

APPENDIX 5-A
RECOMMENDED STANDARDS FOR WATERWORKS; 1997 EDITION
(UNDER SEPARATE COVER)

APPENDIX 5-B
RURAL WATER SUPPLY; 1995 EDITION
(UNDER SEPARATE COVER)

Appendix 5C is REPEALED and a new Section 5C is added to read as follows:

APPENDIX 5-C.

ACCEPTABLE METHODS FOR THE ANALYSIS OF
CONTAMINANTS IN DRINKING WATER

Table of Contents

- I. Inorganic Chemicals and Physical Characteristics** (Tables 1, 2, and 8A)
 - A. Laboratory Certification
 - B. Approved Methods
 - C. Sample Collection and Preservation Requirements
 - (1) Compositing Requirements
 - D. Detection Limits for Analytical Methods for Selected Inorganic Chemicals
 - E. Lead and Copper
 - (1) Laboratory Certification
- II. Organic Chemicals**
 - A. Principal Organic Contaminants (Table 9D)
 - (1) Laboratory Certification
 - (2) Approved Methods
 - B. Pesticides, Dioxin, and PCBs (Table 9C)
 - (1) Laboratory Certification
 - (2) Approved Methods
 - (3) Compositing Requirements
 - C. Propylene Glycol
 - (1) Approved Methods
 - (2) Analytical method Number and Reference
 - D. Methyl-Tertiary-Butyl-Ether (MTBE)
 - (1) Approved Methods
 - E. Disinfectants, Disinfection Byproduct Precursors, and Disinfection Byproducts (Table 9A/9B)
 - (1) Approved Methods
 - F. Sample Preservation and Holding Time Requirements
 - G. Method References for Organic Contaminants
- III. Radionuclides** (Table 7)
 - A. Laboratory Certification
 - B. Approved Methods
 - C. Sample Collection, Preservation and Instrumentation Requirements
- IV. Microbiological Contaminants** (Tables 6, 11, 11A)
 - A. Laboratory Certification
 - B. Approved Methods
- V. Turbidity**
 - A. Approved Methods
- VI. Residual Disinfectants**
 - A. Approved Methods
- VII. General References**

I. INORGANIC CHEMICALS AND PHYSICAL CHARACTERISTICS (Table 1 and 2, Subpart 5-1)

A. (1) Laboratory Certification - to receive approval to conduct analyses for Inorganic Chemicals in public drinking water, the laboratory must:

- (a) Analyze Performance Evaluation samples which include those substances provided by EPA Environmental Monitoring Systems Laboratory or equivalent samples provided by the State.
- (b) Achieve quantitative results on the analyses that are within the following acceptance limits:

Contaminant	Acceptance Limit
Antimony	$\pm 30\%$ at ≥ 0.006 mg/l
Arsenic	$\pm 30\%$ at ≥ 0.003 mg/l
Asbestos	2 standard deviations based on study statistics
Barium	$\pm 15\%$ at ≥ 0.15 mg/l
Beryllium	$\pm 15\%$ at ≥ 0.001 mg/l
Cadmium	$\pm 20\%$ at ≥ 0.002 mg/l
Chromium	$\pm 15\%$ at ≥ 0.01 mg/l
Cyanide	$\pm 25\%$ at ≥ 0.1 mg/l
Fluoride	$\pm 10\%$ at ≥ 1 to 10 mg/l
Mercury	$\pm 30\%$ at ≥ 0.0005 mg/l
Nickel	$\pm 15\%$ at ≥ 0.01 mg/l
Nitrate	$\pm 10\%$ at ≥ 0.4 mg/l
Nitrite	$\pm 15\%$ at ≥ 0.4 mg/l
Selenium	$\pm 20\%$ at ≥ 0.01 mg/l
Thallium	$\pm 30\%$ at ≥ 0.002 mg/l

B. Approved Methods for the analysis of INORGANIC CHEMICALS

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Alkalinity	Electrometric Titration				I-1030-85 ⁶
	Titrimetric		D1067-92B	2320B	
Aluminum	Atomic Absorption; Direct Aspiration			3111B	
	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
	ICP-Mass Spectrometry	200.8 ⁵			
Ammonia	Colorimetric: Automated Phenate	350.1 ⁷			
Antimony ²²	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Hydride-Atomic Absorption		D3697-92		
	ICP-Mass Spectrometry	200.8 ⁵			
Arsenic ^{8, 22}	Atomic Absorption; Furnace		D2972-93C	3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Hydride-Atomic Absorption		D2972-93B	3114B	
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ^{5, 23}		3120B ²³	
Asbestos	Transmission Electron Microscopy	100.1 ⁹			
	Transmission Electron Microscopy	100.2 ¹⁰			
Barium	Atomic Absorption; Direct Aspiration			3111D	
	Atomic Absorption; Furnace			3113B	
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	

B. Approved Methods - for the analysis of INORGANIC CHEMICALS (continued):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Beryllium	Atomic Absorption; Furnace		D3645-93B	3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
Bromate	Ion Chromatography	300.1 ¹¹			
Bromide	Ion Chromatography	300.0 ⁷			
	Ion Chromatography	300.1 ¹¹			
Cadmium	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵			
Calcium ¹²	Atomic Absorption; Direct Aspiration		D511-93B	3111B	
	EDTA Titrimetric		D511-93A	3500-Ca-D	
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
Chloride	Ion Chromatography	300.0 ⁷	D4327-91	4110B	
	Potentiometric Method			4500-Cl ⁻ -D	
Chlorite	Amperometric Titration ¹³			4500-ClO ₂ -E ¹⁴	
	Ion Chromatography	300.0 ⁷			
	Ion Chromatography	300.1 ¹¹			
Chromium	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	

B. Approved Methods - for the analysis of INORGANIC CHEMICALS (continued):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Color	Visual Comparison Method			2120B	
Conductivity	Conductance		D1125-91A	2510B	
Copper ¹²	Atomic Absorption; Direct Aspiration		D1688-90A	3111B	
	Atomic Absorption; Furnace		D1688-90C	3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
Cyanide	Manual Distillation followed by Spectrophotometric, Amenable			4500-CN-C	
	Spectrophotometric, Amenable		D2036-91B	4500-CN-G	
	Spectrophotometric: Manual		D2036-91A	4500-CN-E	I-3300-85 ⁶
	Spectrophotometric: Semi-automated	335.4 ⁷		4500-CN-E	
	Selective Electrode			4500-CN-F	
Fluoride	Automated Alizarin			4500F-E	129-71W ¹⁵
	Automated Electrode				380-75WE ¹⁵
	Ion Chromatography	300.0 ⁷	D4327-91	4110B	
	Manual Distillation; Colormetric SPADNS Manual Electrode			4500F-B,D 4500F-C	
Foaming Agents	Surfactants			5540C	

B. Approved Methods for the analysis of INORGANIC CHEMICALS (cont'd):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Iron	Atomic Absorption; Direct Aspiration			3111B	
	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ³		3113B	
	Inductively-Coupled Plasma	200.7 ³		3120B	
Lead ^{12, 22}	Atomic Absorption; Furnace		D3559-90D	3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Differential Pulse Anodic Stripping Voltammetry				1001 ¹⁶
Magnesium	Atomic Absorption		D511-93B	3111B	
	Inductively Coupled Plasma	200.7 ⁵		3120B	
	Complexation Titrimetric Methods		D511-93A	3500-Mg-E	
Manganese	Atomic Absorption; Direct Aspiration			3111B	
	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
	ICP-Mass Spectrometry	200.8 ⁵			
Mercury ²²	Automated, Cold Vapor	245.2 ¹⁷			
	Manual, Cold Vapor	245.1 ⁵	D3223-91	3112B	
	ICP-Mass Spectrometry	200.8 ⁵			

B. Approved Methods - for the analysis of INORGANIC CHEMICALS (continued):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Nickel	Atomic Absorption; Direct Aspiration			3111B	
	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
Nitrate	Automated Cadmium Reduction	353.2 ⁷	D3867-90A	4500-NO ₃ -F	
	Ion Chromatography	300.0 ⁷	D4327-91	4110B	B-1011 ¹⁸
	Ion Selective Electrode			4500-NO ₃ -D	601 ¹⁹
	Manual Cadmium Reduction		D3867-90B	4500-NO ₃ -E	
Nitrite	Automated Cadmium Reduction	353.2 ⁷	D3867-90A	4500-NO ₃ -F	
	Ion Chromatography	300.0 ⁷	D4327-91	4110B	B-1011 ¹⁸
	Manual Cadmium Reduction		D3867-90B	4500-NO ₃ -E	
	Spectrophotometric			4500-NO ₂ -B	
Odor				2150B	
Orthophosphate ²⁰	Colorimetric, Ascorbic Acid, Single Reagent		D515-88A	4500-P-E	
	Colorimetric, Ascorbic Acid, Two Reagent				
	Colorimetric, Automated, Ascorbic Acid	365.1 ⁷		4500-P-F	
	Colorimetric, Phosphomolybdate; Automated Discrete; Automated-Segmented Flow				I-1601-85 ⁶ I-2598-85 ⁶ I-2601-90 ⁶
	Ion Chromatography	300.0 ⁷	D4327-91	4110-B	

B. Approved Methods - for the analysis of INORGANIC CHEMICALS (continued):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
pH	Electrometric	150.1 ¹⁷	D1293-84B	4500-H ⁺ -B	
	Electrometric	150.2 ¹⁷			
Selenium ²²	Atomic Absorption; Furnace		D3859-93B	3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Hydride-Atomic Absorption		D3859-93A	3114B	
	ICP-Mass Spectrometry	200.8 ⁵			
Silica	Automated Method for Molybdate-Reactive Silica			4500-Si-F	
	Colorimetric		D859-88		
	Colorimetric, Molybdate Blue; Automated-Segmented Flow				I-1700-85 ⁶ I-2700-85 ⁶
	Heteropoly Blue			4500-Si-E	
	Inductively-Coupled Plasma ⁴	200.7 ⁵		3120B	
	Molybdosilicate			4500-Si-D	
Silver	Atomic Absorption; Direct Aspiration			3111B	
	Atomic Absorption; Furnace			3113B	
	Atomic Absorption; Platform	200.9 ⁵			
	Inductively-Coupled Plasma	200.7 ⁵		3120B	I-3720-85 ²¹
	ICP-Mass Spectrometry	200.8 ⁵			
Sodium	Atomic Absorption; Direct Aspiration			3111B	
	Inductively-Coupled Plasma ⁴	200.7 ⁵			

B. Approved Methods - for the analysis of INORGANIC CHEMICALS (continued):

Contaminant	Methodology ¹	EPA Methods	Reference Method Number		
			ASTM Methods ²	Standard Methods ³	Other Methods ⁴
Sulfate	Automated Chloranilate				
	Automated Methylthymol Blue	375.2 ⁷	D516-90	4500-SO ₄ ²⁻ -F	
	Gravimetric			4500-SO ₄ ²⁻ -C,D	
	Ion Chromatography	300.0 ⁷	D4327-91	4110B	
	Turbidimetric			4500-SO ₄ ²⁻ -E	
TDS	Solids – TDS Dried at 180°C			2540C	
Temperature	Thermometric			2550	
Thallium	Atomic Absorption; Furnace				
	Atomic Absorption; Platform	200.9 ⁵			
	ICP-Mass Spectrometry	200.8 ⁵			
Zinc	Atomic Absorption; Direct Aspiration			3111B	
	Inductively-Coupled Plasma	200.7 ⁵		3120B	
	ICP-Mass Spectrometry	200.8 ⁵			

Information regarding obtaining these documents can be obtained from the Safe Drinking Water Hotline at 800-426-4791. Documents may be inspected at EPA's Drinking Water Docket, 410 M Street, SW., Washington, DC 20460 (Telephone: 202-2603027); or at the Office of Federal Register, 800 North Capitol Street, NW., Suite 700, Washington, DC.

¹ Because MDLs reported in EPA Methods 200.7 and 200.9 were determined using a 2X preconcentration step during sample digestion, MDLs determined when samples are analyzed by direct analysis (i.e., no sample digestion) will be higher. For direct analysis of cadmium and arsenic by Method 200.7, and arsenic by Method 3120 B samples preconcentration using pneumatic nebulization may be required to achieve lower detection limits. Preconcentration may also be required for direct analysis or antimony, lead, and thallium by Method 200.9 ; antimony and lead by Method 3113 B; and lead by Method D3559-90D unless multiple in-furnace depositions are made.

² "Annual Book of ASTM Standards", 1994 and 1996, Vols. 11.01 and 11.02, American Society for Testing and Materials. The previous versions of D1688-95A, D1688-95C (copper), D3559-95D (lead), D1293-95 (pH), D1125-91A (conductivity) and D859-88, respectively are located in the "Annual Book of ASTM Standards", 1994, Vol. 11.01. Copies may be obtained from the American Society of Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

³ 18th, and 19th editions of "Standard Methods for the Examination of Water and Wastewater", 1992 and 1995, respectively, American Public Health Association; any edition may be used. Copies may be obtained from the American Public Health Association, 1015 Fifteenth Street NW, Washington, DC 20005.

⁴ "Other" draws reference to other consensus organizations, such as USGS, or private sector company that has developed an approved analytical method.

⁵ "Methods for the Determination of Metals in Environmental Samples – Supplement I", EPA-600/R-94/111, May 1994. Available at NTIS, PB95-125472.

⁶ Method I-2601-90, "Methods for Analysis by the U.S. Geological Survey National Water Quality Laboratory - Determination of Inorganic and Organic Constituents in Water and Fluvial Sediments", Open File Report 93-125, 1993; For Methods I-1030-85; I-1601-85; I-1700-85; I-2598-85; I-2700-85; and I-3300-85. See "Techniques of Water Resource Investigation of the U.S. Geological Survey", Book 5, Chapter A-1, 3rd Edition, 1989; Available from Information Services, U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225-0425.

⁷ "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA-600/R-93/100, August 1993. Available at NTIS, PB94-120821.

⁸ If ultrasonic nebulization is used in the determination of arsenic by Methods 200.7, 200.8, or SM 3120B, the arsenic must be in the pentavalent state to provide uniform signal response. For Methods 200.7 and 3120B, both samples and standards must be diluted in the same mixed acid matrix concentration of nitric and hydrochloric acid with the addition of 100 µL of 30% hydrogen peroxide per 100 ml of solution. For direct analysis of arsenic with Method 200.8 using ultrasonic nebulization, samples and standards must contain one mg/L of sodium hypochlorite.

⁹ Method 100.1, "Analytical Method for Determination of Asbestos Fibers in Water", EPA-600/4-83-043, September 1983. Available at NTIS, PB83-260471.

¹⁰ Method 100.2, "Determination of Asbestos Structures Over 10 µm in Length in Drinking Water", EPA/600/R-94/134, June 1994. Available at NTIS, PB94-201902.

¹¹ EPA Method 300.1 is titled "USEPA Method 300.1, Determination of Inorganic Anions in Drinking Water by Ion Chromatography", Revision 1.0, USEPA, 1997, EPA/600R-98/118 (available through NTIS, PB98-169196; also available from: Chemical Exposure Research Branch, Microbiological and Chemical Exposure Assessment Research Division, National Exposure Research Laboratory, U.S. Environmental Protection Agency, Cincinnati, OH 45268, Fax Number: 513-569-7757. Phone Number: 513-569-7586.

¹² Samples may not be filtered. Samples that contain less than 1 NTU (nephelometric turbidity unit) and are properly preserved (concentrated nitric acid to pH<2) may be analyzed directly (without digestion) for total metals, otherwise, digestion is required. Turbidity must be measured on the preserved samples just prior to the initiation of metal analysis. When digestion is required, the total recoverable technique as defined in the method must be used.

- ¹³ Amperometric titration may be used for routine daily monitoring of chlorite at the entrance to the distribution system. Ion chromatography must be used for routine monthly monitoring of chlorite and additional monitoring of chlorite in the distribution system.
- ¹⁴ For the analysis of chlorite using SM 4500-ClO₂-E, the version contained in the 19th Edition of “Standard Method for the Examination of Water and Wastewater”, 1995, must be used.
- ¹⁵ Industrial Method No. 129-71W, "Fluoride in Water and Wastewater", December 1972, and Method NO. 380-75WE, “Fluoride in Water and Wastewater”, February 1976, Technicon Industrial Systems. Copies may be obtained from Bran & Luebbe, 1025 Busch Parkway, Buffalo Grove, IL, 60089.
- ¹⁶ The description for Method Number 1001 for lead is available from Palintest, LTC, 21 Kenton Lands Road, P.O. Box 18395, Erlanger, KY 41018 or from Hach Company, P.O. Box 389, Loveland, CO 8053.
- ¹⁷ "Methods for Chemical Analysis of Water and Wastes", EPA-600/4-79/020, March 1983. Available at NTIS, PB-95-125472.
- ¹⁸ Method B-1011, "Waters Test Method for Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography", Millipore Corporation, Waters Chromatography Division, 34 Maple Street, Milford, MA 01757.
- ¹⁹ The procedure shall be done in accordance with Technical Bulletin 601 "Standard Method of Test for Nitrate in Drinking Water", July 1994, PN 221890-001, Analytical Technology Inc. Copies may be obtained from ATI Orion, 529 Main Street, Boston, MA 02129.
- ²⁰ Unfiltered, no digestion or hydrolysis.
- ²¹ Method I-3720-85, “Techniques of Water Resources Investigation of the U. S. Geological Survey”, Book 5, Chapter A-1, 3rd Edition, 1989; Available from Information Services, U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225-0425.
- ²² There are three technologies for which compliance determinations of total metals require an acid digestion of the sample even if the turbidity of the sample is less than 1 NTU. The three technologies and the applicable metals are cold vapor AA (mercury), DPASV (lead), and gaseous hydride AA (antimony, arsenic and selenium).
- ²³ After January 23, 2006 analytical methods using the ICP-AES technology, may not be used because the detection limits for these methods are 0.008 mg/L or higher. This restriction means that the two ICP-AES methods (EPA Method 200.7 and SM 3120 B) approved for use for the MCL of 0.05 mg/L may not be used for compliance determinations for the revised MCL of 0.01mg/L. However, prior to 2005 systems may have compliance samples analyzed with these less sensitive methods

C. Sample Collection and Preservation Requirements for Inorganic Chemicals

Sample collection for the inorganic chemicals under this section shall be conducted using the sample preservation, container, and maximum holding time procedures specified in the following table:

Parameter	Preservative ¹	Sample Holding Time ²	Sample Container Size	Type of Container
Alkalinity	4°C	14 days	100 mL	Plastic or Glass
Aluminum	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Ammonia	4°C, H ₂ SO ₄ to pH < 2	28 days	100 mL	Plastic or Glass
Antimony	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Arsenic	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Asbestos ³	4°C	48 hours	800 mL in duplicate	Plastic or Glass
Barium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Beryllium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Bromate	50 mg/L EDA	28 days	100 mL	Plastic or Glass
Bromide	None	28 days	100 mL	Plastic or Glass
Cadmium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Calcium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Chloride	None	28 days	50 mL	Plastic or Glass
Chlorite	4°C, 50 mg/L EDA	14 days	100 mL	Plastic or Glass
Chromium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Color	4°C	48 hours	50 mL	Plastic or Glass
Conductivity	4°C	28 days	100 mL	Plastic or Glass
Copper	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Cyanide	4°C, NaOH to pH >12, Ascorbic Acid ⁴	14 days	1 L	Plastic or Glass
Fluoride	None	1 month	300 mL	Plastic or Glass
Foaming Agents	4°C	48 hours	500 mL	Plastic or Glass
Iron	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Lead	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Magnesium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Manganese	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Mercury ⁴	HNO ₃ to pH < 2	28 days	100 mL	Plastic or Glass
Nickel	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Nitrate	4°C	48 hours ⁵	100 mL	Plastic or Glass
Nitrate-Nitrite ⁶	4°C, H ₂ SO ₄ to pH < 2	28 days	100 mL	Plastic or Glass
Nitrite	4°C	48 hours	50 mL	Plastic or Glass
Odor	4°C	24 hours	200 mL	Glass
Orthophosphate	Filter immediately, 4°C	48 hours	50 mL	Plastic or Glass

Parameter	Preservative ¹	Sample Holding Time ²	Sample Container Size	Type of Container
pH	None	Immediately	25 mL	Plastic or Glass
Selenium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Silica	4°C	28 days	50 mL	Plastic
Silver	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Sodium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Sulfate	4°C	28 days	50 mL	Plastic or Glass
TDS	None	7 days	100 mL	Plastic or Glass
Temperature	None	Immediately	1 L	Plastic or Glass
Thallium	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass
Zinc	HNO ₃ to pH < 2	6 months	1 L	Plastic or Glass

¹ For cyanide determinations, samples must be adjusted with sodium hydroxide to pH > 12 at the time of collection. When chilling is indicated the sample must be shipped and stored at 4°C or less. Acidification of nitrate or metals samples may be with a concentrated acid. Acidification of samples for metals analysis is encouraged and allowed at the laboratory rather than at the time of sampling provided the shipping time and other instructions in Section 8.3 of EPA Methods 200.7 or 200.8 or 200.9 are followed.

² In all cases, samples should be analyzed as soon after collection as possible. Follow additional (if any) information on preservation, containers or holding times that is specified in the method.

³ Instructions for containers, preservation procedures and holding times as specified in Method 100.2 must be adhered to for all compliance analyses including those conducted with Method 100.1.

⁴ If the sample container is plastic, the holding time is 14 days.

⁵ If the sample is chlorinated, the holding time for an unacidified samples kept at 4°C is extended to 14 days.

⁶ Nitrate-Nitrite refers to a measurement of total nitrate.

(1) Compositing Requirements

The State may reduce the total number of samples which must be analyzed by allowing the use of compositing. Composite samples from a maximum of five samples are allowed, provided that the detection limit of the method used for analysis is less than one-fifth of the MCL. Compositing of samples must be done in the laboratory.

If the concentration in the composite sample is greater than or equal to one-fifth of the MCL of any inorganic chemical, then a follow-up sample must be taken within 14 days at each sampling point included in the composite. These samples must be analyzed for the contaminants that exceeded one-fifth of the MCL in the composite sample.

D. Detection Limits for Analytical Methods for Selected Inorganic Chemicals

Contaminant	Methodology	Detection Limit (mg/L)
Antimony	Atomic Absorption; Furnace	0.003
	Atomic Absorption; Platform	0.0008 ¹
	Hydride-Atomic Absorption	0.001
	ICP-Mass Spectrometry	0.0004
Arsenic	Atomic Absorption; Furnace	0.001
	Atomic Absorption; Platform	0.0005 ³
	Atomic Absorption; Gaseous Hydride	0.001
	ICP-Mass Spectrometry	0.0014 ⁴
Asbestos	Transmission Electron Microscopy	0.01 MFL
Barium	Atomic Absorption; Direct Aspiration	0.1
	Atomic Absorption; Furnace	0.002
	ICP-Mass Spectrometry	
	Inductively-Coupled Plasma	0.002 (0.001)
Beryllium	Atomic Absorption; Furnace	0.0002
	Atomic Absorption; Platform	0.00002 ¹
	ICP-Mass Spectrometry	0.0003
	Inductively-Coupled Plasma ⁵	0.0003
Cadmium	Atomic Absorption; Furnace	0.0001
	Inductively-Coupled Plasma	0.001
Chromium	Atomic Absorption; Furnace	0.001
	Inductively-Coupled Plasma	0.007 (0.001)
Cyanide	Distillation, Spectrophotometric ⁶	0.02
	Distillation, Automated, Spectrophotometric ⁶	0.005
	Distillation, Selective Electrode ⁶	0.05
	Distillation, Amenable, Spectrophotometric ⁷	0.02
Mercury	Automated, Cold Vapor	0.0002
	Manual, Cold Vapor	0.0002
Nickel	Atomic Absorption; Furnace	0.001
	Atomic Absorption; Platform	0.0006 ¹
	ICP-Mass Spectrometry	0.0005
	Inductively-Coupled Plasma ⁵	0.005
Nitrate	Automated Cadmium Reduction	0.05
	Ion Chromatography	0.01
	Ion Selective Electrode	1
	Manual Cadmium Reduction	0.01

Contaminant	Methodology	Detection Limit (mg/L)
Nitrite	Automated Cadmium Reduction	0.05
	Ion Chromatography	0.004
	Manual Cadmium Reduction	0.01
	Spectrophotometric	0.01
Selenium	Atomic Absorption; Furnace	0.002
	Hydride-Atomic Absorption	0.002
Thallium	Atomic Absorption; Furnace	0.001
	Atomic Absorption; Platform	0.00007 ¹
	ICP-Mass Spectrometry	0.0003

¹ Lower MDLs are reported using stabilized temperature graphite furnace atomic absorption.

² The value in parentheses “()” is effective January 23, 2006.

³ The MDL reported for EPA Method 200.9 (Atomic Absorption; Platform) was determined using a 2X concentration step during sample digestion. The MDL determined for samples analyzed using direct analyses (i.e., no sample digestion) will be higher. Using multiple depositions, EPA 200.9 is capable of obtaining a MDL of 0.0001 mg/L.

⁴ Using selective ion monitoring, EPA Method 200.8 (ICP-MS) is capable of obtaining a MDL of 0.0001 mg/L.

⁵ Using a 2X preconcentration step as noted in Method 200.7. Lower MDLs may be achieved when using a 4X preconcentration.

⁶ Screening method for total cyanides.

⁷ Measures “free” cyanides.

E. Lead and Copper

(1) Laboratory Certification - to obtain certification to conduct analyses for lead and copper, environmental laboratories must:

- (a) Analyze performance evaluation samples which include lead and copper provided by EPA Environmental Monitoring and Support Laboratory or equivalent samples provided by the State; and
- (b) Achieve quantitative acceptance limits as follows:
 - (i) For lead: ± 30 percent of the actual amount in the Performance Evaluation sample when the actual amount is greater than or equal to 0.005 mg/L. The Practical Quantitation Level, or PQL for lead is 0.005 mg/L.

- (ii) For copper: ± 10 percent of the actual amount in the Performance Evaluation sample when the actual amount is greater than or equal to 0.050 mg/L. The Practical Quantitation Level, or PQL for copper is 0.050 mg/L.
- (c) Achieve method detection limits as follows:
 - (i) Lead: 0.001 mg/L; and
 - (ii) Copper: 0.001 mg/L or 0.020 mg/L when atomic absorption direct aspiration is used.
- (d) The State has the authority to allow the use of previously collected monitoring data for purposes of monitoring, if the data were collected and analyzed in accordance with the requirements of this Appendix.
- (e) All lead and copper levels measured between the PQL and MDL must be either reported as measured or they can be reported as one-half the PQL and MDL specified for lead and copper in subparagraph (b) of paragraph (1) of this section. All levels below the lead and copper MDLs must be reported as zero.

II. ORGANIC CHEMICALS

A. Principal Organic Contaminants (Table 9D)

- (1) Laboratory Certification - the analysis of Principal Organic Contaminants (POCs) shall only be conducted by laboratories that have received approval of the State Environmental Laboratory Approval Program (ELAP) according to the following approval conditions:
 - a. Analyze Performance Evaluation samples which include those substances provided by EPA Environmental and Support Laboratory or proficiency samples provided by the State ELAP system.
 - b. Achieve the quantitative acceptance limits under the following paragraphs (c) and (d) for at least 80 percent of the regulated organic chemicals listed in II.A.(2).
 - c. Achieve quantitative results on the analyses performed under (a) above that are within ± 20 percent to the actual amount of the substances in the performance evaluation sample when the actual amount is greater than or equal to 0.010 mg/l.
 - d. Achieve quantitative results on the analyses performed under paragraph (a) above that are within ± 40 percent of the actual amount of the substances in the performance evaluation sample when the actual amount is less than 0.010 mg/l.
 - e. Achieve a method detection limit of 0.0005 mg/L.
- (2) Approved Methods - the analysis of Principal Organic Contaminants and vinyl chloride shall be conducted using the following methods:

Contaminant	CAS No. ¹	EPA Analytical Method ²
Benzene	71-43-2	502.2, 524.2
Bromobenzene	108-86-1	502.2, 524.2
Bromochloromethane	74-97-5	502.2, 524.2
Bromomethane	74-83-9	502.2, 524.2
n-Butylbenzene	104-51-8	502.2, 524.2
sec-Butylbenzene	135-98-8	502.2, 524.2
tert-Butylbenzene	98-06-6	502.2, 524.2
Carbon tetrachloride	56-23-5	502.2, 524.2, 551.1
Chlorobenzene	108-90-7	502.2, 524.2
Chloroethane	75-00-3	502.2, 524.2
Chloromethane	74-87-3	502.2, 524.2
2-Chlorotoluene	95-49-8	502.2, 524.2
4-Chlorotoluene	106-43-4	502.2, 524.2
Dibromomethane	74-95-3	502.2, 524.2
1,2-Dichlorobenzene	95-50-1	502.2, 524.2
1,3-Dichlorobenzene	541-73-1	502.2, 524.2
1,4-Dichlorobenzene	106-46-7	502.2, 524.2
Dichlorodifluoromethane	75-71-8	502.2, 524.2
1,1-Dichloroethane	75-34-3	502.2, 524.2
1,2-Dichloroethane	107-06-2	502.2, 524.2
1,1-Dichloroethene	75-35-4	502.2, 524.2
cis-1,2-Dichloroethene	156-59-4	502.2, 524.2
trans-1,2-Dichloroethene	156-60-5	502.2, 524.2
1,2-Dichloropropane	78-87-5	502.2, 524.2
1,3-Dichloropropane	142-28-9	502.2, 524.2
2,2-Dichloropropane	590-20-7	502.2, 524.2
1,1-Dichloropropene	563-58-6	502.2, 524.2
cis-1,3-Dichloropropene	10061-01-5	502.2, 524.2
trans-1,3-Dichloropropene	10061-02-6	502.2, 524.2
Ethylbenzene	100-41-4	502.2, 524.2
Hexachlorobutadiene	87-68-3	502.2, 524.2
Isopropylbenzene	98-82-8	502.2, 524.2
4-Isopropyltoluene	99-87-6	502.2, 524.2
Methylene chloride	75-09-2	502.2, 524.2
n-Propylbenzene	103-65-1	502.2, 524.2
Styrene	100-42-5	502.2, 524.2
1,1,1,2-Tetrachloroethane	630-20-6	502.2, 524.2
1,1,2,2-Tetrachloroethane	79-34-5	502.2, 524.2
Tetrachloroethene	127-18-4	502.2, 524.2, 551.1
Toluene	108-88-3	502.2, 524.2

Contaminant	CAS No. ¹	EPA Analytical Method ²
1,2,3-Trichlorobenzene	87-61-6	502.2, 524.2
1,2,4-Trichlorobenzene	120-82-1	502.2, 524.2
1,1,1-Trichloroethane	71-55-6	502.2, 524.2, 551.1
1,1,2-Trichloroethane	79-00-5	502.2, 524.2, 551.1
Trichloroethene	79-01-6	502.2, 524.2, 551.1
Trichlorofluoromethane	75-69-4	502.2, 524.2
1,2,3-Trichloropropane	96-18-4	502.2, 524.2
1,2,4-Trimethylbenzene	95-63-6	502.2, 524.2
1,3,5-Trimethylbenzene	108-67-8	502.2, 524.2
Vinyl chloride	75-01-4	502.2, 524.2
m-Xylene	95-47-6	502.2, 524.2
o-Xylene	108-38-3	502.2, 524.2
p-Xylene	106-42-3	502.2, 524.2

¹CAS No. – Chemical Abstract Service Registry Number

²Method Detection Limit – 0.0005 mg/l

B. Pesticides, Dioxin, and PCBs (Table 9C)

- (1) Laboratory Certification - Analysis for Pesticides, Dioxin, and PCBs shall only be conducted by laboratories that have received approval of the State Environmental Laboratory Approval Program (ELAP) according to the following approval conditions:
 - a. Analyze Performance Evaluation samples that include those substances provided by EPA Environmental Monitoring Systems Laboratory or equivalent samples provided by the State.
 - b. Laboratories must achieve quantitative results within the acceptance limits on 80% of the analytes included in the PT sample. Acceptance is defined as within the 95% confidence interval around the mean of the PT study data.
 - c. Achieve quantitative results on the analyses that are within the following acceptance limits:

Contaminant	Acceptance Limit
Alachlor	±45%
Aldicarb	2 standard deviations
Aldicarb sulfone	2 standard deviations
Aldicarb sulfoxide	2 standard deviations
Atrazine	±45%
Benzo(a)pyrene	2 standard deviations
Carbofuran	±45%
Chlordane	±45%
2,4-D (as acid salts and esters)	±50%
Dalapon	2 standard deviations
Dibromochloropropane	±40%
Di(2-ethylhexyl)adipate	2 standard deviations
Di(2-ethylhexyl)phthalate	2 standard deviations
Dinoseb	2 standard deviations
Diquat	2 standard deviations
Endothall	2 standard deviations
Endrin	±30%
Ethylene dibromide (EDB)	±40%
Glyphosate	2 standard deviations
Heptachlor	±45%
Heptachlor epoxide	±45%
Hexachlorobenzene	2 standard deviations
Hexachlorocyclopentadiene	2 standard deviations
Lindane	±45%
Methoxychlor	±45%
Oxamyl (Vydate)	2 standard deviations
PCBs (as Aroclors) (as decachlorobiphenyl)	0 – 200%
Pentachlorophenol	±50%
Picloram	2 standard deviations
Simazine	2 standard deviations
2,4,5-TP (Silvex)	±50%
Toxaphene	±45%
2,3,7,8-TCDD (Dioxin)	standard deviations

- (2) Approved Methods - the analysis of Pesticides, Dioxin, and PCBs shall be conducted using the following methods:

Contaminant	CAS No. ¹	Detection Limit (mg/l) ^{2,3}	Analytical Method
Alachlor ⁴	15972-60-8	0.0002	505, 507, 508.1, 525.2, 551.1
Aldicarb	116-06-3	0.0005	531.1, SM-6610
Aldicarb sulfone	1646-87-4	0.0008	531.1, SM-6610
Aldicarb sulfoxide	1646-87-3	0.0005	531.1, SM-6610
Aldrin	309-00-2	0.075	505, 508, 508.1, 525.2
Atrazine ⁴	1912-24-9	0.0001	505, 507, 508.1, 525.2, 551.1
Benzo(a)pyrene	50-32-8	0.00002	525.2, 550, 550.1
Butachlor	23184-66-9	0.38	507, 525.2
Carbaryl	63-25-2	2.0	531.1, SM-6610
Carbofuran	1563-66-2	0.0009	531.1, SM-6610
Chlordane (Technical)	57-74-9	0.0002	505, 508, 508.1, 525.2
Dalapon	75-99-0	0.001	515.1, 515.3, 552.1, 552.2
Di(2-ethylhexyl)adipate	103-23-1	0.0006	506, 525.2
Di(2-ethylhexyl)phthalate	117-81-7	0.0006	506, 525.2
Dibromochloropropane (DBCP)	96-12-8	0.00002	504.1, 551.1
Dicamba	1918-00-9	0.081	515.1, 515.2, 555
2,4-D (as acid, salts and esters)	94-75-7	0.0001	515.1, 515.2, 515.3, 555, ASTM-D5317-93
Dieldrin	60-57-1	0.02	505, 508, 508.1, 525.2
Dinoseb ⁵	88-85-7	0.0002	515.1, 515.2, 515.3, 555
Diquat	2764-72-9	0.0004	549.2
Endothall	145-73-3	0.009	548.1
Endrin	72-20-8	0.00001	505, 508, 508.1, 525.2, 551.1
Ethylene dibromide (EDB)	106-93-4	0.00001	504.1, 551.1
Glyphosate	1071-83-6	0.006	547, SM-6651
Heptachlor	76-44-8	0.00004	505, 508, 508.1, 525.2, 551.1
Heptachlor epoxide	1024-57-3	0.00002	505, 508, 508.1, 525.2, 551.1
Hexachlorobenzene	118-74-1	0.0001	505, 508, 508.1, 525.2, 551.1
Hexachlorocyclopentadiene	77-47-4	0.0001	505, 508, 508.1, 525.2, 551.1
3-Hydroxycarbofuran	16655-82-6	2.0	531.1, SM-6610
Lindane	58-89-9	0.00002	505, 508, 508.1, 525.2, 551.1
Methomyl	16752-77-5	0.5	531.1, SM-6610
Methoxychlor	72-43-5	0.0001	505, 508, 508.1, 525.2, 551.1
Metolachlor	51218-45-2	0.75	507, 508.1, 525.2
Metribuzin	21087-64-9	0.75	507, 508.1, 525.2
Oxamyl (vydate)	23135-22-0	0.002	531.1, SM-6610
		Detection	

Contaminant	CAS No. ¹	Detection Limit (mg/l) ^{2,3}	Analytical Method
Pentachlorophenol (PCP)	87-86-5	0.00004	515.1, 515.2, 515.3, 525.2, 555, ASTM-D5317-93
Picloram ⁵	1918-02-1	0.0001	515.1, 515.2, 515.3, 555, ASTM-D5317-93
Polychlorinated biphenyls (PCBs) ⁶ (as decachlorobiphenyl)	1336-36-3	0.0001	508A
Aroclor 1016	12674-11-2	0.00008	505, 508, 508.1, 525.2
Aroclor 1221	11104-28-2	0.02	505, 508, 508.1, 525.2
Aroclor 1232	11141-16-5	0.0005	505, 508, 508.1, 525.2
Aroclor 1242	53469-21-9	0.0003	505, 508, 508.1, 525.2
Aroclor 1248	12672-29-6	0.0001	505, 508, 508.1, 525.2
Aroclor 1254	11097-69-1	0.0001	505, 508, 508.1, 525.2
Aroclor 1260	11096-82-5	0.0002	505, 508, 508.1, 525.2
Propachlor	1918-16-7	0.5	508, 508.1, 525.2
Simazine ⁴	122-34-9	0.0007	505 ⁸ , 507, 508.1, 525.2, 551.1
(2,4,5-TP) (Silvex) ⁷	93-72-1	0.0002	515.1, 515.2, 515.3, 555, ASTM-D5317-93
Toxaphene (Technical)	8001-35-2	0.001	505, 508, 508.1, 525.2
2,3,7,8-TCDD (Dioxin) ^{8,9}	1746-01-6	0.000000005	1613

¹ CAS No. – Chemical Abstract Services Registry Number

² The EDL or Estimated Detection Limit is given with the EPA Analytical Method cited.

³ Detection limit as used in this context shall be defined as, greater than or equal to the concentration cited in this table for the individual contaminant.

⁴ Substitution of the detector specified in Method 505, 507, 508 or 508.1 for the purpose of achieving lower detection limits is allowed as follows: either an electron capture or nitrogen phosphorous detector may be used provided all regulatory requirements and quality control criteria are met.

⁵ Accurate determination of the chlorinated esters requires hydrolysis of the sample as described in EPA Methods 515.1, 515.2, 515.3 and 555, and ASTM.

⁶ If PCBs (as one of seven Aroclors) are detected in any sample analyzed using Methods 505 or 508, the system shall reanalyze the sample using Method 508A to quantitate PCBs (as decachlorobiphenyl). Compliance with the PCB MCL shall be determined based on the quantitative results of analyses using method 508A.

⁷ 2-(2,4,5-Trichlorophenoxy) propionic acid

⁸ 2,3,7,8-Tetrachlorodibenzo-p-dioxin

⁹ A nitrogen-phosphorous detector should be substituted for the electron capture detector in Method 505 (or another approved method should be used) to determine alachlor, atrazine and simazine, if lower detection limits are required.

(3) Water Sample Compositing Requirements for Pesticides, Dioxin and PCBs

The State may reduce the total number of samples collected and analyzed in accordance with Table 9C by allowing the use of compositing. Equal size samples from a maximum of five separate sampling points are allowed. The number of samples included in the composite must also be less than the ratio of the Maximum Contaminant Level divided by the detection level for

the contaminant as reported by the State certified laboratory. Compositing of samples must be done in the laboratory.

- (a) If the concentration in the composite sample is greater than or equal to the detection limit of any organic chemicals listed under paragraph (4) of this section, then a separate follow-up sample must be taken within 14 days at each sampling point included in the composite. These samples must be analyzed for the contaminants which were detected in the composite sample.
- (b) If duplicates or residual portions of the original sample taken from each sampling point used in the composites are available, the system may use these instead of resampling. This additional sample must be analyzed and the results reported to the State within 14 days of collection.
- (c) In systems serving fewer than 3,300 persons, the State may permit compositing among different systems provided the 5-sample limit is maintained. In systems serving 3,300 or more persons, the State may permit compositing of samples from up to five sampling locations within the system, provided the reporting limit is maintained.

C. Propylene Glycol

- (1) Approved Methods - Analysis for glycol shall be conducted using the following methods:

Contaminant	CAS No. ¹	Method Detection Limit (mg/L) ²	Analytical Method ³
Total glycol	---	0.05	APC-44
Propylene glycol	57-55-6	0.01	Westchester County FID Method
Ethylene glycol	107-21-1	0.01	Westchester County FID Method

¹CAS No. – Chemical Abstract Services Registry Number

²The State certified laboratory must report a detection level equal to or less than those listed in order for the analytical result to be indicative of a contaminant being “not detected.”

³If glycol is detected by Method APC-44 at 0.1 mg/L or greater, the State will require laboratory verification that the total glycol consists of less than 0.05 mg/L of ethylene glycol using the Westchester County FID method. The Westchester County FID method can distinguish between propylene glycol and ethylene glycol.

- (2) Analytical Method Number and Reference.

REFERENCE: Procedure for Method APC-44 – “Tentative Method for the Determination of Ethylene Glycol in Water” – Revision 1/91 may be obtained from the New York State Department of Health’s Wadsworth Laboratories and Research – Division of Environmental Sciences, Albany, New York. The telephone number is (518) 474-4170.

REFERENCE: Procedure for the Westchester County FID Method – “Analyzing Ethylene Glycol and Propylene Glycol in Water Supplies” may be obtained from Westchester County Department of Laboratories and Research Environmental Services, 2 Dana Road, Valhalla, New York, 10595. The telephone number is (914) 595-5575.

D. Methyl-tertiary-butyl-ether (MTBE)

- (1) Approved Methods - Analysis for MTBE shall be conducted using the following methods:

Contaminant	CAS No. ¹	Method Detection Limit (µg/L) ²	Analytical Method
MTBE	1634-04-4	2.5	EPA 502.2 ³
MTBE	1634-04-4	2.5	EPA 524.2 ³

¹CAS No. – Chemical Abstract Services Registry Number

²The State certified laboratory must report a detection level equal to or less than those listed in order for the analytical result to be indicative of a contaminant being not detected.

³EPA Method 502.2 and 524.2 as set forth in the New York State Environmental Laboratory Approval Program (ELAP) manual, modified on May 15, 2000.

E. Disinfectants, Disinfection Byproduct Precursors, and Disinfection Byproducts (Table 9A/9B in Subpart 5-1)

- (1) Approved Methods – the analysis of disinfection byproducts and disinfection byproduct precursors shall be conducted using the following methods (for approved methods for bromate, bromide and chlorite, see section I. A. (1) of this appendix):

Parameter	Methodology ¹	Reference Method
Total Trihalomethanes (TTHMs)	P&T/GC/EICD & PID	EPA method 502.2 ²
	P&T/GC/MS	EPA Method 524.2
	LLE/GC/ECD	EPA Method 551.1
Haloacetic Acids (HAA5)	LLE/GC/ECD	Standard Method 6251 B
	SPE/GC/ECD	EPA Method 552.1
	LLE/GC/ECD	EPA Method 552.2
Total Organic Carbon (TOC)	High-Temperature Combustion	Standard Method 5310 B
	Persulfate-Ultraviolet or Heated-Persulfate Oxidation	Standard Method 5310 C
	Wet-Oxidation	Standard Method 5310 D
Dissolved Organic Carbon (DOC) ^{3,4}	High-Temperature Combustion	Standard Method 5310 B
	Persulfate-Ultraviolet or Heated-Persulfate Oxidation	Standard Method 5310 C
	Wet-Oxidation	Standard Method 5310 D
UV ₂₅₄ ^{3,4}	Ultraviolet Absorption Method	Standard Method 5910 B

¹P&T=purge and trap; GC=gas chromatography; EICD=electrolytic conductivity detector; PID=photoionization detector; MS=mass spectrometer; LLE=liquid/liquid extraction; ECD=electron capture detector; SPE= solid phase extractor.

²If TTHMs are the only parameter being measured in the sample, then a PID is not required.

³DOC and UV₂₅₄ values are used to calculate Specific Ultraviolet Absorbance (SUVA). SUVA is equal to the UV₂₅₄ divided by the DOC concentration. SUVA must be measured on water before the addition of disinfectants or oxidants to the system. DOC and UV₂₅₄ samples used to determine a SUVA value must be taken at the same time and at the same location.

⁴Prior to analysis, DOC and UV₂₅₄ samples must be filtered through a 0.45 µm pore-diameter filter. Water passed through the 0.45 µm pore-diameter filter prior to filtration of the sample must serve as the filtered blank.

F. Sample Preservation and Holding Time Requirements

Method	Preservative	Sample Holding Time	Extract Holding Time	Suggested Sample Size	Type of Container
502.2	Sodium Thiosulfate or Ascorbic Acid, 4°C, HCl pH<2	14 days		40-120 mL	Glass with PFTE lined septum
504.1	Sodium Thiosulfate Cool, 4°C	14 days	4°C, 24 hours	40 mL	Glass with PFTE lined septum
505	Sodium Thiosulfate Cool, 4°C	14 days (7 days for Heptachlor)	4°C, 24 hours	40 mL	Glass with PFTE lined septum
506	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark 14 days	1 L	Amber Glass with PFTE lined cap
507	Sodium Thiosulfate Cool, 4°C, Dark	14 days (see method for exceptions)	4°C, dark 14 days	1 L	Amber Glass with PFTE lined cap
508	Sodium Thiosulfate Cool, 4°C, Dark	7 days (see method for exceptions)	4°C, dark 14 days	1 L	Glass with PFTE lined cap
508A	Cool, 4°C	14 days	30 days	1 L	Glass with PFTE lined cap
508.1	Sodium Sulfite, HCl pH<2 Cool, 4°C	14 days (see method for exceptions)	30 days	1 L	Glass with PFTE lined cap
515.1	Sodium Thiosulfate Cool, 4°C, Dark	14 days	4°C, dark 28 days	1 L	Amber Glass with PFTE lined cap
515.2	Sodium Thiosulfate, HCl pH<2 Cool, 4°C, Dark	14 days	less than of equal to 4°C, dark, 14 days	1 L	Amber Glass with PFTE lined cap
524.2	Ascorbic Acid, HCl pH<2, Cool 4°C	14 days		40-120 mL	Glass with PFTE lined septum

Method	Preservative	Sample Holding Time	Extract Holding Time	Suggested Sample Size	Type of Container
525.2	Sodium Sulfite, Dark, Cool 4°C, HCl pH<2	14 days (see method for exceptions)	30 days from collection	1 L	Amber Glass with PFTE lined cap
531.1, 6610	Sodium Thiosulfate, monochloroacetic acid, pH<3, Cool 4°C	Cool 4C 28 days		60 mL	Glass with PFTE lined Septum
547	Sodium Thiosulfate Cool, 4°C	14 days (18 months frozen)		60 mL	Glass with PFTE lined septum
548.1	Sodium Thiosulfate (HCl pH 1.5-2 if high biological activity) Cool 4°C, Dark	7 days	14 days less than or equal to 4°C	greater than or equal to 250 mL	Amber Glass with PFTE lined septum
549.1	Sodium Thiosulfate, (H ₂ SO ₄ pH<2 if biologically active) Cool 4°C, Dark	7 days	21 days	greater than or equal to 250 mL	High Density Amber Plastic or Silanized Amber Glass
550, 550.1	Sodium Thiosulfate, Cool 4°C, HCl pH<2	7 days	550 – 30 days 550.1 – 40 days Dark, 4°C	1 L	Amber Glass with PFTE lined cap
551	Sodium Thiosulfate, Sodium Sulfite, Ammonium Chloride, or Ascorbic Acid, HCl pH 4.5-5.0 Cool 4°C	14 days		greater than or equal to 40 mL	Glass with PFTE lined septum
555	Sodium Sulfite HCl, pH less than or equal to 2, Dark, Cool 4°C	14 days		greater than or equal to 100 mL	Glass with PFTE lined cap
1613B	Sodium Thiosulfate Cool 0-4°C, Dark		Recommended 40 days	1 L	Amber Glass with PFTE lined cap

* PTFE – polytetrafluoroethylene (teflon)

G. METHOD REFERENCES

Procedures for analysis of trihalomethanes and haloacetic acids using Methods 502.2, 524.2, 551.1, and 552.2 may be found in “Methods for the Determination of Organic Compounds in Drinking Water – Supplement III”, EPA/600/R-95/131, August 1995.

Procedures for Methods 502.2, 505, 507, 508, 508A, 515.1, and 531.1 may be found in “Methods for the Determination of Organic Compounds in Drinking Water”, EPA-600/4-88-039, December 1988, Revised, July 1991.

Procedures for Methods 506, 547, 550, 550.1, and 551.1 may be found in “Methods for the Determination of Organic Compounds in Drinking Water – Supplement I”, EPA/600-4-90-020, July 1990.

Procedures for Methods 515.2, 524.2, 548.1, 552.1, 552.2 and 555 may be found in “Methods for the Determination of Organic Compounds in Drinking Water – Supplement II”, EPA/600/R-92/129, August 1992.

Method 1613 is titled, “Tetra-Through Octa-chlorinated Dioxins and Furans by Isotope Dilution HRGC/HRMS”, EPA 821-B-94-005, October 1994.

These documents are available from the National Technical Information Service (NTIS) PB91-231480, PB91-146027, PB92-207703 and PB95-104774, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll-free number is 800-553-6847.

EPA Methods 504.1, 508.1 and 525.2 are available from US EPA EMSL-Cincinnati, OH 45268. The phone number is (513)-569-7586.

Procedure for Method 6651 may be found in “Standard Methods for the Examination of Water and Wastewater”, 18th Edition, American Public Health Association, American Water Works Association, Water Environment Federation, 1992.

Procedure for Method 6610 may be found in “Supplement to the 18th Edition of Standard Methods for the Examination of Water and Wastewater”, 1994, American Public Health Association, 1015 Fifteenth Street NW, Washington, DC 20005.

Procedures for Methods 5310B, 5310C, and 5310D may be found in “Supplement to the 19th Edition of Standard Methods for the Examination of Water and Wastewater”, American Public Health Association, 1996.

Procedure for Method 5910B may be found in “Standard Methods for the Examination of Water and Wastewater, 19th Edition”, American Public Health Association, 1995.

ASTM Method D5317-93 can be obtained from the “Annual Book of ASTM Standards”, 1994 and 1996, Vol. 11.01 and 11.02, American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

III. RADIONUCLIDES (Table 7 in Subpart 5-1)

A. Laboratory Certification – the analysis of Radionuclides shall only be conducted by laboratories that have received approval of the State Environmental Laboratory Approval Program (ELAP) according to the following approval conditions:

- (a) Analyze Performance Evaluation samples that include those substances provided by EPA Environmental Monitoring Systems Laboratory or equivalent samples provided by the State.
- (b) Laboratories must achieve quantitative results within the acceptance limits on 80% of the analytes included in the PT sample. Acceptance is defined as within the 95% confidence interval around the mean of the PT study data.
- (c) Achieve quantitative results on the analyses that are within the following acceptance limits:

Contaminant	Acceptance Limit
Gross alpha	±50%
Gross beta	±30%
Cesium-134	±30%
Iodine-131	±30%
Strontium-89, 90	±30%
Tritium	±20%
Gamma emitters	
Radium-226	±30%
Radium-228	±50%
Uranium	±30%

(d) Achieve the following detection limits:

Contaminant	Detection Limit (pCi/L)
Gross alpha	3
Gross beta	4
Radium-226	1
Radium-228	1
Cesium-134	10
Strontium-89	10
Strontium-90	2
Iodine-131	1
Tritium	1,000
Other Radionuclides and Photon/Gamma Emitters	1/10 th of the MCL

B. (1) **Approved Methods** – the analysis of Radionuclides shall be conducted using the following methods:

Contaminant	Methodology	Reference (method or page number)								
		EPA ¹ Methods	EPA ² Methods	EPA ³ Methods	EPA ⁴ Methods	Standard Methods ⁵	ASTM Methods ⁶	USGS Methods ⁷	DOE Methods ⁸	Other Methods
Naturally occurring										
Gross alpha ¹¹ and beta	Evaporation	900.0	p. 1	00-01	p. 1	302, 7110 B		R-1120-76		
Gross alpha ¹¹	Co-precipitation			00-02		7110 C				
Radium-226	Radon emanation	903.1	p. 16	Ra-04	p. 19	7500-Ra C	D 3454-91	R-1141-76	Ra-05	N.Y. ⁹
	Radiochemical	903.0	p. 13	Ra-03		304, 305, 7500-Ra B	D 2460-90	R-1140-76		
Radium-228	Radiochemical	904.0	p. 24	Ra-05	p. 19	304, 7500-Ra D		R-1142-76		N.Y. ⁹ N. J. ¹⁰
Uranium ¹²	Radiochemical	908.0				7500-U B				
	Fluorometric	908.1				7500-U C (17 th Ed.)	D 2907-91	R-1180-76, R-1181-76	U-04	
	Alpha spectrometry			00-07	p. 33	7500-U C (18 th or 19 th Ed.)	D 3972-90	R-1182-76	U-02	
	Laser Phosphorimetry						D 5174-91			
Man-made										
Cesium-134	Radiochemical	901.0	p. 4			7500-Cs B	D-2459-72	R-1111-76		
	Gamma ray spectrometry	901.1			p. 92	7120 (19 th Ed.)	D 3649-91	R-1110-76	4.5.2.3	
Iodine-131	Radiochemical	902.0	p. 6 p. 9			7500-1 B 7500-1 C 7500-1 D	D 3649-91			
	Gamma ray spectrometry	901.1			p. 92	7120 (19 th Ed.)	D 4785-88		4.5.2.3	
Strontium-89, 90	Radiochemical	905.0	p. 29	Sr-4	p. 65	303, 7500-Sr B		R-1160-76	Sr-01 Sr-02	
Tritium	Liquid scintillation	906.0	p. 34	H-2	p. 87	306, 7500-3H B	D 4107-91	R-1171-76		
Gamma emitters	Gamma ray spectrometry	901.1 902.0 901.0			p. 92	7120 (19 th Ed.), 7500-Cs B, 7500-I B	D 3649-91 D 4785-88	R-1110-76	4.5.2.3	

¹ "Prescribed Procedures for Measurement of Radioactivity in Drinking Water", EPA 600/4-80-032 , August 1980. Available at U.S. Department of Commerce, National Technical Information Service (NTIS), 5285 Port Royal Road, Springfield, VA 22161 (Telephone 800-553-6847) , PB 80-224744.

² "Interim Radiochemical Methodology for Drinking Water", EPA 600/4-75-008(revised), March 1976. Available at NTIS, ibid. PB 253258.

³ "Radiochemistry Procedures Manual", EPA 520/5-84-006, December 1987. Available at NTIS, ibid. PB 84 - 215581.

⁴ "Radiochemical Analytical Procedures for Analysis of Environmental Samples", March 1979. Available at NTIS, ibid. EMSL LV 053917.

⁵ "Standard Methods for the Examination of Water and Wastewater", 13th, 17th, 18th, 19th Editions, 1971, 1989, 1992, 1995. Available at American Public Health Association, 1015 Fifteenth Street N.W., Washington, D.C. 20005 . All methods are in the 17th, 18th and 19th editions except 7500-U C Fluorometric Uranium was discontinued after the 17th Edition, 7120 Gamma Emitters is only in the 19th Edition, and 302, 303, 304, 305 and 306 are only in the 13th Edition.

⁶ "Annual Book of ASTM Standards", Vol. 11.02, 1994; any year containing the cited version of the method may be used. Copies may be obtained from the American Society for Testing and Materials, 100 Barr Harbor Drive, West Conshohocken, PA 19428.

⁷ "Methods for Determination of Radioactive Substances in Water and Fluvial Sediments", Chapter A5 in Book 5 of "Techniques of Water-Resources Investigations of the United States Geological Survey", 1977. Available at U.S. Geological Survey (USGS) Information Services, Box 25286, Federal Center, Denver, CO 80225-0425.

⁸ "EML Procedures Manual", 27th Edition, Volume 1, 1990. Available at the Environmental Measurements Laboratory, U.S. Department of Energy (DOE), 376 Hudson Street, New York, NY 10014-3621.

⁹ "Determination of Ra-226 and Ra-228 (Ra-02)", January 1980, Revised June 1982. Available at Radiological Sciences Institute Center for Laboratories and Research, New York State Department of Health, Empire State Plaza, Albany, NY 12201.

¹⁰ "Determination of Radium 228 in Drinking Water", August 1980. Available at State of New Jersey, Department of Environmental Protection, Division of Environmental Quality, Bureau of Radiation and Inorganic Analytical Services, 9 Ewing Street, Trenton, NJ 08625.

¹¹ Natural uranium and thorium-230 are approved as gross alpha-particle activity calibration standards for gross alpha co-precipitation and evaporation methods; americium-241 is approved for use with the gross alpha co-precipitation methods.

¹² If uranium (U) is determined by mass-type methods (i.e., fluorometric or laser phosphorimetry), a 0.67 pCi/μg of uranium conversion factor must be used. This conversion factor is conservative and is based on the 1:1 activity ratio of U-234 to U-238 that is characteristic of naturally-occurring uranium in rock.

C. Sample Collection, Preservation and Instrumentation Requirements

Sample collection for Radionuclides shall be conducted using the sample preservation, container, and maximum holding time procedures specified in the following table:

Parameter	Preservative ¹	Sample Holding Time ²	Type of Container	Instrumentation ³
Gross alpha	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A, B, or G
Gross beta	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A or G
Strontium-89	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A or G
Strontium-90	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A or G
Radium-226	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A,B,D or G
Radium-228	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	A or G
Cesium-134	Conc. HCl to pH <2 ⁴	6 months	Plastic or Glass	A, C or G
Iodine-131	None	8 days	Plastic or Glass	A, C or G
Tritium	None	6 months	Glass	E
Uranium	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	F
Photon emitters	Conc. HCl or HNO ₃ to pH <2 ⁴	6 months	Plastic or Glass	C

¹ It is recommended that the preservative be added to the sample at the time of collection unless suspended solids activity is to be measured. It is also recommended that samples be filtered, if suspended or settleable solids are present, prior to adding preservative, at the time of collection. However, if the sample has to be shipped to a laboratory or storage area, acidification of the sample (in its original container) may be delayed for a period not to exceed 5 days. A minimum of 16 hours must elapse between acidification and analysis.

² Holding time is defined as the period from time of sampling to time of analysis. In all cases, samples should be analyzed as soon after collection as possible. If a composite sample is prepared, a holding time cannot exceed 12 months.

³ A = Low background proportional system; B = Alpha and beta scintillation system; C = Gamma spectrometer [Ge(Hp) or Ge(Li)]; D = Scintillation cell system; E = Liquid scintillation system; F = Fluorometer; G = Low background alpha and beta counting system other than gas-flow proportional.

⁴ If HCl is used to acidify samples which are to be analyzed for gross alpha or gross beta activities, the acid salts must be converted to nitrate salts before transfer of the samples to planchets.

IV. MICROBIOLOGICAL CONTAMINANTS (Tables 6, 11, and 11A)

A. Laboratory Certification - Measurement of total coliforms, fecal coliforms/*E. Coli*. and heterotrophic plate count (HPC) must be conducted by a laboratory certified by the Department's Environmental Laboratory Approval Program (ELAP) for these analyses.

B. Approved Methods – the following analytical methods are acceptable for measurement of microbiological contaminants:

Approved Methods ^{1,2}	Media	Reference Method ^{3,4}
Total Coliforms⁵		
Fermentation broth method ^{6,7,8}	LTB BGLB Broth	SM 9221B
	P-A Broth BGLB Broth ^{8,10}	SM 9221D
Enzyme substrate method	Colilert, Colilert-18 ¹¹	SM 9223
	Colisure ^{12,13}	SM 9223
	E*colite Test ¹⁴	
Membrane filter method	mEndo or LES-Endo	SM 9222B
	MI Agar ⁹	
	m-ColiBlue 24 ¹⁵	
Fecal Coliforms⁵		
Fermentation broth method	EC broth	SM 9221E
	A-1 broth ¹⁶	SM 9221E
Membrane filter method	mFC	SM 9222D
<i>Escherichia coli</i>		
Enzyme substrate method	Colilert or Colilert-18	SM 9223
	Colisure ^{12,13}	SM 9223
	E*Colite ¹⁴	
	LTB or P/A broth EC-MUG	SM 9221B SM 9221F
Membrane filter method	MI Medium ⁹	
	m-ColiBlue24 ¹⁵	
	mEndo or LES Endo NA-MUG	SM 9222B SM 9222G
Heterotrophic Bacteria⁵		
Pour plate method		SM 9215B

¹It is strongly recommended that laboratories evaluate the false-positive and negative rates for the method(s) they use for monitoring total coliforms. Laboratories are also encouraged to establish false-positive rates within their own laboratory and sample matrix (drinking water or source water) with the intent that if the method they choose has an unacceptable false-positive or negative rate, another method can be used. It is suggested that laboratories perform these studies on a minimum of 5% of all total coliform-positive samples, except for those methods where verification/confirmation is already required, e.g., the M-Endo and LES Endo Membrane Filter Tests, Standard Total Coliform Fermentation Technique, and Presence-Absence Coliform Test. Methods for establishing false-positive and negative-rates may be based on lactose fermentation, the rapid test for β -galactosidase and cytochrome oxidase, multi-test identification systems, or equivalent confirmation tests. False-positive and false negative information is often available in published studies and/or from the manufacturer(s).

²Preparation of EC medium is described in Method 9221 E (paragraph 1a) and preparation of Nutrient Agar is described in Method 9221 B (paragraph 3). Both methods are in "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, and 19th Edition, 1995; either edition may be used.

³SM = *Standard Methods for the Examination of Water and Wastewater*, 18th, or 19th edition.

⁴Methods 9221 A, B; 9222 A, B, C; 9221 D and 9223 are contained in "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, and 19th Edition, 1995, American Public Health Association, 1015 Fifteenth Street NW, Washington, D.C. 20005; either edition may be used.

⁵The time from sample collection of a drinking water sample to initiation of total coliform analysis may not exceed 30 hours. The time from sample collection of a drinking water sample to initiation of heterotrophic bacteria analysis may not exceed 8 hours. Raw water samples may not exceed 8 hours. Systems are encouraged, but not required to hold samples below 10°C during transit.

⁶Lactose broth, as commercially available, may be used in lieu of lauryl tryptose broth, if the system conducts at least 25 parallel tests between this medium and lauryl tryptose broth using the water normally tested, and this comparison demonstrates that the false-positive rate for total coliforms, using lactose broth, is less than 10 percent.

⁷If inverted tubes are used to detect gas production, the media should cover these tubes at least one-half to two-thirds after the sample is added.

⁸No requirement exists to run the completed phase on 10 percent of all total coliform-positive confirmed tubes.

⁹Preparation and use of MI agar is set forth in the article, "New medium for the simultaneous detection of total coliform and *Escherichia coli* in water" by Brenner K.P., et al., 1993, Appl. Environ. Microbiol. 59:3534-3544. Also available from the Office of Water Resources Center (RC-4100), 1200 Pennsylvania Avenue, SW, Washington, D.C. 20460, EPA 600/J-99/225.

¹⁰Six-times formulation strength may be used if the medium is filter-sterilized rather than autoclaved.

¹¹The Chromogenic Substrate Coliform Test or ONPG-MUG Test is also known as the Autoanalysis Colilert System.

¹²A description of the Colisure Test, Feb. 28, 1994, may be obtained from the IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, Maine 04092.

¹³The Colisure test may be read after an incubation time of 24 hours.

¹⁴A description of the E*Colite® Test, "Presence/Absence for Coliforms and *E. coli* in Water", Dec. 21, 1997, is available from Charm Sciences, Inc., 36 Franklin Street, Malden, MA 02148-4120.

¹⁵A description of the m-ColiBlue24® Test, Aug. 17, 1999, is available from Hach Company, 100 Dayton Avenue, Ames, IA 50010.

¹⁶A-1 Broth may be held up to 3 months in a tightly closed screwcap tube at 4°C.

V. TURBIDITY (Table 4)

A. Approved Methods – Turbidity shall be conducted using the following methods:

Parameter	Methodology	Reference Methods ¹
Turbidity	Nephelometric Method	2130 B
	Nephelometric method	180.1 ²
	Great Lakes Instruments	Method 2 ³

¹ "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, and 19th Edition, 1995, American Public Health Association, American Water Works Association, Water Environment Federation.

² "Methods for the Determination of Inorganic Substances in Environmental Samples", EPA-600/R-93-100, August 1993. Available at NTIS, PB94-121811.

³GLI Method 2, "Turbidity" November 2, 1992 Great Lakes Instruments, Inc., 8855 North 55th Street, Milwaukee, Wisconsin 53223.

VI. RESIDUAL DISINFECTANTS

A. Approved Methods – Residual Disinfectants shall be conducted using the following methods:

Disinfectant	Reference Methodology	Reference Methods ¹
Free and Combined Chlorine ²	Amperometric Titration Method	4500-C1 D
	Low Level Amperometric Titration	4500-C1 E
	DPD Ferrous Titrimetric Method	4500-C1 F
	DPD Colorimetric Method ³	4500-C1 G
	Syringaldazine (FACTS) Method	4500-C1 H
Ozone	Indigo Colorimetric Method	4500-O ₃ B
Chlorine Dioxide	DPD Method	4500-C1O ₂ D
	Amperometric Method II	4500-C1O ₂ E

¹ "Standard Methods for the Examination of Water and Wastewater", 18th Edition, 1992, 19th Edition, 1995, and 20th Edition 1998, American Public Health Association, American Water Works Association, Water Environment Federation.

²Free 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 of the measurement remain the same. Instruments used for continuous monitoring must be calibrated with a grab sample measurement at least every 5 days, or with a protocol approved by the State.

³The Hach Company Method No. 8167 (Version no. 1, dated April 24, 1995) as found in Hach Method 8021 in the "Water Quality Analysis Handbook", 3rd edition, by Hach Company, Loveland, Colorado, 1997, pg. 335, for determining total chlorine is an acceptable version of the spectrophotometric, DPD, Standard Method 4500-C1-G in "Standard Methods for the Examination of Water and Wastewater", 18th Edition, American Public Health Association, American Water Works Association, Water Environment Federation, 1992.

VII. GENERAL REFERENCES

More information about the regulations pertaining to the parameters listed in this appendix can be found in 40CFR parts 141.23, 141.24, National Primary and Secondary Drinking Water Regulations.

Copies of documents referenced in this appendix may be obtained from the National Technical Information Services, U.S. Department of Commerce, 5285 Pont Royal Road, Springfield, Virginia 22161.

Copies are available for review and inspection from Records Access Officer, Department of Health, Room 2230, Corning Tower, Empire State Plaza, Albany, New York 12237 and New York State Department of State, Office of Information Services, 41 State Street, Albany, New York 12231.

U.S. EPA. "Technical Notes on Drinking Water Methods", Office of Research and Development, Washington, DC 20460. EPA/600/R-94/173, October 1994 (EPA, 1994).

Copies of EPA methods may be obtained by contacting EPA's Safe Drinking Water Hotline at 1-800-426-4791, or email: sdwh@erols.com.