>	<u>Radiochemical</u>	<u>7500-I B 7500-I C 7500-I D</u>	
	<u>Gamma Ray Spectrometry</u>	<u>7120</u>	
<u>Radioactive Strontium 89, 90</u>	<u>Radiochemical</u>	<u>7500-Sr B</u>	
<u>Tritium</u>	<u>Liquid Scintillation</u>	<u>7500-³H B</u>	
<u>Gamma Emitters</u>	<u>Gamma Ray Spectrometry</u>	<u>7120 7500-Cs B 7500-I B</u>	

Alternative testing methods for contaminants listed in Section 10.5.1(a)(1)

<u>Organism</u>	<u>Methodology</u>	<u>SM 21st Edition¹</u>	<u>Other</u>
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<u>Heterotrophic bacteria</u>	<u>Pour Plate Method</u>	<u>9215 B</u>		
<u>Turbidity</u>	<u>Nephelometric Method</u>	<u>2130 B</u>		
	<u>Laser Nephelometry (on-line)</u>			<u>Mitchell M5271</u> ¹⁰
	<u>LED Nephelometry (on-line)</u>			<u>Mitchell M5331</u> ¹¹
	<u>LED Nephelometry (on-line)</u>			<u>AMI Turbiwell</u> ¹⁵
	<u>LED Nephelometry (portable)</u>			<u>Orion AQ4500</u> ¹²
<u>Alternative testing methods for disinfectant residuals listed in Section 10.5.1(a)(2)</u>				
<u>Residual</u>	<u>Methodology</u>	<u>SM 21st Edition</u> ¹	<u>ASTM</u> ⁴	<u>Other</u>
<u>Free Chlorine</u>	<u>Amperometric Titration</u>	<u>4500-Cl D</u>	<u>D 1253-08</u>	
	<u>DPD Ferrous Titrimetric</u>	<u>4500-Cl F</u>		
	<u>DPD Colorimetric</u>	<u>4500-Cl G</u>		
	<u>Syringaldazine (FACTS)</u>	<u>4500-Cl H</u>		
	<u>On-line Chlorine Analyzer</u>			<u>EPA 334.0</u> ¹⁶
	<u>Amperometric Sensor</u>			<u>ChloroSense</u> ¹⁷
<u>Total Chlorine</u>	<u>Amperometric Titration</u>	<u>4500-Cl D</u>	<u>D 1253-08</u>	
	<u>Amperometric Titration (Low level measurement)</u>	<u>4500-Cl E</u>		
	<u>DPD Ferrous Titrimetric</u>	<u>4500-Cl F</u>		
	<u>DPD Colorimetric</u>	<u>4500-Cl G</u>		
	<u>Iodometric Electrode</u>	<u>4500-Cl I</u>		
	<u>On-line Chlorine Analyzer</u>			<u>EPA 334.0</u> ¹⁶
	<u>Amperometric Sensor</u>			<u>ChloroSense</u> ¹⁷
<u>Chlorine Dioxide</u>	<u>Amperometric Titration</u>	<u>4500-ClO₂ C</u>		
	<u>Amperometric Titration</u>	<u>4500-ClO₂ E</u>		
<u>Ozone</u>	<u>Indigo Method</u>	<u>4500-O₃ B</u>		
<u>Alternative testing methods for contaminants listed in Section 10.7.2(a)</u>				
<u>Contaminant</u>	<u>Methodology</u>	<u>EPA Method</u>	<u>ASTM</u> ⁴	<u>SM 21st Edition</u> ¹
<u>TTHM</u>	<u>P&T/GC/MS</u>	<u>524.3</u> ⁹		
<u>HAA5</u>	<u>LLE (diazomethane)/GC/ECD</u>			<u>6251 B</u>
	<u>Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)</u>	<u>557</u> ¹⁴		
<u>Bromate</u>	<u>Two-Dimensional Ion Chromatography (IC)</u>	<u>302.0</u> ¹⁸		
	<u>Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)</u>	<u>557</u> ¹⁴		

	<u>Chemically Suppressed Ion Chromatography</u>		<u>D 6581-08 A</u>	
	<u>Electrolytically Suppressed Ion Chromatography</u>		<u>D 6581-08 B</u>	
<u>Chlorite</u>	<u>Chemically Suppressed Ion Chromatography</u>		<u>D 6581-08 A</u>	
	<u>Electrolytically Suppressed Ion Chromatography</u>		<u>D 6581-08 B</u>	
<u>Chlorite – daily monitoring as prescribed in 7.6.3(b)(2)(i)(A)</u>	<u>Amperometric Titration</u>			<u>4500-ClO₂ E</u>

Alternative testing methods for disinfectant residuals listed in Section 10.7.3(a)

<u>Residual</u>	<u>Methodology</u>	<u>SM 21st Edition¹</u>	<u>ASTM⁴</u>	<u>Other</u>
<u>Free Chlorine</u>	<u>Amperometric Titration</u>	<u>4500-Cl D</u>	<u>D 1253-08</u>	
	<u>DPD Ferrous Titrimetric</u>	<u>4500-Cl F</u>		
	<u>DPD Colorimetric</u>	<u>4500-Cl G</u>		
	<u>Syringaldazine (FACTS)</u>	<u>4500-Cl H</u>		
	<u>Amperometric Sensor</u>			<u>ChloroSense¹⁷</u>
	<u>On-line Chlorine Analyzer</u>			<u>EPA 334.0¹⁶</u>
	<u>Test Strips</u>			<u>Method D99-003⁵</u>
<u>Combined Chlorine</u>	<u>Amperometric Titration</u>	<u>4500-Cl D</u>	<u>D 1253-08</u>	
	<u>DPD Ferrous Titrimetric</u>	<u>4500-Cl F</u>		
	<u>DPD Colorimetric</u>	<u>4500-Cl G</u>		
<u>Total Chlorine</u>	<u>Amperometric Titration</u>	<u>4500-Cl D</u>	<u>D 1253-08</u>	
	<u>Low level Amperometric Titration</u>	<u>4500-Cl E</u>		
	<u>DPD Ferrous Titrimetric</u>	<u>4500-Cl F</u>		
	<u>DPD Colorimetric</u>	<u>4500-Cl G</u>		
	<u>Iodometric Electrode</u>	<u>4500-Cl I</u>		
	<u>Amperometric Sensor</u>			<u>ChloroSense¹⁷</u>
	<u>On-line Chlorine Analyzer</u>			<u>EPA 334.0¹⁶</u>
<u>Chlorine Dioxide</u>	<u>Amperometric Method II</u>	<u>4500-ClO₂ E</u>		

Alternative testing methods for parameters listed in Section 10.7.4

<u>Parameter</u>	<u>Methodology</u>	<u>SM 21st Edition¹</u>	<u>EPA</u>
<u>Total Organic Carbon (TOC)</u>	<u>High Temperature Combustion</u>	<u>5310 B</u>	<u>415.3, Rev 1.2¹⁹</u>
	<u>Persulfate-Ultraviolet or Heated Persulfate Oxidation</u>	<u>5310 C</u>	<u>415.3, Rev 1.2</u>
	<u>Wet Oxidation</u>	<u>5310 D</u>	<u>415.3, Rev 1.2</u>
<u>Specific Ultraviolet Absorbance (SUVA)</u>	<u>Calculation using DOC and UV₂₅₄ data</u>		<u>415.3, Rev 1.2</u>
<u>Dissolved Organic Carbon (DOC)</u>	<u>High Temperature Combustion</u>	<u>5310 B</u>	<u>415.3, Rev 1.2</u>
	<u>Persulfate-Ultraviolet or Heated Persulfate Oxidation</u>	<u>5310 C</u>	<u>415.3, Rev 1.2</u>
	<u>Wet Oxidation</u>	<u>5310 D</u>	<u>415.3, Rev 1.2</u>
<u>Ultraviolet absorption at 254 nm (UV₂₅₄)</u>	<u>Spectrophotometry</u>	<u>5910 B</u>	<u>415.3, Rev 1.2</u>

Alternative testing methods with MRL ≤ 0.0010 mg/L for monitoring listed in Section 7.6.3(b)(3)(ii)(A)					
Contaminant	Methodology	EPA Method			
Bromate	Two-Dimensional Ion Chromatography (IC)	302.0 ¹⁸			
	Ion Chromatography Electrospray Ionization Tandem Mass Spectrometry (IC-ESI-MS/MS)	557 ¹⁴			
Alternative testing methods for contaminants listed in Section 10.1.5(b)					
Methodology	SM 20 th Edition ⁶	SM 21 st Edition ¹	SM Online ³		
Colilert		9223 B	9223 B-97		
Colisure		9223 B	9223 B-97		
Colilert-18	9223 B	9223 B	9223 B-97		
Multiple-Tube Technique			9230 B-04		
Alternative testing methods for contaminants listed in Section 10.1.3(c)					
Organism	Methodology	SM 20 th Edition ⁶			
E. coli	Membrane Filtration, Two Step	9222 D/9222 G			
Alternative testing methods for contaminants listed in Section 3.4					
Contaminant	Methodology	EPA Method	ASTM ⁴	SM 21 st Edition ¹	SM Online ³
Aluminum	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2 ²			
	Atomic Absorption; Direct			3111 D	
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Chloride	Silver Nitrate Titration		D 512-04 B	4500-Cl ⁻ B	
	Ion Chromatography			4110 B	
	Potentiometric Titration			4500-Cl ⁻ D	
Color	Visual Comparison			2120 B	
Foaming Agents	Methylene Blue Active Substances (MBAS)			5540 C	
Iron	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct			3111 B	
	Atomic Absorption; Furnace			3113 B	
	Inductively Coupled Plasma			3120 B	
Manganese	Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)	200.5, Revision 4.2			
	Atomic Absorption; Direct			3111 B	
	Atomic Absorption; Furnace			3113 B	

	<u>Inductively Coupled Plasma</u>			<u>3120 B</u>	
<u>Odor</u>	<u>Threshold Odor Test</u>			<u>2150 B</u>	
<u>Silver</u>	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>			
	<u>Atomic Absorption; Direct</u>			<u>3111 B</u>	
	<u>Atomic Absorption; Furnace</u>			<u>3113 B</u>	
	<u>Inductively Coupled Plasma</u>			<u>3120 B</u>	
<u>Sulfate</u>	<u>Ion Chromatography</u>			<u>4110 B</u>	
	<u>Gravimetric with ignition of residue</u>			<u>4500-SO₄⁻² C</u>	<u>4500-SO₄⁻² C-97</u>
	<u>Gravimetric with drying of residue</u>			<u>4500-SO₄⁻² D</u>	<u>4500-SO₄⁻² D-97</u>
	<u>Turbidimetric method</u>		<u>D 516-07</u>	<u>4500-SO₄⁻² E</u>	<u>4500-SO₄⁻² E-97</u>
	<u>Automated methylthymol blue method</u>			<u>4500-SO₄⁻² F</u>	<u>4500-SO₄⁻² F-97</u>
<u>Total Dissolved Solids</u>	<u>Total Dissolved Solids Dried at 180 deg C</u>			<u>2540 C</u>	
<u>Zinc</u>	<u>Axially viewed inductively coupled plasma-atomic emission spectrometry (AVICP–AES)</u>	<u>200.5, Revision 4.2</u>			
	<u>Atomic Absorption; Direct Aspiration</u>			<u>3111 B</u>	
	<u>Inductively Coupled Plasma</u>			<u>3120 B</u>	

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/nerlcwww/ordmeth.htm>.)

3 _____ Standard Methods Online are available at <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 methods listed are the only online versions that may be used.

4 _____ Available from ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428-2959 or <http://astm.org>. The methods listed are the only alternative versions that may be used.

5 _____ Method D99-003, Revision 3.0. "Free Chlorine Species (HOCl- and OCl-) by Test Strip," November 21, 2003. Available from Industrial Test Systems, Inc., 1875 Langston St., Rock Hill, SC 29730.

6 _____ Standard Methods for the Examination of Water and Wastewater, 20th edition (1998). Available from American Public Health Association, 800 I Street, NW, Washington, DC 20001-3710.

7 _____ Method ME355.01, Revision 1.0. "Determination of Cyanide in Drinking Water by GC/MS Headspace," May 26, 2009. Available at <http://www.nemi.gov> or from James Eaton, H & E Testing Laboratory, 221 State Street, Augusta, ME 04333. (207) 287-2727.

8 _____ Syssta Easy (1-Reagent). "Syssta Easy (1-Reagent) Nitrate Method," February 4, 2009. Available at <http://www.nemi.gov> or from Syssta Scientific, LLC., 900 Jorie Blvd., Suite 35, Oak Brook, IL 60523.

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 http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.

10 _____ Mitchell Method M5271, Revision 1.1. "Determination of Turbidity by Laser Nephelometry," March 5, 2009. Available at <http://www.nemi.gov> or from Leck Mitchell, Ph.D., PE, 656 Independence Valley Dr., Grand Junction, CO 81507.

- 11 Mitchell Method M5331, Revision 1.1. "Determination of Turbidity by LED Nephelometry," March 5, 2009. Available at <http://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 <http://www.nemi.gov> or from Thermo Scientific, 166 Cummings Center, Beverly, MA 01915, <http://www.thermo.com>.
- 13 Modified Colitag™ Method. "Modified 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, 580 Skylane Boulevard, Santa Rosa, CA 95403.
- 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)," August 2009. EPA 815-B-09-012. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.
- 15 AMI Turbiwell, "Continuous Measurement of Turbidity Using a SWAN AMI Turbiwell Turbidimeter," August 2009. Available at <http://www.nemi.gov> or from Markus Bernasconi, SWAN Analytische Instrumente AG, Stubbachstrasse 13, CH-8340 Hinwil, Switzerland.
- 16 EPA Method 334.0. "Determination of Residual Chlorine in Drinking Water Using an On-line Chlorine Analyzer," August 2009. EPA 815-B-09-013. Available at http://epa.gov/safewater/methods/analyticalmethods_ogwdw.html.
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13.1 General requirements and applicability.

- (a) ~~Scope. The requirements of Article 13 constitute *Colorado Primary Drinking Water Regulations*.~~
- (b)(a) General Requirements and Applicability. The Groundwater Rule Article 13 applies to all public water systems that use groundwater except that it does not apply to public water systems that combine all of their groundwater with surface water or with groundwater under the direct influence of surface water prior to treatment under Article 7. For the purposes of Article 13, "groundwater system" is defined as any public water system meeting this applicability statement, including consecutive systems receiving finished groundwater.
- (c) ~~General requirements.~~
- (1) All groundwater systems: All groundwater systems must comply with the requirements of sections 13.2(a-c) with the following exceptions:
- (i) Groundwater systems operating pursuant to a disinfection waiver must comply with section 13.2(d).
 - (ii) Groundwater systems that have only hand pumped wells must comply with section 13.2(e).
 - (iii) Groundwater systems that have hand pumped wells and other sources must comply with 13.2(a-c) for groundwater sources that are not hand pumped wells. These systems must comply with section 13.2(e) for groundwater sources that are hand pumped wells.
 - (iv) Consecutive systems that only serve finished groundwater to the public must comply with sections 13.2(a)(2)(ii), 13.2(b)(2), 13.2(b)(3) and 13.2(c)(2).

- (2) **All groundwater systems:** In addition to sections 1.6.3 and 1.6.4, all groundwater systems must comply with the recordkeeping and reporting requirements of sections 13.5 and 13.6.
- (1)(3) **SanitaryAll groundwater systems:** All groundwater systems must comply with the sanitary survey information requirements for all groundwater systems as described in section 11.1(a).
- (2)(4) **Groundwater systems that do not treat all of their groundwater to at least 4-log treatment:** MicrobialGroundwater systems must comply with the microbial source water monitoring requirements for groundwater systems that do not treat all of their groundwater to at least 99.99 percent (4-log) treatment of viruses before or at the first customer as described in section 13.3.
- (3)(5) **Groundwater systems that have fecally contaminated source waters:** Treatment technique requirements, described in section 13.4, that apply to groundwater systems that have fecally contaminated source waters, as determined by source water monitoring conducted under section 13.3. A groundwater system with fecally contaminated source water must implement one or more of the following corrective actions: correct all significant deficiencies; provide an alternate source of water; eliminate the source of contamination; or provide treatment that reliably achieves at least 4-log treatment of viruses before or at the first customer.
- (4)(6) **Groundwater systems that provide at least 4-log treatment of viruses before or at the first customer:** Groundwater systems that provide at least 4-log treatment of viruses before or at the first customer are required to conduct compliance monitoring to demonstrate treatment effectiveness, as described in section 13.4(c).
- (7) **Groundwater systems that chemically disinfect all groundwater sources:** Groundwater systems that chemically disinfect all groundwater sources must comply with sections 13.2(b)(1) and 13.2(c)(1) by July 1, 2011.
- (8) **Groundwater systems that have an approved ultra violet light treatment system as their only means of treatment:** Groundwater systems that have an approved ultra violet light treatment system as their only means of treatment must comply with sections 13.2(a-c) by July 1, 2012.
- (9) **Non-community groundwater systems that serve susceptible populations:** Non-community groundwater systems that meet one or both of the following definitions, or non-community groundwater systems that the Department has determined predominantly serve populations susceptible to microbial illness, may no longer operate pursuant to a disinfection waiver and must comply with sections 13.2(a-c) by July 1, 2012:
- (i) **Schools:** Any facility (public, proprietary, parochial, denominational, or eleemosynary) which is maintained for preschool, elementary or secondary educational purposes.
 - (ii) **Child care facilities** licensed by the Colorado Department of Human Services under provisions of Sections 26-6-102(1.5), (2.5)(a), (5), (5.1), (8), (9), (10)(a), C.R.S.
- (10) **Only transient non-community groundwater systems may operate hand pumped wells.**

(11) For the purposes of Article 13, “detectable”, in regards to a residual disinfectant concentration, is considered at or above the detection limit of the approved methods in section 10.5.1(a)(2).

(5)(12) If requested by the Department, groundwater systems must provide the Department with any existing information that will enable the Department to perform a hydrogeologic sensitivity assessment.

(13) Community and non-transient non-community groundwater systems using chemical treatment must comply with sections 7.6, 7.7 and 7.8.

(14) Effective November 30, 2010, the Department will no longer approve waivers from disinfection requirements.

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13.2 Disinfection of Groundwater Minimum Treatment Technique Requirements

(a) In addition to complying with the requirements under sections 7.6, 7.7 and 7.8 public water Groundwater systems that use groundwater must comply with section 13.22 the following treatment technique requirements:

(1) A groundwater source must be disinfected at all times that it is used to serve water to the public. The groundwater system must use disinfection methods that are approved by the Department. Groundwater source disinfection methods may include physical treatment methods but must include at least one chemical treatment method.

(2) The groundwater system must maintain a residual disinfectant concentration whenever serving water from a groundwater source to the public.

(i) For water entering the distribution system at the entry points, maintaining a residual disinfectant concentration means chemical treatment must provide a residual disinfectant concentration at the entry points which cannot be below 0.2 mg/L for longer than a 72 hour period.

(ii) For water throughout the distribution system, maintaining a residual disinfectant concentration means chemical treatment must provide a residual disinfectant concentration in the water throughout the distribution system that cannot be undetectable in more than 5 percent of the samples taken each monitoring period, for any two consecutive monitoring periods that the groundwater system serves water to the public.

(b) A public water system that uses only groundwater sources which have been determined to not be under the direct influence of surface water shall be disinfected by means or methods which are approved by the Department and are effective in the killing or removal of pathogenic organisms. Disinfection may include physical as well as chemical treatment. When chlorination methods are employed, a sufficient amount of chlorine shall be added to the water to destroy any pathogenic organisms potentially present and to maintain a detectable residual in at least 95 percent of the samples taken at the extremities of the distribution system from which water may be withdrawn.

(b) Groundwater systems must monitor the effectiveness and reliability of the disinfection treatment required in section 13.2(a):

- (1) For water entering the distribution system, the residual disinfection concentration must be measured at the entry point at least once in every week that water from the groundwater source is served to the public.
 - (i) If any entry point sample measurement falls below 0.2 mg/L residual disinfectant concentration, then the groundwater system must measure the residual disinfectant concentration at that entry point at least every 24 hours from the time of discovery until the residual disinfectant concentration is equal to or greater than 0.2 mg/L.
 - (2) The residual disinfectant concentration in the distribution system must be measured at least at the same points and at the same time as total coliforms are sampled.
 - (3) For sections 13.2(b)(1-2), the groundwater system must measure residual disinfectant concentrations as total chlorine, free chlorine or chlorine dioxide using analytical methods specified in section 10.5.1(a)(2). The Department may specify which residual disinfectant the system must measure.
- (c) The following requirements pertain to residual disinfectant concentrations of finished water within the distribution system:
- (1) The residual disinfectant concentration in the distribution system, measured as total chlorine, combined chlorine, free chlorine or chlorine dioxide, cannot be undetectable in more than 5 percent of the samples taken each month, for any two consecutive months that the system serves water to the public.
 - (2) The residual disinfectant concentration must be measured at least at the same points in the distribution system and at the same time as total coliforms are sampled.
- (c) The following constitute treatment technique violations:
- (1) Groundwater systems that fail to maintain at least 0.2 mg/L residual disinfectant concentration as required in section 13.2(a)(2)(i) are in violation of the treatment technique if the failure is not corrected within 72 hours of discovery of the failure. In the event of a violation the system must do the following:
 - (i) The groundwater system must determine and resolve the problems that resulted in the treatment technique violation.
 - (ii) The groundwater system must document the date, time and duration of the failure, the source of the failure, the steps taken to correct the failure, and what steps will be taken to prevent future failures. The documentation must be available within 48 hours of the resolution of the failure and be provided to the Department upon request.
 - (iii) The groundwater system must notify the Department as required in section 13.6(a)(1).
 - (iv) The groundwater system must provide public notice as required in section 9.2.3.
 - (2) Groundwater systems that fail to maintain a detectable residual disinfectant concentration in the distribution system, as required in section 13.2(a)(2)(ii), are in violation of the treatment technique if the residual disinfectant concentration is undetectable in more than 5 percent of the samples taken each monitoring period, for any two consecutive

monitoring periods that the groundwater system serves water to the public. In the event of a violation the system must do the following:

- (i) The groundwater system must provide public notice as required in section 9.2.3.
- (d) The Department may waive the requirement for disinfection upon written application by a supplier. Waivers may be granted when competent evidence is submitted by the supplier to establish that the water being supplied to the public is from a protected groundwater source, determined safe and free from contamination. An application for a waiver shall include information regarding the source, distribution and quality of the system's water.

(d) Groundwater systems operating pursuant to a disinfection waiver are waived from the requirements of sections 13.2(a-c) and the following provisions apply:

(1) General Requirements:

- (i) The groundwater system must only serve water from groundwater sources.
- (ii) The groundwater system must provide publication of a special notice regarding the waiver as required in section 9.2.12.
- (iii) The groundwater system must be operated by qualified personnel who meet the requirements of Regulation 100, 5 CCR 1003-2, Water and Wastewater Facility Operators Certification Requirements, and are included in a State register of qualified operators.
- (iv) The groundwater system must have the ability to provide an emergency disinfectant residual concentration. The groundwater system must submit for Department approval the plans and specifications for emergency disinfection equipment by October 1, 2011 and have Department approved emergency disinfection equipment by May 1, 2012 or submit for Department approval an emergency operating plan by October 1, 2011 and operate in accordance with the Department approved emergency operating plan by May 1, 2012.
- (v) The groundwater system must keep records of all chlorination activities. At a minimum, the records must include the following:
 - (A) The date, duration, locations and purpose of each chlorination event.
 - (B) The maximum and minimum chlorine dose in mg/L the groundwater system applied during each chlorination event and the results of any and all residual measurements taken during each chlorination event.
- (vi) The groundwater system must have a Monitoring Plan that meets the requirements of section 1.12. The groundwater system must submit for Department approval a Monitoring Plan by October 1, 2011 and operate in accordance with the Department approved Monitoring Plan by May 1, 2012.
- (vii) Distribution System Protection Plan: The groundwater system must submit for Department approval a Distribution System Protection Plan by October 1, 2011 and operate in accordance with the Department approved Distribution System Protection Plan by May 1, 2012. The Distribution System Protection Plan must describe protection measures designed to reduce public health risks for water provided through the storage and distribution system. At a minimum, the Distribution System Protection Plan must include:

- (A) Description of distribution system operation and maintenance practices (e.g., flushing schedules, scheduled upgrades, disinfection schedules etc.).
- (B) Description of a hazardous cross-connection control program that meets the requirements of Article 12.
- (C) Identification of each potential point of entry for hazards and/or contaminants into the storage and distribution system and a description of the hazard and/or contaminant control measures to be used to mitigate the potential public health risks.
- (D) Description of monitoring locations and parameters that will be used to verify and document that the hazard and/or contaminant control measures are effective.
- (E) Description of incident response procedures to be followed in the case of a distribution system breach, hazard condition and/or contamination event. The procedure must at least include confirmation and repeat sampling protocols and flushing procedures.
- (viii) Source Water Protection Plan: The groundwater system must submit for Department approval a Source Water Protection Plan by October 1, 2011 and operate in accordance with the Department approved Source Water Protection Plan by May 1, 2012. The Source Water Protection Plan must describe protection measures designed to reduce public health risks for water provided from groundwater sources. At a minimum, the Source Water Protection Plan must include:
 - (A) Delineation of source water protection areas.
 - (B) An inventory of potential sources of contamination.
 - (C) Plan for management of potential contaminant sources.
 - (D) Well failure emergency and contingency plans.
 - (E) Capacity development plan for new wells.
 - (F) Description of the methods to be used to involve and educate the public during the source water protection planning and implementation process.
- (2) The Department may evaluate a groundwater system's wells and storage systems to determine if there are potential health risks from these sources. The Department will conduct the evaluation based on criteria found in:
 - (i) Well construction and location criteria outlined in the Rules and Regulations and Colorado Statutes Governing Construction of Water Wells and the Installation of Pumping Equipment as enforced by the State Board of Examiners of Water Well and Pump Installation Contractors.
 - (ii) Design criteria developed by the Department. Copies of the "State of Colorado Design Criteria for Potable Water Systems" are available electronically on the Department's web site at www.cdphe.state.co.us

- (3) Existing sources. The Department may require assessment source water monitoring as specified in section 13.3(b) and/or additional testing and/or additional information to establish that the water being supplied to the public is from a groundwater source determined to be free from microbial contamination.
- (4) New sources. New groundwater sources are subject to the requirements of section 13.3(f). The Department may require additional testing and/or additional information to establish that the water being supplied to the public is from a groundwater source determined to be free from microbial contamination. The Department may require that all testing and evaluation be completed before the source may begin supplying water to the public.
- (5) The Department may at any time perform a full or partial sanitary survey pursuant to Article 11 to establish that the groundwater system is at low risk of contamination.
- (6) If a groundwater system is not in compliance with 13.2(d)(1), or if based on the information obtained in sections 13.2(d)(2-5) and/or other information, it appears that the water being served to the public presents a potential public health risk, the Department may summarily withdraw the waiver, whereupon disinfection shall be required and the groundwater system must comply with sections 13.2(a-c).
- (7) The following conditions may result in immediate waiver withdrawal, and if the waiver is withdrawn, the groundwater system must comply with sections 13.2(a-c):

 - (i) The groundwater system fails to correct significant deficiencies as required under section 11.4.
 - (ii) The groundwater system fails to comply with the provisions of Article 5 Microbial Contaminants.
 - (iii) The groundwater system fails to comply with the triggered source water monitoring and reporting requirements under section 13.3(a).
 - (iv) The groundwater system fails to comply with the provisions of Article 12 Hazardous Cross-Connection.
 - (v) There is an incidence of microbial disease, the source of which is reasonably identified by the Department as originating from consumption of drinking water from the groundwater system.
 - (vi) There is an occurrence of unforeseeable situations or conditions which are reasonably identified by the Department as having the potential to contribute to a microbial disease incidence.
 - (vii) The groundwater system is in violation of the Colorado Drinking Water Regulations.
- (8) A groundwater system with a source that has been determined to be fecally contaminated or is required to comply with 13.4(c)(3) shall no longer operate pursuant to a disinfection waiver and must comply with sections 13.2(a-c).
- (9) The groundwater system may request a hearing to contest the withdrawal of the waiver. Request for such a hearing must be filed in writing within 60 days after service of the Department's withdrawal. Such hearing must be conducted pursuant to the procedures established by Article 4 of Title 24, Colorado Revised Statutes.

- ~~(e) If the Department initially determines that a waiver request satisfies the criteria of section 13.2(d):~~
- ~~(1) The public water system shall provide publication of a special notice regarding the waiver pursuant to section 9.2.12.~~
 - ~~(2) A person adversely affected or aggrieved by the waiver may request a hearing. Such requests shall be filed in writing with the Department within 60 days after publication of notice. Such hearing shall be conducted in accordance with procedures established by Article 4 of Title 24, Colorado Revised Statutes. The applicant shall be named as a party to such hearing. If no request for hearing is made, the waiver shall take effect 60 days from publication of notice. If a request for a hearing is made the waiver shall remain in effect prior to any determination made at the hearing.~~
- (e) Groundwater systems with hand pumped wells are subject to the following requirements unless otherwise determined by the Department.
- (1) Groundwater systems must operate and maintain hand pumped wells in accordance with Department approved hand pumped well monitoring and operational criteria. Systems must submit criteria to the Department for approval unless the system uses the Department's 'Monitoring and Operational Guidance Handbook for Colorado Public Water Systems Utilizing Hand Pumped Wells Which Do Not Provide Continuous Disinfection,' which is considered pre-approved criteria.
 - (2) Groundwater systems must disinfect seasonally operated hand pumped wells no earlier than 30 days prior to opening for the season. Groundwater systems must disinfect hand pumped wells that operate year round at least once a year during the busiest month of operation.
 - (3) The groundwater system must monitor each hand pumped well for total coliform at least monthly during any period of operation as required in section 5.1.1(e)(6) and report results as required in section 1.6.4.
 - (4) If the result of any routine total coliform sample is positive for fecal coliforms or E. coli or a repeat total coliform sample is positive, then the groundwater system must close the hand pumped well until a total coliform sample is absent of bacteria. The groundwater system must disinfect the hand pumped well before resuming operation.
 - (5) The groundwater system must conduct special public notice as described in section 9.2.14.
- ~~(f) If the Department denies the request for waiver, the applicant may request a hearing to contest the denial. Such request shall be in writing and shall be filed with the Department within 60 days after service of the Department's statement of denial. Such hearing shall be conducted in accordance with procedures established by Article 4 of Title 24, Colorado Revised Statutes.~~
- ~~(g) Samples from public water systems for which waivers have been granted shall be submitted for analyses upon request of the Department. If at any time it appears that the water being furnished is not in compliance with applicable contaminant levels or for any reason is not safe to drink, the Department may summarily withdraw the waiver, whereupon disinfection shall be required. The affected supplier may request a hearing to contest the withdrawal of the waiver. Request for such a hearing shall be filed in writing within 60 days after service of the Department's withdrawal. Such hearing shall be conducted pursuant to the procedures established by Article 4 of Title 24, Colorado Revised Statutes.~~

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13.4 Treatment technique requirements for groundwater systems. Additional Treatment Technique Requirements

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(c)

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(3) ...

(i) ...

(A) Groundwater systems serving greater than 3,300 people. A groundwater system that serves greater than 3,300 people must continuously monitor the residual disinfectant concentration using analytical methods specified in section ~~40.5(a)(2)~~ 10.5.1(a)(2) at a location approved by the Department and must record the lowest residual disinfectant concentration each day that water from the groundwater source is served to the public. The groundwater system must maintain the Department-determined residual disinfectant concentration every day the groundwater system serves water from the groundwater source to the public. If there is a failure in the continuous monitoring equipment, the groundwater system must conduct grab sampling every four hours until the continuous monitoring equipment is returned to service. The system must resume continuous residual disinfectant monitoring within fourteen (14) days.

(B) Groundwater systems serving 3,300 or fewer people. A groundwater system that serves 3,300 or fewer people must monitor the residual disinfectant concentration using analytical methods specified in section ~~40.5(a)(2)~~ 10.5.1(a)(2) at a location approved by the Department and record the residual disinfection concentration each day that water from the groundwater source is served to the public. The groundwater system must maintain the Department-determined residual disinfectant concentration every day the groundwater system serves water from the groundwater source to the public. The groundwater system must take a daily grab sample during the hour of peak flow or at another time specified by the Department. If any daily grab sample measurement falls below the Department-determined residual disinfectant concentration, the groundwater system must take follow-up samples every four hours until the residual disinfectant concentration is restored to the Department-determined level. Alternatively, a groundwater system that serves 3,300 or fewer people may monitor continuously and meet the requirements of section 13.4(c)(3)(i)(A).

...

(d) Discontinuing compliance monitoring or treatment. A groundwater system may discontinue compliance monitoring if the system notifies the Department and the Department determines and documents in writing that compliance monitoring is no longer necessary for that groundwater source. A system that discontinues compliance monitoring is subject to the source water monitoring and analytical methods requirements of sections 13.3 and 10.1.5. A system discontinuing compliance monitoring is still subject to the requirements for disinfection of

~~groundwater in sections 13.2(b) and 13.2(c), unless the system has obtained a disinfection waiver under sections 13.2(d) and 13.2(e). applicable requirements of section 13.2.~~

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13.5 Recordkeeping Requirements

- (a) In addition to other recordkeeping requirements in section 1.6.3, systems must maintain records as described below.
- (1) Records of residual disinfection concentration measurements as required in section 13.2(b) must be kept for a period of not less than 5 years and include the following information:
 - (i) The date, place, and time of sampling, and the name of the person(s) who collected/analyzed the sample;
 - (ii) The analytical technique/method used; and
 - (iii) The results of the analyses.
 - (2) Documentation relating to treatment technique violations as required in section 13.2(c)(1)(ii) must be kept for a period of not less than 5 years.
 - (3) A system operating pursuant to a waiver from disinfection requirements must keep all correspondence and documentation relating to the requirements of section 13.2(d) for as long as the system is operating pursuant to a waiver from disinfection requirements and for a period of not less than 5 years after waiver withdrawal.
 - (4) A system operating pursuant to a waiver from disinfection requirements must keep all chlorination activity records as required in section 13.2(d)(1)(v) for a period of not less than 5 years.
 - (5) Documentation of corrective actions must be kept for a period of not less than ten years.
 - (6) Documentation of notice to the public as required under sections 9.1.3(h) and 9.2.13 must be kept for a period of not less than three years.
 - (7) Records of decisions under section 13.3(a)(5)(ii) and records of invalidation of fecal indicator-positive groundwater source samples under section 13.3(d) must be kept for a period of not less than five years.
 - (8) For consecutive systems, documentation of notification to the wholesale system(s) of total-coliform positive samples that are not invalidated under section 5.3 must be kept for a period of not less than five years.
 - (9) For systems, including wholesale systems, that are required to perform compliance monitoring under section 13.4(c):
 - (i) Records of the Department-specified minimum disinfectant residual must be kept for a period of not less than ten years.
 - (ii) Records of the lowest daily residual disinfectant concentration and records of the date and duration of any failure to maintain the Department-prescribed minimum residual disinfectant concentration for a period of more than four hours must be kept for a period of not less than five years.

- (iii) Records of Department-specified compliance requirements for membrane filtration and of parameters specified by the Department for Department-approved alternative treatment and records of the date and duration of any failure to meet the membrane operating, membrane integrity, or alternative treatment operating requirements for more than four hours must be kept for a period of not less than five years.

13.6 Reporting Requirements

- (a) In addition to other reporting requirements in section 1.6.4, systems must provide the following information to the Department:
 - (1) A groundwater system conducting monitoring under section 13.2(b)(1) must notify the Department any time the system fails to maintain at least 0.2 mg/L residual disinfectant concentration as required in section 13.2(a)(2)(i) if the failure is not corrected within 72 hours of discovery of the failure. The groundwater system must notify the Department as soon as possible, but in no case later than the end of the next business day.
 - (2) A groundwater system conducting compliance monitoring under section 13.2(b)(2) must report sample results to the Department as required by 1.6.4(a).
 - (3) A groundwater system conducting compliance monitoring under section 13.4(c) must notify the Department any time the system fails to meet any Department-specified requirements including, but not limited to, minimum residual disinfectant concentration, membrane operating criteria or membrane integrity, and alternative treatment operating criteria, if operation in accordance with the criteria or requirements is not restored within four hours. The groundwater system must notify the Department as soon as possible, but in no case later than the end of the next business day.
 - (4) After completing any corrective action under section 13.4(a)(3) or 11.4, a groundwater system must notify the Department within 30 days of completion of the corrective action.
 - (5) If a groundwater system subject to the requirements of section 13.3(a) does not conduct source water monitoring under section 13.3(a)(5)(ii), the system must provide documentation to the Department within 30 days of the total coliform positive sample that it met the Department's criteria for distribution system conditions that will cause total coliform-positive samples.

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Article 25 STATEMENT OF BASIS, SPECIFIC STATUTORY AUTHORITY AND PURPOSE:
August 10, 2010 rulemaking; Effective Date November 30, 2010

Adoption of Amendments to Article 13 – Groundwater Rule, with amendments to Articles 1, 3, 5, 7, 9, and 10 of the Colorado Primary Drinking Water Regulations.

The Colorado Revised Statutes (CRS), §25-1.5-202, provide specific authority for adoption of these regulatory amendments. The Commission also adopted, in compliance with §24-4-103(4), CRS, the following statement of basis and purpose.

Basis and Purpose

All suppliers of drinking water in Colorado are subject to regulations adopted by the U.S. Environmental Protection Agency (EPA) under the Safe Drinking Water Act, (42 U.S.C. 300f et seq.) as well as by the Colorado Primary Drinking Water Regulations under the direction of the Water Quality Control Division (Division). Colorado has been granted primary enforcement responsibility (primacy) for the public water system supervision program under the federal Safe Drinking Water Act. However, in order to maintain primacy, states must also promulgate new regulations that are no less stringent than those adopted by the federal government. By retaining primacy, the Division is able to protect the public health by ensuring that public water systems provide safe drinking water to Colorado citizens and visitors.

Article 13 (Groundwater Rule) of the Colorado Primary Drinking Water Regulations was adopted on 12/08/2008. While the majority of the provisions in Article 13 were required to maintain primacy and are based on federal language, Section 13.2 does not contain federal requirements and Colorado's primary enforcement authority was not contingent upon its adoption. The substance of Section 13.2 covers Colorado rules on the disinfection of groundwater sources and the rules for granting public water systems a waiver from disinfection requirements.

The Center for Disease Control has called providing safe drinking water one of the greatest public health achievements of the 20th century. Prior to 1908, no U.S. municipal water systems chemically disinfected drinking water. Consequently, waterborne diseases exacted a heavy toll in illness and death. Without chlorination or other disinfection processes, the public is at great risk of contracting waterborne diseases. Meeting the goal of clean, safe drinking water requires a multi-barrier approach that includes protecting raw source water from contamination, appropriately treating raw water, and ensuring safe distribution of treated water to consumers' taps.

Water-borne disease outbreaks have been common in Colorado dating back to the 1800s. As a result, mandatory disinfection of all water served to the public, including groundwater sources, has long been recognized by both the Colorado Board of Health and subsequently the Water Quality Control Commission as necessary for the protection of public health. This recognition predates the federal Safe Drinking Water Act. Disinfection of groundwater sources has always been included in mandatory disinfection requirements and Colorado has a regulatory history that views untreated groundwater as a potentially significant health hazard.

In November 1967, the Colorado Board of Health recognized that mandatory disinfection of drinking water served to the public was necessary to protect public health and the Board amended then existing regulations to include the requirement that "a sufficient amount of chlorine shall be added to the water to maintain a measurable chlorine residual at all points in the distribution system." The Board also established, at that time, the ability of the Water Quality Control Division (WQCD) to grant groundwater systems a waiver from disinfection requirements if the system could demonstrate that their water was "reasonably safe and free from contamination."

In 1977, the Board further strengthened disinfection requirements by adopting amendments that required systems to maintain a "free available chlorine residual of at least 0.2 mg/L at the extremities of the

distribution system.” Amendments adopted in 1991, modified the requirement for maintaining a chlorine residual in the distribution system from 0.2 mg/L to maintaining a “detectable residual in at least 95% of the samples taken at the extremities of the distribution system.” An amendment requiring a residual disinfectant concentration in the distribution system measured “at the same time as total coliforms are sampled” was also added.

Based on the regulatory authority established in the 1967 amendments, WQCD issued disinfection waivers dating back over several decades. Concerns with the ongoing appropriateness of some of these existing waivers prompted the initiation of a waiver review process in 2007. This process resulted in the withdrawal of a number of disinfection waivers due to concerns over the system’s ability to provide safe drinking water to the public.

Recently, two disease outbreaks associated with groundwater systems occurred in Colorado - the 2008 salmonella outbreak in Alamosa and the Skyline Ranch norovirus outbreak in 2007. The Alamosa outbreak was particularly serious due to the large number of people who were sickened and one death associated with this particular disease outbreak. Alamosa had a disinfection waiver at the time of the outbreak (which has since been withdrawn) and, as a result, the city’s drinking water was not being disinfected. An extensive report was developed in the wake of the Alamosa outbreak. This report outlined a combined failure of physical, regulatory and human infrastructure all of which contributed to the outbreak.

After careful consideration, in particular, of the history of disinfection in Colorado, of the historical issuance of disinfection waivers, of the reality of continued disease outbreaks, and of growing concerns with the clarity of regulatory language, the amendments as described in this article (Article 25) were developed and adopted. These amendments reflect several conclusions. Retention of waivers is not appropriate except for systems that have shown a consistent, long-term history of operating in a manner that is fully protective of public health without the barrier of disinfection and can demonstrate continuing adherence to high standards of source and distribution system protection. Increased requirements and oversight of systems that continue to operate under disinfection waivers is appropriate. The issuance of waivers to new water systems poses too high a risk to public health given that new systems cannot clearly demonstrate a long-term history of being able to successfully operate without disinfection. Furthermore, it is not appropriate for systems that are currently providing chemical disinfection to discontinue such disinfection thereby removing a demonstrably effective primary barrier to microbial contamination. Systems serving populations susceptible to microbial contamination, specifically schools and day care centers, are unsuitable to operate without chemical disinfection due to the increased health risks these types of populations face.

For those systems that are required to disinfect, further conclusions were reached. Clarification of continuous chemical disinfection requirements was needed. Clarification of entry point and distribution system monitoring and compliance requirements was needed. It was recognized that systems providing only ultraviolet treatment as a means of disinfection are not providing sufficiently protective disinfection due to the inability of ultraviolet treatment to maintain a disinfection residual. It was recognized that there are inherent difficulties requiring hand pumped wells to maintain continuous disinfection due to their typically remote locations. Therefore, there was a need to establish criteria for proper operation, maintenance and monitoring of such wells. Finally, it was concluded that amendments clarifying the recordkeeping, reporting and public notice requirements for groundwater systems were needed.

These amendments clarify and expand upon long standing requirements of the Colorado Primary Drinking Water Regulations, and are in line with requirements that are already part of existing guidance and/or policy. The overall goal of these amendments is to further protect the public from microbial contamination and to enhance Article 13 regarding specific regulations that apply to groundwater systems. These amendments primarily revise the previously adopted Section 13.2 and add a recordkeeping section (Section 13.5) and a reporting section (Section 13.6).

Summary

Groundwater Disinfection Amendments. The Commission has amended the Colorado Primary Drinking Water Regulations concerning minimum treatment technique requirements for groundwater systems in the following ways. Requirements in Article 1 were redesignated to Article 9, a requirement to Article 5 was added and requirements were revised and added to Articles 9 and 13.

Primary Enforcement Responsibility Amendments. The Commission adopted amendments to the Colorado Primary Drinking Water Regulations in order to remain consistent with provisions of the National Primary Drinking Water Regulations which were amended to include revisions concerning approved analytical methods and revisions concerning compliance monitoring requirements. The federal provisions were published in the following Federal Registers:

The federal regulations as published in the Federal Register, Volume 74, Number 123, June 29, 2009, pages 30953 through 30959, National Primary Drinking Water Regulations: Minor Correction to Stage 2 Disinfectants and Disinfection Byproducts Rule and Changes in References to Analytical Methods

The federal regulations as published in the Federal Register, Volume 74, Number 216, November 10, 2009, pages 57908 through 57918, Expedited Approval of Alternative Test Procedures for the Analysis of Contaminants Under the Safe Drinking Water Act; Analysis and Sampling Procedures

The federal regulations as published in the Federal Register, Volume 74, Number 230, December 2, 2009, pages 63069 through 63070, Expedited Approval of Alternative Test Procedures for the Analysis of Contaminants Under the Safe Drinking Water Act; Analysis and Sampling Procedures

The revised analytical methods concerned microbial contaminants, surface water minimum disinfectant residuals, maximum disinfectant residuals, disinfectant byproducts, disinfectant byproducts precursors, and secondary maximum contaminants. These amendments added language to sections 3.4, and multiple sections of Article 10.

The revised compliance monitoring requirements concerned stage 2 disinfection byproducts routine monitoring. These amendments had to be adopted to maintain primary enforcement authority. These amendments revised Tables 7-29 and 7-33.

Additionally, the Commission adopted amendments removing Section 1.9.1(b) concerning consecutive public water systems in order to remain consistent with and at least as stringent as regulations adopted by the federal government.

Other Amendments to the Colorado Primary Drinking Water Regulations. The Commission adopted amendments to the Colorado Primary Drinking Water Regulations that added, corrected, removed or revised obsolete references and dates, spelling, typographical and reference errors. This was done to provide clarity and accuracy.

Groundwater Disinfection Requirements.

The Commission amended Articles 1, 5, 9 and 13 of the Colorado Primary Drinking Water Regulations to include the following requirements as summarized below:

- Groundwater disinfection requirements
 - Groundwater Source (13.1(a)(7-8), 13.2(a)(1), 13.2(a)(2)(i), 13.2(b)(1), 13.2(b)(3) and 13.2(c)(1))
 - Establishes minimum treatment techniques requiring groundwater systems to disinfect a groundwater source at all times that the source is serving water to the public. The disinfection must include chemical treatment resulting in at least 0.2 mg/L residual disinfectant

concentration in water entering the distribution system at the entry points.

- Establishes weekly residual disinfectant concentration monitoring at all entry points serving groundwater to the public. The monitoring requirement increases to every 24 hours while the residual disinfectant concentration is below 0.2 mg/L.
 - Establishes a timeframe of 72 hours to correct a residual disinfectant concentration that is discovered to be below 0.2 mg/L, otherwise a treatment technique violation occurs.
 - Establishes that a groundwater system in violation of the treatment technique must resolve and document the situation, keep records, notify the Department and issue public notice.
 - Establishes when a system that is chlorinating needs to begin compliance with monitoring requirements.
 - Establishes when a system disinfecting with only ultra violet light must begin additional required chemical disinfection.
- Groundwater distribution system (13.2(a)(2)(ii), 13.2(b)(2), 13.2(b)(3) and 13.2(c)(2))
 - Establishes at least a detectable residual disinfectant concentration throughout the distribution system to be measured at the same point and time as total coliform.
 - Establishes residual disinfectant concentration cannot be undetectable in more than 5 percent of the measurements taken each monitoring period for any two consecutive monitoring periods, otherwise a treatment technique violation occurs.
 - Establishes that a groundwater system in violation of the treatment technique must issue public notice.
- Groundwater disinfection waiver requirements (9.2.12, 13.1(a)(1)(i), 13.1(a)(9), 13.1(a)(14), 13.2(d) and 13.5(a)(3))
 - Establishes that groundwater systems with a disinfection waiver prior to November 30, 2010, will continue to have a disinfection waiver and are not subject to groundwater disinfection requirements in 13.2(a-c).
 - Establishes that a groundwater system with a disinfection waiver that is determined to be a school or a daycare center will no longer have a disinfection waiver.
 - Establishes Department authority to revoke disinfection waivers from groundwater systems with susceptible populations.
 - Establishes that the Department will no longer issue new disinfection waivers.
 - Establishes that a groundwater system with a disinfection waiver must comply with the following:

- Provide public notice that the system operates under a disinfection waiver.
 - Ensure that the system is operated by a certified operator.
 - Have emergency disinfection or an emergency disinfection plan.
 - Keep records of all chlorination activities.
 - Have a Monitoring Plan.
 - Protect their distribution system (Distribution System Protection Plan).
 - Protect their groundwater sources (Source Water Protection Plan).
- Establishes Department authority to:
 - Evaluate any groundwater source or storage system using Department Design Criteria and CRS Well Construction Criteria.
 - Require sampling of any groundwater source.
 - Require sampling and proof that new groundwater sources are not contaminated.
 - Perform a sanitary survey of the system at any time.
 - Review the violation history of the system.
 - Withdraw a waiver from a system with a fecally contaminated source.
 - Withdraw the disinfection waiver.
- Establishes that the groundwater system has the right of appeal to a Department decision to withdraw a disinfection waiver.
- Groundwater systems with hand pumped well requirements (5.1.1(e)(6), 9.2.14, 13.1(a)(1)(ii-iii), 13.2(e))
 - Establishes that groundwater systems with hand pumped wells must comply with the following:
 - Operate according to Department guidance or Department approved alternative guidance.
 - Disinfect hand pumped wells before opening for the season.
 - Monitor for total coliform at least once a month.
 - Take a hand pumped well out of service if it is contaminated. The system must eliminate the contamination and disinfect the hand pumped well before the well can be put back into service.
 - Continuously post public notice whenever the hand pump well is available for public use. (9.2.14(b))

Primary Enforcement Responsibility Requirements.

The Commission amended Articles 1, 3, 7 and 10 of the Colorado Primary Drinking Water Regulations to revise or add the following requirements as summarized below:

- Consecutive System Requirements (1.9)
 - Removed Section 1.9.1(b). This section allowed for an exemption from regulation under the Colorado Primary Drinking Water Regulations for consecutive public water systems. This exemption made the Colorado Primary Drinking Water Regulations less stringent than regulations adopted by the federal government.
- Analytical methods (3.4, 10.1.3(c), 10.1.4(a))
 - Standard Methods 21st Addition approved for multiple methods.
 - Additional approved methods for residual chlorine analysis including On-Line Chlorine Analyzer EPA 334.0 and Test Strips Method D99-003.
- Stage 2 disinfection byproducts routine monitoring (Tables 7-29 and 7-33)
 - Community and non-transient non-community water systems that serve only groundwater with a population less than 500 may take individual TTHM and HAA5 samples. Community and non-transient non-community water systems that serve surface water with a population less than or equal to 3,300 may take individual TTHM and HAA5 samples. All others must take dual sample sets.

Other Requirements of the Colorado Primary Drinking Water Regulations.

The Commission amended the Colorado Primary Drinking Water Regulations to add, correct, remove or revise the following requirements as summarized below:

- Monitoring Plan (1.12)
 - Public water system must submit one copy of the monitoring plan instead of two.
- Additional Analytical Methods (Article 10)
 - Section 10.12 and Table 10-30 was added.
 - First paragraph reference to Tables 10-23 and 10-24 is corrected to be 10-24 and 10-27
- Sanitary Survey Frequency and Response to Significant Deficiencies or Violations of Colorado Primary Drinking Water Regulations in a Sanitary Survey Written Notice (11.2 and 11.4)
 - Language referencing December 1, 2009 is now obsolete and is removed.

Discussion Items.

These amendments to the Colorado Primary Drinking Water Regulations were developed in consultation with stakeholders. Stakeholders were provided opportunities to express concerns regarding particular

provisions of the amendments and today's amendments have addressed many of those comments. The discussion below reflects conclusions of major comments.

Entry Point Monitoring:

These amendments were intended to achieve several levels of public health protection and required that all groundwater sources be disinfected at all times that they are used to serve water to the public and required that disinfection at least include one chemical treatment method. As a means to verify sufficient disinfection of the source entry point monitoring has been established. Since the amendments require the use of chemical disinfection, measurement of residual disinfectant concentration at each entry point to the distribution system ensures that chemical disinfection is being provided. Additionally, monitoring is required at entry points that have served water to the public during the monitoring period, meaning when water from a groundwater source is available to a consumer in any way, sampling is required at that source's entry point. Conversely, when no water enters the distribution system from a source or a number of sources that combine before entering the distribution system, then no monitoring is required to confirm that treatment is being delivered.

It is recognized that some groundwater systems operate continuous chlorine analyzers at the entry points to the distribution system. With a minimum monitoring requirement of once per week per entry point, it is apparent that monitoring more frequently meets this requirement. The amendments require action on behalf of the groundwater system when the system discovers that the residual disinfectant concentration falls below the minimum disinfectant level and therefore the system must be aware of this event. At a minimum, these systems must make themselves aware of the residual disinfectant concentration once a week. Although this will meet the minimum monitoring requirement, systems are required to take proper follow up action any time they become aware of a residual disinfectant concentration measurement that falls below the minimum. Additionally, systems must keep records of entry point compliance monitoring. Chart recordings and data logs meet this requirement as long as they record all pieces of information required by the recordkeeping requirements of the amendments and make note of the recordings they will use for compliance.

Minimum Entry Point Residual Disinfectant Concentration:

The amendments identify a minimum level of disinfectant of 0.2 mg/L of chlorine that must be maintained at the entry points to the distribution system. This level is appropriate as demonstrated in the history of the Colorado Primary Drinking Water Regulations as well as in requirements of the Surface Water Treatment Rule of 1989. The Colorado Primary Drinking Water Regulations have previously required 0.2 mg/L of residual disinfectant concentration at all points in the distribution system. In addition, at least 7 other states require at a minimum 0.2 mg/L residual disinfectant concentration throughout the entire distribution system. Additionally, given that a large percentage of groundwater sources contain known chlorine measurement interferences, establishing an entry point free chlorine residual requirement that is well above method detection limits, ensures that systems will be providing an actual free chlorine residual at least at the entry points to the distribution system.

Entry Point Treatment Technique Violation:

The amendments establish the point at which a system has violated the groundwater source treatment technique. Upon discovery of the insufficient residual disinfectant concentration the system must begin sampling the entry point every 24 hours until the residual disinfectant concentration is restored to at least 0.2 mg/L. Additionally, upon observing a measurement of the residual disinfectant concentration below 0.2 mg/L the system has 72 hours to restore the residual to at least 0.2 mg/L before the system incurs a treatment technique violation. It is the system's responsibility to notify the Water Quality Control Division when a treatment technique violation has occurred. Regular reporting of weekly entry point sampling data is not required unless the Water Quality Control Division identifies the need to collect and maintain this information (pursuant to Section 1.6.4).

Considering that treatment technique violations require Tier 2 public notification, it is considered burdensome to require that level of notification when disinfection has failed for only a short period of time if the water has not been identified as contaminated. However, extended periods where disinfection is not being applied (longer than 72 hours) does constitute an elevated level of public health risk that warrants a Tier II public notification. The 72 hour time period does allow for the system to make progress towards resolving the issue concerning the insufficient level of disinfectant as well as time to contact the Water Quality Control Division to request assistance and guidance.

Waivered Systems Introducing New sources:

Systems that have maintained a waiver from disinfection, just like many other water systems in Colorado, face issues of water scarcity and growing populations and therefore may require the addition of new sources to the system. Although, the amendments identify that issuing new waivers is not appropriate, systems that have shown a history of operating in a manner that is fully protective of public health without the barrier of disinfection may continue that operation with the addition of new groundwater sources that are shown to be free of contamination and properly constructed.

Systems that wish to maintain a waiver from disinfection cannot add a groundwater source that is contaminated or comes from a well that has been improperly constructed. Furthermore, the addition of a source that is a surface water source or is identified as a groundwater under the direct influence of surface water source will result in immediate waiver withdrawal.