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**40 CFR Ch. I (7-1-22 Edition)**

sample used for the purpose of calculating the monthly average. If the monthly average of the daily samples exceeds the maximum allowable limit, or if the average of two samples taken on consecutive days exceeds 5 TU, the supplier of water shall report to the State and notify the public as directed in §141.31 and subpart Q.

(c) Sampling for non-community water systems shall begin within two years after the effective date of this part.

(d) The requirements of this §141.22 shall apply only to public water systems which use water obtained in whole or in part from surface sources.

(e) The State has the authority to determine compliance or initiate enforcement action based upon analytical results or other information compiled by their sanctioned representatives and agencies.

[40 FR 59570, Dec. 24, 1975, as amended at 45 FR 57344, Aug. 27, 1980; 47 FR 8998, Mar. 3, 1982; 47 FR 10998, Mar. 12, 1982; 54 FR 27527, June 29, 1989; 59 FR 62466, Dec. 5, 1994; 65 FR 26022, May 4, 2000]

**§ 141.23 Inorganic chemical sampling and analytical requirements.**

Community water systems shall conduct monitoring to determine compliance with the maximum contaminant levels specified in §141.62 in accordance with this section. Non-transient, non-community water systems shall conduct monitoring to determine compliance with the maximum contaminant levels specified in §141.62 in accordance with this section. Transient, non-community water systems shall conduct monitoring to determine compliance with the nitrate and nitrite maximum contaminant levels in §§141.11 and 141.62 (as appropriate) in accordance with this section.

(a) Monitoring shall be conducted as follows:

(1) Groundwater systems shall take a minimum of one sample at every entry point to the distribution system which is representative of each well after treatment (hereafter called a sampling point) beginning in the initial compli-

ance period. The system shall take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

(2) Surface water systems shall take a minimum of one sample at every entry point to the distribution system after any application of treatment or in the distribution system at a point which is representative of each source after treatment (hereafter called a sampling point) beginning in the initial compliance period. The system shall take each sample at the same sampling point unless conditions make another sampling point more representative of each source or treatment plant.

NOTE: For purposes of this paragraph, surface water systems include systems with a combination of surface and ground sources.

(3) If a system draws water from more than one source and the sources are combined before distribution, the system must sample at an entry point to the distribution system during periods of normal operating conditions (*i.e.*, when water is representative of all sources being used).

(4) 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.

(i) 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 which exceeded one-fifth of the MCL in the composite sample. Detection limits for each analytical method and MCLs for each inorganic contaminant are the following:

DETECTION LIMITS FOR INORGANIC CONTAMINANTS

Contaminant	MCL (mg/l)	Methodology	Detection limit (mg/l)
Antimony	0.006	Atomic Absorption; Furnace	0.003
		Atomic Absorption; Platform	0.0008 <sup>5</sup>
		ICP-Mass Spectrometry	0.0004
Arsenic	0.010 <sup>6</sup>	Hydride-Atomic Absorption	0.001
		Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform—Stabilized Temperature	0.0005 <sup>7</sup>
		Atomic Absorption; Gaseous Hydride	0.001
Asbestos	7 MFL <sup>1</sup>	Transmission Electron Microscopy	0.01 MFL
Barium	2	Atomic Absorption; furnace technique	0.002
		Atomic Absorption; direct aspiration	0.1
		Inductively Coupled Plasma	0.002 (0.001)
Beryllium	0.004	Atomic Absorption; Furnace	0.0002
		Atomic Absorption; Platform	0.00002 <sup>5</sup>
		Inductively Coupled Plasma <sup>2</sup>	0.0003
		ICP-Mass Spectrometry	0.0003
Cadmium	0.005	Atomic Absorption; furnace technique	0.0001
		Inductively Coupled Plasma	0.001
Chromium	0.1	Atomic Absorption; furnace technique	0.001
		Inductively Coupled Plasma	0.007 (0.001)
Cyanide	0.2	Distillation, Spectrophotometric <sup>3</sup>	0.02
		Distillation, Automated, Spectrophotometric <sup>3</sup>	0.005
		Distillation, Amenable, Spectrophotometric <sup>4</sup>	0.02
		Distillation, Selective Electrode <sup>3,4</sup>	0.05
		UV, Distillation, Spectrophotometric <sup>9</sup>	0.0005
		Micro Distillation, Flow Injection, Spectrophotometric <sup>3</sup>	0.0006
		Ligand Exchange with Amperometry <sup>4</sup>	0.0005
Mercury	0.002	Manual Cold Vapor Technique	0.0002
		Automated Cold Vapor Technique	0.0002
Nickel	xl	Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform	0.0006 <sup>5</sup>
		Inductively Coupled Plasma <sup>2</sup>	0.005
		ICP-Mass Spectrometry	0.0005
Nitrate	10 (as N)	Manual Cadmium Reduction	0.01
		Automated Hydrazine Reduction	0.01
		Automated Cadmium Reduction	0.05
		Ion Selective Electrode	1
		Ion Chromatography	0.01
		Capillary Ion Electrophoresis	0.076
Nitrite	1 (as N)	Spectrophotometric	0.01
		Automated Cadmium Reduction	0.05
		Manual Cadmium Reduction	0.01
		Ion Chromatography	0.004
		Capillary Ion Electrophoresis	0.103
Selenium	0.05	Atomic Absorption; furnace	0.002
Thallium	0.002	Atomic Absorption; gaseous hydride	0.002
		Atomic Absorption; Furnace	0.001
		Atomic Absorption; Platform	0.0007 <sup>5</sup>
		ICP-Mass Spectrometry	0.0003

<sup>1</sup> MFL = million fibers per liter >10 μm.  
<sup>2</sup> Using a 2X preconcentration step as noted in Method 200.7. Lower MDLs may be achieved when using a 4X preconcentration.  
<sup>3</sup> Screening method for total cyanides.  
<sup>4</sup> Measures "free" cyanides when distillation, digestion, or ligand exchange is omitted.  
<sup>5</sup> Lower MDLs are reported using stabilized temperature graphite furnace atomic absorption.  
<sup>6</sup> The value for arsenic is effective January 23, 2006. Unit then, the MCL is 0.05 mg/L.  
<sup>7</sup> The MDL reported for EPA method 200.9 (Atomic Absorption; Platform—Stabilized Temperature) 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 MDL of 0.0001 mg/L.  
<sup>8</sup> Using selective ion monitoring, EPA Method 200.8 (ICP-MS) is capable of obtaining a MDL of 0.0001 mg/L.  
<sup>9</sup> Measures total cyanides when UV-digester is used, and "free" cyanides when UV-digester is bypassed.

(ii) If the population served by the system is >3,300 persons, then compositing may only be permitted by the State at sampling points within a single system. In systems serving ≤3,300 persons, the State may permit compositing among different systems provided the 5-sample limit is maintained.

(iii) If duplicates of the original sample taken from each sampling point

used in the composite sample are available, the system may use these instead of resampling. The duplicates must be analyzed and the results reported to the State within 14 days after completing analysis of the composite sample, provided the holding time of the sample is not exceeded.

(5) The frequency of monitoring for asbestos shall be in accordance with paragraph (b) of this section: the frequency of monitoring for antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium and thallium shall be in accordance with paragraph (c) of this section; the frequency of monitoring for nitrate shall be in accordance with paragraph (d) of this section; and the frequency of monitoring for nitrite shall be in accordance with paragraph (e) of this section.

(b) The frequency of monitoring conducted to determine compliance with the maximum contaminant level for asbestos specified in §141.62(b) shall be conducted as follows:

(1) Each community and non-transient, non-community water system is required to monitor for asbestos during the first three-year compliance period of each nine-year compliance cycle beginning in the compliance period starting January 1, 1993.

(2) If the system believes it is not vulnerable to either asbestos contamination in its source water or due to corrosion of asbestos-cement pipe, or both, it may apply to the State for a waiver of the monitoring requirement in paragraph (b)(1) of this section. If the State grants the waiver, the system is not required to monitor.

(3) The State may grant a waiver based on a consideration of the following factors:

(i) Potential asbestos contamination of the water source, and

(ii) The use of asbestos-cement pipe for finished water distribution and the corrosive nature of the water.

(4) A waiver remains in effect until the completion of the three-year compliance period. Systems not receiving a waiver must monitor in accordance with the provisions of paragraph (b)(1) of this section.

(5) A system vulnerable to asbestos contamination due solely to corrosion

of asbestos-cement pipe shall take one sample at a tap served by asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

(6) A system vulnerable to asbestos contamination due solely to source water shall monitor in accordance with the provision of paragraph (a) of this section.

(7) A system vulnerable to asbestos contamination due both to its source water supply and corrosion of asbestos-cement pipe shall take one sample at a tap served by asbestos-cement pipe and under conditions where asbestos contamination is most likely to occur.

(8) A system which exceeds the maximum contaminant levels as determined in §141.23(i) of this section shall monitor quarterly beginning in the next quarter after the violation occurred.

(9) The State may decrease the quarterly monitoring requirement to the frequency specified in paragraph (b)(1) of this section provided the State has determined that the system is reliably and consistently below the maximum contaminant level. In no case can a State make this determination unless a groundwater system takes a minimum of two quarterly samples and a surface (or combined surface/ground) water system takes a minimum of four quarterly samples.

(10) If monitoring data collected after January 1, 1990 are generally consistent with the requirements of §141.23(b), then the State may allow systems to use that data to satisfy the monitoring requirement for the initial compliance period beginning January 1, 1993.

(c) The frequency of monitoring conducted to determine compliance with the maximum contaminant levels in §141.62 for antimony, arsenic, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium and thallium shall be as follows:

(1) Groundwater systems shall take one sample at each sampling point during each compliance period. Surface water systems (or combined surface/ground) shall take one sample annually at each sampling point.

(2) The system may apply to the State for a waiver from the monitoring

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frequencies specified in paragraph (c)(1) of this section. States may grant a public water system a waiver for monitoring of cyanide, provided that the State determines that the system is not vulnerable due to lack of any industrial source of cyanide.

(3) A condition of the waiver shall require that a system shall take a minimum of one sample while the waiver is effective. The term during which the waiver is effective shall not exceed one compliance cycle (*i.e.*, nine years).

(4) The State may grant a waiver provided surface water systems have monitored annually for at least three years and groundwater systems have conducted a minimum of three rounds of monitoring. (At least one sample shall have been taken since January 1, 1990). Both surface and groundwater systems shall demonstrate that all previous analytical results were less than the maximum contaminant level. Systems that use a new water source are not eligible for a waiver until three rounds of monitoring from the new source have been completed.

(5) In determining the appropriate reduced monitoring frequency, the State shall consider:

(i) Reported concentrations from all previous monitoring;

(ii) The degree of variation in reported concentrations; and

(iii) Other factors which may affect contaminant concentrations such as changes in groundwater pumping rates, changes in the system's configuration, changes in the system's operating procedures, or changes in stream flows or characteristics.

(6) A decision by the State to grant a waiver shall be made in writing and shall set forth the basis for the determination. The determination may be initiated by the State or upon an application by the public water system. The public water system shall specify the basis for its request. The State shall review and, where appropriate, revise its determination of the appropriate monitoring frequency when the system submits new monitoring data or when other data relevant to the system's appropriate monitoring frequency become available.

(7) Systems which exceed the maximum contaminant levels as calculated

in §141.23(i) of this section shall monitor quarterly beginning in the next quarter after the violation occurred.

(8) The State may decrease the quarterly monitoring requirement to the frequencies specified in paragraphs (c)(1) and (c)(2) of this section provided it has determined that the system is reliably and consistently below the maximum contaminant level. In no case can a State make this determination unless a groundwater system takes a minimum of two quarterly samples and a surface water system takes a minimum of four quarterly samples.

(9) All new systems or systems that use a new source of water that begin operation after January 22, 2004 must demonstrate compliance with the MCL within a period of time specified by the State. The system must also comply with the initial sampling frequencies specified by the State to ensure a system can demonstrate compliance with the MCL. Routine and increased monitoring frequencies shall be conducted in accordance with the requirements in this section.

(d) All public water systems (community; non-transient, non-community; and transient, non-community systems) shall monitor to determine compliance with the maximum contaminant level for nitrate in §141.62.

(1) Community and non-transient, non-community water systems served by groundwater systems shall monitor annually beginning January 1, 1993; systems served by surface water shall monitor quarterly beginning January 1, 1993.

(2) For community and non-transient, non-community water systems, the repeat monitoring frequency for groundwater systems shall be quarterly for at least one year following any one sample in which the concentration is  $\geq 50$  percent of the MCL. The State may allow a groundwater system to reduce the sampling frequency to annually after four consecutive quarterly samples are reliably and consistently less than the MCL.

(3) For community and non-transient, non-community water systems, the State may allow a surface water

system to reduce the sampling frequency to annually if all analytical results from four consecutive quarters are <50 percent of the MCL. A surface water system shall return to quarterly monitoring if any one sample is ≥50 percent of the MCL.

(4) Each transient non-community water system shall monitor annually beginning January 1, 1993.

(5) After the initial round of quarterly sampling is completed, each community and non-transient non-community system which is monitoring annually shall take subsequent samples during the quarter(s) which previously resulted in the highest analytical result.

(e) All public water systems (community; non-transient, non-community; and transient, non-community systems) shall monitor to determine compliance with the maximum contaminant level for nitrite in §141.62(b).

(1) All public water systems shall take one sample at each sampling point in the compliance period beginning January 1, 1993 and ending December 31, 1995.

(2) After the initial sample, systems where an analytical result for nitrite is <50 percent of the MCL shall monitor at the frequency specified by the State.

(3) For community, non-transient, non-community, and transient non-community water systems, the repeat monitoring frequency for any water system shall be quarterly for at least one year following any one sample in which the concentration is ≥50 percent of the MCL. The State may allow a system to reduce the sampling frequency to annually after determining the system is reliably and consistently less than the MCL.

(4) Systems which are monitoring annually shall take each subsequent sample during the quarter(s) which previously resulted in the highest analytical result.

(f) Confirmation samples:

(1) Where the results of sampling for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium or thallium indicate an exceedance of the maximum contaminant level, the State may require that one additional sample be collected as soon as possible after the initial sample was

taken (but not to exceed two weeks) at the same sampling point.

(2) Where nitrate or nitrite sampling results indicate an exceedance of the maximum contaminant level, the system shall take a confirmation sample within 24 hours of the system's receipt of notification of the analytical results of the first sample. Systems unable to comply with the 24-hour sampling requirement must immediately notify persons served by the public water system in accordance with §141.202 and meet other Tier 1 public notification requirements under subpart Q of this part. Systems exercising this option must take and analyze a confirmation sample within two weeks of notification of the analytical results of the first sample.

(3) If a State-required confirmation sample is taken for any contaminant, then the results of the initial and confirmation sample shall be averaged. The resulting average shall be used to determine the system's compliance in accordance with paragraph (i) of this section. States have the discretion to delete results of obvious sampling errors.

(g) The State may require more frequent monitoring than specified in paragraphs (b), (c), (d) and (e) of this section or may require confirmation samples for positive and negative results at its discretion.

(h) Systems may apply to the State to conduct more frequent monitoring than the minimum monitoring frequencies specified in this section.

(i) Compliance with §141.11 or §141.62(b) (as appropriate) shall be determined based on the analytical result(s) obtained at each sampling point.

(1) For systems which are conducting monitoring at a frequency greater than annual, compliance with the maximum contaminant levels for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium or thallium is determined by a running annual average at any sampling point. If the average at any sampling point is greater than the MCL, then the system is out of compliance. If any one sample would

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cause the annual average to be exceeded, then the system is out of compliance immediately. Any sample below the method detection limit shall be calculated at zero for the purpose of determining the annual average. If a system fails to collect the required number of samples, compliance (average concentration) will be based on the total number of samples collected.

(2) For systems which are monitoring annually, or less frequently, the system is out of compliance with the maximum contaminant levels for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, selenium or thallium if the level of a contaminant is greater than the MCL. If confirmation samples are required by the State, the determination of compliance will be based on the annual average of the initial MCL exceedance and any State-required confirmation samples. If a system fails to collect the required number of samples, compliance (average concentration) will be based on the total number of samples collected.

(3) Compliance with the maximum contaminant levels for nitrate and nitrate is determined based on one sample if the levels of these contaminants are below the MCLs. If the levels of ni-

trate and/or nitrite exceed the MCLs in the initial sample, a confirmation sample is required in accordance with paragraph (f)(2) of this section, and compliance shall be determined based on the average of the initial and confirmation samples.

(4) Arsenic sampling results will be reported to the nearest 0.001 mg/L.

(j) Each public water system shall monitor at the time designated by the State during each compliance period.

(k) Inorganic analysis:

(1) Analysis for the following contaminants shall be conducted in accordance with the methods in the following table, or the alternative methods listed in appendix A to subpart C of this part, or their equivalent as determined by EPA. 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. This document is available from the National Service Center for Environmental Publications (NSCEP), P.O. Box 42419, Cincinnati, OH 45242-0419 or <http://www.epa.gov/nscep/>.

Contaminant	Methodology <sup>13</sup>	EPA	ASTM <sup>3</sup>	SM <sup>4</sup> (18th, 19th ed.)	SM <sup>4</sup> (20th ed.)	SM Online <sup>22</sup>	Other
1. Alkalinity	Titrimetric Electrometric titration Inductively Coupled Plasma (ICP)—Mass Spectrometry	200.8 <sup>2</sup>	D1067–92, 02 B	2320 B	2320 B	2320 B–97, I–1030–85 <sup>5</sup>	
2. Antimony	Hydride-Atomic Absorption Atomic Absorption; Platform Atomic Absorption; Furnace ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Hydride Atomic Absorption	200.9 <sup>2</sup> 200.8 <sup>2</sup> , 200.9 <sup>2</sup>	D3697–92, 02 D2972–97, 03 C D1972–97, 03 B	3113 B	3113 B 3114 B	3113 B–99 3113 B–99 3114 B–97	
3. Arsenic <sup>14</sup>	Atomic Absorption; Furnace ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Hydride Atomic Absorption	200.8 <sup>2</sup> , 200.9 <sup>2</sup>	D2972–97, 03 C D1972–97, 03 B	3113 B 3114 B	3113 B 3114 B	3113 B–99 3114 B–97	
4. Asbestos	Transmission Electron Microscopy Transmission Electron Microscopy Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Direct Atomic Absorption; Furnace Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Inductively Coupled Plasma	100.1 <sup>9</sup> 100.2 <sup>10</sup> 200.7 <sup>2</sup> 200.8 <sup>2</sup>	D1972–97, 03 B	3120 B	3120 B	3120 B–99 3111 D–99 3113 B–99 3120 B–99	
5. Barium	Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Inductively Coupled Plasma	200.7 <sup>2</sup> 200.8 <sup>2</sup> 200.9 <sup>2</sup>	D3645–97, 03 B	3113 B	3120 B	3113 B–99	
6. Beryllium	Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Inductively Coupled Plasma	200.7 <sup>2</sup> 200.8 <sup>2</sup> 200.9 <sup>2</sup>	D3645–97, 03 B	3113 B	3120 B	3113 B–99	
7. Cadmium	Inductively Coupled Plasma ICP-Mass Spectrometry Atomic Absorption; Platform Atomic Absorption; Furnace Inductively Coupled Plasma	200.7 <sup>2</sup> 200.8 <sup>2</sup> 200.9 <sup>2</sup>	D3645–97, 03 B	3113 B	3120 B	3113 B–99	

8. Calcium	Atomic Absorption; Furnace. EDTA titrimetric				3113 B-99. 3500-Ca B-97. 3111 B-99. 3120 B-99.
9. Chromium	Atomic Absorption; Direct Aspiration. Inductively Coupled Plasma. Ion Chromatography Inductively Coupled Plasma. ICP-Mass Spectrometry Atomic Absorption; Platform. Atomic Absorption; Furnace. Atomic Absorption; Furnace. Atomic Absorption; Direct Aspiration. Inductively Coupled Plasma. ICP-Mass spectrometry Atomic Absorption; Platform.	D511-93, 03 A D511-93, 03 B D6919-03.	3113 B 3500-Ca D 3111 B 3120 B 3120 B	3500-Ca B 3111 B-99. 3120 B-99.	3113 B-99. 3113 B-99. 3111 B-99. 3120 B-99.
10. Copper	Atomic Absorption; Direct Aspiration. Inductively Coupled Plasma. ICP-Mass spectrometry Atomic Absorption; Platform. Conductance	D1688-95, 02 C D1688-95, 02 A	3113 B 3113 B 3111 B 3120 B	3113 B-99. 3113 B-99. 3111 B-99. 3120 B-99.	
11. Conductivity		D1125-95 (Reapproved 1999) A.	2510 B	2510 B-97.	
12. Cyanide	Manual Distillation followed by Spectrophotometric, Amenable. Spectro-photometric Manual. Spectro-photometric Semi-automated. Selective Electrode UV, Distillation, Spectrophotometric. Micro Distillation, Flow Injection. Spectrophotometric. Ligand Exchange and Amperometry <sup>21</sup> .	D2036-98 A D2036-98 B D2036-98 A	4500-CN C 4500-CN G 4500-CN E	4500-CN C. 4500-CN G 4500-CN E	4500-CN G-99. 4500-CN E-99.
			4500-CN F	4500-CN F	I-3300-85 <sup>5</sup>
					Kelada-01 <sup>17</sup>
					QuikChem 10-204-00-1-X <sup>18</sup> OIA-1677, DW <sup>20</sup>



Contaminant	Methodology <sup>13</sup>	EPA	ASTM <sup>3</sup>	SM <sup>4</sup> (18th, 19th ed.)	SM <sup>4</sup> (20th ed.)	SM Online <sup>22</sup>	Other
13. Fluoride	Ion Chromatography	300.0 <sup>6</sup> , 300.1 <sup>19</sup>	D4327-97, 03	4110 B	4110 B	4110 B-00.	
	Manual Distill.; Color. SPADNS.			4500-F- B, D.	4500-F- B, D.	4500-F- B, D-97.	
	Manual Electrode		D1179-93, 99 B	4500-F- C	4500-F- C	4500-F- C-97.	
14. Lead	Automated Electrode			4500-F- E	4500-F- E	4500-F- E-97.	380-75WE <sup>11</sup> 129-71W <sup>11</sup>
	Automated Alizarin						D6508, Rev. 2 <sup>23</sup>
	Capillary Ion Electro-phoresis. Atomic Absorption; Fur-nace. ICP-Mass spectrometry Atomic Absorption; Plat-form. Differential Pulse Anodic Stripping Voltametry.	200.8 <sup>2</sup> 200.9 <sup>2</sup>	D3559-96, 03 D	3113 B			3113 B-99.
15. Magnesium	Atomic Absorption	200.7 <sup>2</sup>		3111 B 3120 B		3111 B-99. 3120 B-99.	Method 1001 <sup>16</sup>
	ICP		D511-93, 03 B	3500-Mg E	3500-Mg B	3500-Mg B-97.	
	Complexation Titrimetric Methods.						
16. Mercury	Ion Chromatography	245.1 <sup>2</sup>	D6919-03.	3112 B		3112 B-99.	
	Manual, Cold Vapor	245.2 <sup>1</sup>	D3223-97, 02				
	Automated, Cold Vapor ICP-Mass Spectrometry Inductively Coupled Plasma.	200.8 <sup>2</sup> 200.7 <sup>2</sup>		3120 B	3120 B	3120 B-99.	
17. Nickel	ICP-Mass Spectrometry Atomic Absorption; Plat-form. Atomic Absorption; Di-rect. Atomic Absorption; Fur-nace.	200.8 <sup>2</sup> 200.9 <sup>2</sup>		3111 B		3111 B-99.	
	Ion Chromatography	300.0 <sup>6</sup> , 300.1 <sup>19</sup>	D4327-97, 03	4110 B	4110 B	4110 B-00	B-1011 <sup>8</sup>
	Automated Cadmium Reduction. Ion Selective Electrode	353.2 <sup>6</sup>	D3867-90 A	4500-NO <sub>3</sub> <sup>-</sup> F 4500-NO <sub>3</sub> <sup>-</sup> D.	4500-NO <sub>3</sub> <sup>-</sup> F 4500-NO <sub>3</sub> <sup>-</sup> D.	4500-NO <sub>3</sub> <sup>-</sup> F-00 4500-NO <sub>3</sub> <sup>-</sup> D-00.	601 <sup>7</sup>



Contaminant	Methodology <sup>13</sup>	EPA	ASTM <sup>3</sup>	SM <sup>4</sup> (18th, 19th ed.)	SM <sup>4</sup> (20th ed.)	SM Online <sup>22</sup>	Other
24. Sodium	Heteropoly blue	.....	.....	4500-Si E	4500-SiO <sub>2</sub> D	4500-SiO <sub>2</sub> D-97	
	Automated for Molybdate-reactive Silica. Inductively Coupled Plasma. Inductively Coupled Plasma.	200.7 <sup>2</sup>	.....	4500-Si F	4500-SiO <sub>2</sub> E	4500-SiO <sub>2</sub> E-97	
25. Temperature	Atomic Absorption; Direct Aspiration.	200.7 <sup>2</sup>	.....	3120 B	3120 B	3120 B-99.	
	Ion Chromatography	.....	.....	3111 B	.....	3111 B-99.	
26. Thallium	Thermometric	.....	D6919-03.	2550	2550	2550-00.	
	ICP-Mass Spectrometry	200.8 <sup>2</sup>	.....	.....	.....	.....	
	Atomic Absorption; Plating form.	200.9 <sup>2</sup>	.....	.....	.....	.....	

The procedures shall be done in accordance with the documents listed below. The incorporation by reference of the following documents listed in footnotes 1-11, 16-20, and 22-23 was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies of the documents may be obtained from the sources listed below. 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, EPA West, 1301 Constitution Avenue, NW, Room 3334, Washington, DC 20460 (Telephone: 202-566-2426); or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: [http://www.archives.gov/federal/register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal/register/code_of_federal_regulations/ibr_locations.html).

<sup>1</sup>Methods for Chemical Analysis of Water and Wastes, EPA/600/4-79/020, March 1983. Available at NTIS, PB84-128677.

<sup>2</sup>Methods for the Determination of Metals in Environmental Samples—Supplement 1, EPA/600/R-94/111, May 1994. Available at NTIS, PB95-125472.

<sup>3</sup>Annual Book of ASTM Standards, ASTM International, 100 Barr Harbor Drive, West Conshohocken, PA 19428. <http://www.astm.org>; Annual Book of ASTM Standards 1994, Vols. 11.01 and 11.02; Annual Book of ASTM Standards 1996, Vols. 11.01 and 11.02; Annual Book of ASTM Standards 1998, Vols. 11.01 and 11.02; Annual Book of ASTM Standards 2003, Vols. 11.01 and 11.02.

<sup>4</sup>Standard Methods for the Examination of Water and Wastewater, American Public Health Association, 800 I Street NW, Washington, DC 20001-3710; Standard Methods for the Examination of Water and Wastewater, 18th edition (1992); Standard Methods for the Examination of Water and Wastewater, 19th edition (1995); Standard Methods for the Examination of Water and Wastewater, 20th edition (1998). The following methods from this edition cannot be used: 3111 B, 3111 D, 3113 B, and 3114 B.

<sup>5</sup>U.S. Geological Survey, Federal Center, Box 25286, Denver, CO 80225-0425; Methods for Analysis by the U.S. Geological Survey, National Water Quality Laboratory—Determination of Inorganic and Organic Constituents in Water and Fluvial Sediment, Open File Report 93-125, 1993; Techniques of Water Resources Investigation of the U.S. Geological Survey, Book 5, Chapter A-1, 3rd edition, 1989.

<sup>6</sup>Methods for the Determination of Inorganic Substances in Environmental Samples, EPA/600/R-93/100, August 1993. Available as Technical Report PB94-120821 at National Technical Information Service (NTIS), 5301 Shawnee Road, Alexandria, VA 22312. <http://www.ntis.gov>.

<sup>7</sup>The procedure shall be done in accordance with the 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.

<sup>8</sup>Method B-1011, "Waters Test Method for Determination of Nitrite/Nitrate in Water Using Single Column Ion Chromatography," August, 1987. Copies may be obtained from Waters Corporation, Technical Services Division, 34 Maple Street, Milford, MA 01757. Telephone: 508/482-2963, Fax: 508/482-4056.

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

<sup>10</sup>Method 100.2, "Determination of Asbestos Structure Over 10-um In Length in Drinking Water," EPA/600/R-94/134, June 1994. Available at NTIS, PB94-201902.

<sup>11</sup>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.

<sup>12</sup>Unfiltered, no digestion or hydrolysis.

<sup>13</sup>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, sample preconcentration using pneumatic nebulization may be required to achieve lower detection limits. Preconcentration may also be required for direct analysis of 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.

<sup>14</sup>If ultrasonic nebulization is used in the determination of arsenic by Method 200.8, the arsenic must be in the pentavalent state to provide uniform signal response. For direct analysis of arsenic with Method 200.8 using ultrasonic nebulization, samples and standards must contain 1 mg/L of sodium hypochlorite.

<sup>15</sup>[Reserved]

- <sup>16</sup> The description for Method Number 1001 for lead is available from Palintest, LTD, 21 Kenton Lands Road, P.O. Box 18395, Erlanger, KY 41018. Or from the Hach Company, P.O. Box 389, Loveland, CO 80539.
- <sup>17</sup> The description for the Kelada-01 Method, "Kelada Automated Test Methods for Total Cyanide, Acid Dissociable Cyanide, And Thiocyanate," Revision 1.2, August 2001, EPA # 821-B-01-009 for cyanide is available from the National Technical Information Service (NTIS), PB 2001-108275, 5285 Port Royal Road, Springfield, VA 22161. The toll free telephone number is 800-553-6847. **Note:** A 450-W UV lamp may be used in this method instead of the 550-W lamp specified if it provides performance within the quality control (QC) acceptance criteria of the method in a given instrument. Similarly, modified flow cell configurations and flow conditions may be used in the method, provided that the QC acceptance criteria are met.
- <sup>18</sup> The description for the QuikChem Method 10-204-000-1-X, "Digestion and distillation of total cyanide in drinking and wastewaters using MICRO DIST and determination of cyanide by flow injection analysis," Revision 2.1, November 30, 2000, for cyanide is available from Lachat Instruments, 6645 W. Mill Rd., Milwaukee, WI 53218. Telephone: 414-358-4200.
- <sup>19</sup> "Methods for the Determination of Organic and Inorganic Compounds in Drinking Water," Vol. 1, EPA 815-R-00-014, August 2000. Available as Technical Report PB2000-106981 at National Technical Information Service (NTIS), 5301 Shawnee Road, Alexandria, VA 22312. <http://www.ntis.gov>.
- <sup>20</sup> Method OIA-1677, DW "Available Cyanide by Flow Injection, Ligand Exchange, and Amperometry," January 2004. EPA-821-R-04-001, Available from ALPKEM, A Division of OI Analytical, P.O. Box 9010, College Station, TX 77842-9010.
- <sup>21</sup> Sulfide levels below those detected using lead acetate paper may produce positive method interferences. Test samples using a more sensitive sulfide method to determine if a sulfide interference is present, and treat samples accordingly.
- <sup>22</sup> Standard Methods Online, American Public Health Association, 800 I Street NW., Washington, DC 20001, 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.

§ 141.23

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(2) Sample collection for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, nitrate, nitrite, selenium, and thallium under this section shall be conducted using the sample preservation, container, and maximum holding time procedures specified in the table below:

Contaminant	Preservative <sup>1</sup>	Con-tainer <sup>2</sup>	Time <sup>3</sup>
Antimony	HNO <sup>3</sup>	P or G	6 months
Arsenic	Conc HNO <sub>3</sub> to pH <2.	P or G	6 months
Asbestos	4 °C	P or G	48 hours <sup>4</sup>
Barium	HNO <sup>3</sup>	P or G	6 months
Beryllium	HNO <sup>3</sup>	P or G	6 months
Cadmium	HNO <sup>3</sup>	P or G	6 months
Chromium	HNO <sup>3</sup>	P or G	6 months
Cyanide	4 °C, NaOH	P or G	14 days
Fluoride	None	P or G	1 month
Mercury	HNO <sup>3</sup>	P or G	28 days
Nickel	HNO <sup>3</sup>	P or G	6 months
Nitrate	4 °C	P or G	48 hours <sup>5</sup>
Nitrate-Nitrite <sup>6</sup>	H <sup>2</sup> SO <sup>4</sup>	P or G	28 days
Nitrite	4 °C	P or G	48 hours
Selenium	HNO <sup>3</sup>	P or G	6 months
Thallium	HNO <sup>3</sup>	P or G	6 months

<sup>1</sup> 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 or a dilute (50% by volume) solution of the applicable 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.

<sup>2</sup> P = plastic, hard or soft; G = glass, hard or soft.  
<sup>3</sup> 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 method.

<sup>4</sup> 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.

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

<sup>6</sup> Nitrate-Nitrite refers to a measurement of total nitrate.

(3) Analysis under this section shall only be conducted by laboratories that have been certified by EPA or the State. Laboratories may conduct sample analysis under provisional certification until January 1, 1996. To receive certification to conduct analyses for antimony, arsenic, asbestos, barium, beryllium, cadmium, chromium, cyanide, fluoride, mercury, nickel, nitrate, nitrite and selenium and thallium, the laboratory must:

(i) Analyze Performance Evaluation (PE) samples provided by EPA, the State or by a third party (with the approval of the State or EPA) at least once a year.

(ii) For each contaminant that has been included in the PE sample and for each method for which the laboratory desires certification achieve quantitative results on the analyses that are within the following acceptance limits:

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

(1) Analyses for the purpose of determining compliance with §141.11 shall be conducted using the requirements specified in paragraphs (1) through (q) of this section.

(1) Analyses for all community water systems utilizing surface water sources shall be completed by June 24, 1978. These analyses shall be repeated at yearly intervals.

(2) Analyses for all community water systems utilizing only ground water sources shall be completed by June 24, 1979. These analyses shall be repeated at three-year intervals.

(3) For non-community water systems, whether supplied by surface or ground sources, analyses for nitrate shall be completed by December 24, 1980. These analyses shall be repeated at intervals determined by the State.

(4) The State has the authority to determine compliance or initiate enforcement action based upon analytical results and other information compiled by their sanctioned representatives and agencies.

(m) If the result of an analysis made under paragraph (1) of this section indicates that the level of any contaminant listed in §141.11 exceeds the maximum contaminant level, the supplier of the water shall report to the State within 7 days and initiate three additional analyses at the same sampling point within one month.

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(n) When the average of four analyses made pursuant to paragraph (m) of this section, rounded to the same number of significant figures as the maximum contaminant level for the substance in question, exceeds the maximum contaminant level, the supplier of water shall notify the State pursuant to §141.31 and give notice to the public pursuant to subpart Q. Monitoring after public notification shall be at a frequency designated by the State and shall continue until the maximum contaminant level has not been exceeded in two successive samples or until a monitoring schedule as a condition to a variance, exemption or enforcement action shall become effective.

(o) The provisions of paragraphs (m) and (n) of this section notwithstanding, compliance with the maximum contaminant level for nitrate shall be determined on the basis of the mean of two analyses. When a level exceeding the maximum contaminant level for nitrate is found, a second analysis shall be initiated within 24 hours, and if the mean of the two analyses exceeds the maximum contaminant level, the supplier of water shall report his findings to the State pursuant to §141.31 and shall notify the public pursuant to subpart Q.

(p) For the initial analyses required by paragraph (1) (1), (2) or (3) of this section, data for surface waters acquired within one year prior to the effective date and data for ground waters acquired within 3 years prior to the effective date of this part may be substituted at the discretion of the State.

(q) [Reserved]

[56 FR 3579, Jan. 30, 1991]

EDITORIAL NOTE: For FEDERAL REGISTER citations affecting §141.23, see the List of CFR Sections Affected, which appears in the Finding Aids section of the printed volume and at [www.govinfo.gov](http://www.govinfo.gov).

### § 141.24 Organic chemicals, sampling and analytical requirements.

(a)-(d) [Reserved]

(e) Analyses for the contaminants in this section shall be conducted using the methods listed in the following table, or the alternative methods listed in appendix A to subpart C of this part, or their equivalent as determined by EPA.

(1) The following documents are incorporated by reference. This incorporation by reference was approved by the Director of the Federal Register in accordance with 5 U.S.C. 552(a) and 1 CFR part 51. Copies may be inspected at EPA's Drinking Water Docket, 1301 Constitution Avenue, NW., EPA West, Room 3334, Washington, DC 20460 (Telephone: 202-566-2426); or at the National Archives and Records Administration (NARA). For information on the availability of this material at NARA, call 202-741-6030, or go to: [http://www.archives.gov/federal\\_register/code\\_of\\_federal\\_regulations/ibr\\_locations.html](http://www.archives.gov/federal_register/code_of_federal_regulations/ibr_locations.html). Method 508A and 515.1 are in *Methods for the Determination of Organic Compounds in Drinking Water*, EPA/600/4-88-039, December 1988, Revised, July 1991. Methods 547, 550 and 550.1 are in *Methods for the Determination of Organic Compounds in Drinking Water—Supplement I*, EPA/600-4-90-020, July 1990. Methods 548.1, 549.1, 552.1 and 555 are in *Methods for the Determination of Organic Compounds in Drinking Water—Supplement II*, EPA/600/R-92-129, August 1992. Methods 502.2, 504.1, 505, 506, 507, 508, 508.1, 515.2, 524.2 525.2, 531.1, 551.1 and 552.2 are in *Methods for the Determination of Organic Compounds in Drinking Water—Supplement III*, EPA/600/R-95-131, August 1995. 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, PB95-261616 and PB95-104774, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, Virginia 22161. The toll free number is: 800-553-6847. Method 6651 shall be followed in accordance with *Standard Methods for the Examination of Water and Wastewater*, 18th edition (1992), 19th edition (1995), or 20th edition (1998), American Public Health Association (APHA); any of these three editions may be used. Method 6610 shall be followed in accordance with *Standard Methods for the Examination of Water and Wastewater*, (18th Edition Supplement) (1994), or with the 19th edition (1995) or 20th edition (1998) of *Standard Methods for the Examination of Water and Wastewater*;