U.S. GEOLOGICAL SURVEY APPROVED INORGANIC AND ORGANIC METHODS FOR THE ANALYSIS OF WATER AND FLUVIAL SEDIMENT, 1954–94

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U.S. Geological Survey Approved Inorganic and Organic Methods for the Analysis of Water and Fluvial Sediment, 1954–94

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Abstract

All inorganic and organic methods for analyzing samples of water and fluvial sediment, which have been approved for use by the U.S. Geological Survey from 1954 to the present (1994), are listed. Descriptive method names include references to published reports for easy retrieval of methodology. The year each method was approved is listed as well as the year the method was discontinued. Inorganic and organic methods are listed separately by sample type (dissolved, whole water, bottom material, suspended sediment, or fish tissue) and by mode of analysis (manual or automated, or both).

INTRODUCTION

Approved methods in use at the U.S. Geological Survey National Water Quality Laboratory (NWQL) are listed in this report, which provides the reader with a review of historical data. It includes those methods in use from 1954 to the present (1994).

During this period, the first publication containing approved analytical methods for the analysis of water samples was prepared by Rainwater and Thatcher (1960). This publication has been revised several times since 1960 in a series entitled, "Techniques of Water-Resources Investigations of the U.S. Geological Survey" (TWRI), and in a new series of Open-File Reports started in 1992 entitled, "Methods of Analysis by the U.S. Geological Survey National Water Quality Laboratory." Citations in tables 1 and 2 are from the most recent publication. For example, chloride, using the Mohr method, appears in Rainwater and Thatcher (1960); it also appears in Fishman and Friedman (1989). The latter reference is cited in tables 1 and 2.

The four-digit numbering system used in tables 1 and 2 was started in the late 1960's. This numbering system was an attempt to simplify the identification of each method and to update them as new or revised methods were introduced. The first digit of the identifying number indicates the type of determination (or procedure) for which the method is suitable, according to the following:

0----Sample preparation

1----Manual method for dissolved constituents

2----Automated method for dissolved constituents

3----Manual method for analyzing water-suspended sediment mixtures

4----Automated method for analyzing water-suspended sediment mixtures

5----Manual method for analyzing samples of bottom material

6----Automated method for analyzing samples of bottom material

7----Method for suspended constituents

9----Method for fish tissue

The last three digits are unique to each method. The list of methods in numerical order in table 2 is based on the last three digits.

Because of the variety of organic compounds, there is no organized numbering system. The methods included in Wershaw and others (1987) were numbered sequentially starting with 100 (last three digits) using the table of contents. As new methods are approved, numbers are assigned sequentially.

Laboratory codes and schedule numbers can be found in the present and past NWQL Services Catalogs and can be cross-referenced by the reader with the information provided in this Open-File Report.

In addition, the years of start-up and discontinued use of a method are listed in both tables. These dates are approximate and may vary by 1 or 2 years for many of the older methods. However, all new methodology published in the Open-File Report series gives both the month and year of start-up.

Methods are listed in alphabetical order in table 1 and in numerical order in table 2. In both tables, the

inorganic methods are listed first and then followed by the organic methods. The data base for both tables was created using Ingres software, which makes it easy to manipulate the information to serve the needs of most users. For example, discontinued methods could be deleted in favor of listing only those methods in use in 1994. The information also could be sorted by analytical technique. To meet these needs, the data base can be shared electronically by contacting the chief of the Laboratory Operations Program at NWQL.

APPROVED INORGANIC AND ORGANIC METHODS FOR THE ANALYSIS OF WATER AND FLUVIAL SEDIMENT, 1954–94

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order

[LIS, low ionic strength; dna, date not available; dc, direct current; seg., segmented; EPA, U.S. Environmental Protection Agency; ICP, inductively coupled plasma; dig.-dist., digestion-distillation; lab, laboratory; meq/L, milliequivalents per liter; deg., degree; JTU, Jackson turbidity unit; NTU, nephelometric turbidity unit; uv, ultraviolet; nu, never used]

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)										
Acidity, electrometric titration (Fishman and Friedman, 1989)	1960		1020							
Acidity, electrometric titration, LIS (Fishman, 1993)	1987		2022							
Alkalinity, electrometric titration (Fishman and Friedman, 1989)	1954	1972	1030							
Alkalinity, electrometric titration (Fishman and Friedman, 1989)	1972			2030						
Alkalinity, electrometric titration, field (as CO_3) (no reference)	1977	dna	1032							
Alkalinity, electrometric titration, field (as HCO_3) (no reference)	1977	dna	1031							
Alkalinity, electrometric titration, field (as OH) (no reference)	1977	dna	1033							
Alkalinity, electrometric titration, LIS (as $CaCO_3$) (Fishman, 1993)	1986			2034						
Aluminum, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1986	1052		3052					
Aluminum, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1975	1984	1051		3051		5051			
Aluminum, atomic emission spectrometry, dc plasma (Fishman, 1993)	1984		1054		3054					
Aluminum, atomic emission spectrometry, dc plasma (Fishman, 1993)	1986						5054			
Aluminum, colorimetry, ferron orthophenanthroline (Skougstad and others, 1979)	1954	1975	1050							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Aluminum, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1053							
Anions, ion-exchange chromatography (Cl, F, SO_4) (Fishman, 1993)	1985	--[3]		2057						
Anions, ion-exchange chromatography, LIS (Br, Cl, F, NO_3-N, PO_4-P, SO_4) (Fishman and Friedman, 1989)	1981			2058						
Antimony, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1976	1979	1055		3055		5055			
Antimony, atomic absorption spectrometry, hydride (Brown and McLain, 1994)	1979			2055		4055				
Arsenic, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1973	1979	1062		3062		5062			
Arsenic, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1979			2062		4062		6062		
Arsenic, colorimetry, silver diethyldithio-carbamate (Fishman and Friedman, 1989)	1954	1976	1060							
Arsenic, colorimetry, silver diethyldithio-carbamate (Fishman and Friedman, 1989)	1972	1976			3060		5060			
Barium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1084							
Barium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3084		5084			
Barium, gravimetry (Skougstad and others, 1979)	1954	dna	1080							
Barium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1085							
Beryllium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1095							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Beryllium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3095		5095			
Beryllium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1096							
Bismuth, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1100							
Boron, atomic emission spectrometry, dc plasma (Fishman, 1993)	1984		1114		3114		5114			
Boron, colorimetry, azomethine H, seg. flow (Fishman and Friedman, 1989)	1978	1979		2115						
Boron, colorimetry, carminic acid (Skougstad and others, 1979)	1954	1977	1111							
Boron, colorimetry, carminic acid (Skougstad and others, 1979)	1972	1977			3111		5111			
Boron, colorimetry, curcumin (Fishman and Friedman, 1989)	dna		1112		3112					
Boron, colorimetry, dianthrimide (Fishman and Friedman, 1989)	1954	1984	1110							
Boron, colorimetry, dianthrimide (Fishman and Friedman, 1989)	1972	1984			3110		5110			
Boron, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1113							
Bromide, colorimetry, catalytic oxidation (Skougstad and others, 1979)	1963	1984	1127							
Bromide, colorimetry, fluorescein, seg. flow (Fishman and Friedman, 1989)	1984			2129						
Bromide, ion-exchange chromatography-electrochemical (Fishman and Friedman, 1989)	1982	1986		2128						

Table 1. *Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued*

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
							Inorganic methods (I)--Continued			
Bromide, titrimetry, hypochlorite oxidation (Fishman and Friedman, 1989)	1954	1985	1125							
Cadmium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1136							
Cadmium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3136					
Cadmium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1135							
Cadmium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3135		5135			
Cadmium, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1137							
Cadmium, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2138		4138				
Calcium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1152							
Calcium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3152		5152			
Calcium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3153					
Calcium, titrimetry complexometric (Brown and others, 1970)	1954	1970	1150							
Carbon dioxide, calculation (Fishman and Friedman, 1989)	1954	dna	1160							
Carbon, inorganic, Van Slyke (no reference)	dna						5157			

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Chloride, colorimetry, ferric thiocyanate (Fishman and Friedman, 1989)	1960	1970	1187							
Chloride, colorimetry, ferric thiocyanate, discrete (Fishman and Friedman, 1989)	1981	1988		2188						
Chloride, colorimetry, ferric thiocyanate, seg. flow (Fishman and Friedman, 1989)	1967	--[4]		2187						
Chloride, potentiometry (Fishman and Feist, 1970)	1970	1971		2186						
Chloride, titrimetry, mercurimetric (Fishman and Friedman, 1989)	1960	1970	1184							
Chloride, titrimetry, Mohr (Fishman and Friedman, 1989)	1954	1970	1183							
Chlorine, residual orthotolidine-arsenite (Brown and others, 1970)	dna		1200							
Chlorine, residual, amperometry (no reference)	dna		1202							
Chlorine, residual, idometry (no reference)	dna		1201							
Chromium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1987	1238							
Chromium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1987			3238					
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970	1987	1236							
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972	1987			3236					
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972						5236			

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Chromium, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1235							
Chromium, atomic absorption spectrophotometry, graphite furnace (McLain, 1993)	1993		1233		3233					
Chromium, atomic emission spectrometry, dc plasma (Fishman, 1993)	1987	1994	1229		3229					
Chromium, colorimetry, permanganate-azide (Skougstad and others, 1979)	1954	1979	1237							
Chromium, hexavalent, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969		1232							
Chromium, hexavalent, colorimetry, diphenylcarbazide (Fishman and Friedman, 1989)	1954	1980	1230							
Chromium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1234							
Cobalt, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1968	1989	1240							
Cobalt, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3240					
Cobalt, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970		1239							
Cobalt, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3239		5239			
Cobalt, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1241							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Cobalt, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2243		4243				
Cobalt, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1242							
Color, electrometry, visual comparison (Fishman and Friedman, 1989)	1954		1250							
Copper, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1271							
Copper, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3271					
Copper, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1270							
Copper, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3270		5270			
Copper, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1272							
Copper, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2274		4274				
Copper, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1273							
Cyanide, colorimetry, barbituric acid, seg. flow (Fishman and Friedman, 1989)	1976			2302		4302				
Cyanide, colorimetry, barbituric acid, seg. flow (Fishman and Friedman, 1989)	1983							6302		
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1970	1976	1300							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1972	1976			3300					
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1972	1983					5300			
Density, gravimetry (Fishman and Friedman, 1989)	1956		1312							
Fluoride, colorimetry, SPADNS (no reference)	dna	dna	1326		3326					
Fluoride, colorimetry, zirconium-eriochrome (Fishman and Friedman, 1989)	1960	1975	1325							
Fluoride, colorimetry, zirconium-eriochrome (Fishman and Friedman, 1989)	1972	1975			3325					
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1968	1975	1327							
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1975	1984	--[5]	2327						
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1975	1984				4327				
Gallium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1330							
Germanium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1335							
Hardness, calculation (Fishman and Friedman, 1989)	1956	1981	1340							
Hardness, calculation, noncarbonate (Fishman and Friedman, 1989)	1956	1981	1344							
Hardness, titrimetry, complexometric (Fishman and Friedman, 1989)	1956	1970	1338							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Iodide, colorimetry, ceric-arsenious oxidation (Fishman and Friedman, 1989)	1965	1985	1371							
Iodide, colorimetry, ceric-arsenious oxidation (Fishman and Friedman, 1989)	1984			2371						
Iodide, titrimetry, bromine oxidation (Fishman and Friedman, 1989)	1956	1985	1370							
Iron, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1967		1381							
Iron, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3381		5381			
Iron, colorimetry, bipyridine (Skougstad and others, 1979)	1956	1978	1379							
Iron, colorimetry, bipyridine (Skougstad and others, 1979)	1971	1981		2379						
Iron, colorimetry, bipyridine (Skougstad and others, 1979)	1972	1981				4379		6379		
Iron, ferrous, colorimetry, bipyridine (Skougstad and others, 1979)	1956	1978	1388							
Iron, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1382							
Lead, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)[6]	1968	1989	1400							
Lead, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3400					
Lead, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970		1399							
Lead, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3399		5399			

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Lead, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1401							
Lead, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2403		4403				
Lead, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1402							
Lithium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1425							
Lithium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3425		5425			
Magnesium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1447							
Magnesium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3447		5447			
Magnesium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3448					
Magnesium, indirect, titrimetry, complexometric (Brown and others, 1970)	1956	1970	1445							
Manganese, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1967	1972	1456							
Manganese, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1454							
Manganese, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3454		5454			
Manganese, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1455							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Manganese, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1457							
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1970	1977	1462							
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1975			2462						
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1972				3462		5462			
Mercury, total, atomic absorption spectrophotometry, flameless (Fishman, 1993)	1985							6463		
Metals, As, Sb, Se, total-in-sediment, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1985						5475			
Metals, atomic absorption spectrometry (Skougstad and others, 1979)[7]	1970	1989		2470		4470				
Metals, atomic emission spectrometry, ICP (Fishman, 1993)[8]	1979		1472							
Metals, atomic emission spectrometry, ICP, semiquantitative (never published)[9]	1979	1981	1471							
Metals, ICP-mass spectrometry (Faires, 1993)[10]	1992			2477						
Metals, extraction procedure, acid digestion (Fishman and Friedman, 1989)[11]	1972				3485		5485			
Metals, major and minor, total-in-sediment, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)[12]	1984						5474			
Metals, major, total-in-sediment, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)[13]	1984						5473			

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Molybdenum, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1974		1490		3490		5490			
Molybdenum, colorimetry, dithiol (Brown and others, 1970)	1965	1974	1489							
Molybdenum, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1491							
Nickel, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1968	1989	1500							
Nickel, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3500					
Nickel, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1966		1499							
Nickel, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3499		5499			
Nickel, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1501							
Nickel, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2503		4503				
Nickel, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1502							
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, discrete (Fishman and Friedman, 1989)	1984	1986		2558		4558				
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1978	1991		2552		4552				

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
								Inorganic methods (I)--Continued		
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1978	1985						6552		
Nitrogen, ammonia plus organic, colorimetry, dig.-dist.-indophenol, seg. flow (Skougstad and others, 1979)	1973	1978		2551		4551		6551		
Nitrogen, ammonia plus organic, colorimetry, dig.-dist.-nesslerization (Fishman and Friedman, 1989)	1956	1975	1550							
Nitrogen, ammonia plus organic, colorimetry, microblock digestor-salicylate hypochlorite (to be published)	1991			2515		4515				
Nitrogen, ammonia plus organic, titrimetry, dig.-dist. (Fishman, 1993)[14]	1956						5553			
Nitrogen, ammonia, calculation (no reference)	dna		1519		3519					
Nitrogen, ammonia, colorimetry, distillation-nesslerization (Fishman and Friedman, 1989)	1956	1976	1520							
Nitrogen, ammonia, colorimetry, distillation-nesslerization (Fishman and Friedman, 1989)	1972	1976			3520					
Nitrogen, ammonia, colorimetry, indophenol, seg. flow (Fishman and Friedman, 1989)	1973	1983		2523		4523		6523		
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, discrete (Fishman and Friedman, 1989)	1984	1986		2521		4521				
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow (Fishman, 1993)[15]	1984			2522				6522		
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1984	1993				4522				
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow, LIS (Fishman, 1993)	1986			2525						

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Nitrogen, ammonia, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	dna	dna	1524		3524					
Nitrogen, nitrate, calculation (no reference)	1970		1531							
Nitrogen, nitrate, calculation (no reference)	1972				3531		5531			
Nitrogen, nitrate, colorimetry, brucine (Skougstad and others, 1979)	1969	1976	1530							
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow (Fishman, 1993)[15]	1973			2545				6545		
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow (Fishman and Friedman, 1989)	1973	1993				4545				
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow, LIS (Fishman, 1993)[16]	1986			2546						
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow, LIS (no reference)	1989	1993				4546				
Nitrogen, nitrite plus nitrate, colorimetry, hydrazine reduction-diazotization, discrete (Fishman and Friedman, 1989)	1982	1986		2543		4543				
Nitrogen, nitrite plus nitrate, colorimetry, hydrazine reduction-diazotization, seg. flow (never published)	1970	1975		2544						
Nitrogen, nitrite, colorimetry, diazotization (Fishman and Friedman, 1989)	1956	1976	1540							
Nitrogen, nitrite, colorimetry, diazotization, discrete (Fishman and Friedman, 1989)	1982	1986		2539		4539				

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Nitrogen, nitrite, colorimetry, diazotization, seg. flow (Fishman, 1993)[15]	1973			2540						
Nitrogen, nitrite, colorimetry, diazotization, seg. flow (Fishman and Friedman, 1989)	1973	1993				4540				
Nitrogen, nitrite, colorimetry, diazotization, seg. flow, LIS (Fishman, 1993)	1986			2542						
Nitrogen, nitrite, colorimetry, diazotization, seg. flow, LIS (no reference)	1989	1993				4542				
Nitrogen, organic, calculation from indophenol, organic N+NH_3-N method (no reference)	1973	1978		2547		4547		6547		
Nitrogen, organic, calculation from nesslerization, organic N+NH_3-N method (no reference)	1956	1975	1549							
Nitrogen, organic, calculation from salicylate, organic N+NH_3-N method (no reference)	1978			2548		4548		6548		
Nitrogen, pyrochemiluminescence, total, dissolved (Fishman, 1993)	1989			2511						
Nitrogen, titrimetry, dig.-dist. (Fishman and Friedman, 1989)	1978	1988					5554			
Nitrogen, total as NO_3, calculated (no reference)	1970				3557					
Nitrogen, total, calculated (no reference)	1977	dna	1556		3556		5556			
Oxygen demand, biological (BOD), 20-day (no reference)	dna		1579							
Oxygen demand, biological (BOD), probe, 5-day (Skougstad and others, 1979)	dna		1578							
Oxygen demand, biological (BOD), Winkler, 5-day (no reference)	dna		1577							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Oxygen demand, chemical (COD), colorimetry, dichromate oxidation (Fishman and Friedman, 1989)	1978				3561					
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation (Fishman and Friedman, 1989)	1965	1979			3560					
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation (Fishman and Friedman, 1989)	1965						5560			
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation (Fishman and Friedman, 1989)	1965	1979			3562					
Oxygen, dissolved, polarography, probe (Skougstad and others, 1979)	dna		1576							
Oxygen, dissolved, titrimetry, Alsterberg (azide) (Skougstad and others, 1979)	dna		1575							
Percent moisture, total-in-bottom material, gravimetry, 0590 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
pH, electrometry, glass-electrode, lab (Fishman and Friedman, 1989)	1956		1586							
pH, electrometry, glass-electrode, lab (Fishman and Friedman, 1989)	1978			2587						
pH, electrometry, glass-electrode, LIS (Fishman, 1993)	1987			2588						
Phosphorus, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1956	1974	1600							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Phosphorus, colorimetry, phosphomolybdate, block digestor, seg. flow (Patton and Truitt, 1992)	1991			2610		4610				
Phosphorus, colorimetry, phosphomolybdate, discrete (Fishman and Friedman, 1989)	1985	1986		2599		4599				
Phosphorus, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973	1991		2600		4600				
Phosphorus, colorimetry, phosphomolybdate, seg. flow (Fishman, 1993)[15]	1973							6600		
Phosphorus, colorimetry, phosphomolybdate, seg. flow, LIS (Fishman, 1993)	1990			2607		4607				
Phosphorus, organic, calculation (no reference)	1965	1976	1603							
Phosphorus, organic, calculation (no reference)	1973	dna		2603		4603				
Phosphorus, ortho P as phosphate, calculation (no reference)	1965	1976	1604							
Phosphorus, ortho P as phosphate, calculation (no reference)	1973	dna		2604		4604				
Phosphorus, ortho P plus hydrolyzable, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1965	1976	1602							
Phosphorus, ortho P plus hydrolyzable, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973			2602		4602				
Phosphorus, ortho P, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1956	1976	1601							
Phosphorus, ortho P, colorimetry, phosphomolybdate, discrete (Fishman and Friedman, 1989)	1985	1986		2598		4598				
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow (Fishman, 1993)[15]	1973			2601						

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
							Inorganic methods (I)--Continued			
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973	1993				4601				
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow, LIS (Fishman, 1993)	1986	dna		2606						
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow, LIS (no reference)	1989	1993				4606				
Phosphorus, total P as phosphate, calculation (no reference)	1965	dna					5605			
Potassium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1630							
Potassium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3630		5630			
Potassium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3631					
Potassium, atomic absorption spectrometry, direct, flow injection (no reference)	1982	1986		2632		4632		6632		
Sample preparation, bottom material, 0520 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Selenium, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1973	1980	1667		3667		5667			
Selenium, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1980			2667		4667		6667		
Selenium, colorimetry, diaminobenzidine (Brown and others, 1970)	1960	1976	1665							
Selenium, colorimetry, diaminobenzidine (no reference)	1972	1976			3665		5665			

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Silica, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970	1976	1702							
Silica, colorimetry, molybdate blue (Fishman and Friedman, 1989)	1954	1976	1700							
Silica, colorimetry, molybdate blue, seq. flow (Fishman and Friedman, 1989)	1976			2700						
Silver, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1720							
Silver, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3720					
Silver, atomic absorption spectrometry, direct (no reference)	1970	1976			3723					
Silver, atomic absorption spectrometry, graphite furnace (no reference)	1978	dna	1721							
Silver, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2724		4724				
Silver, atomic absorption spectrophotometry, graphite furnace, LIS (Damrau, 1993)	1991			2725						
Silver, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1722							
Sodium absorption ratio, calculation (Fishman and Friedman, 1989)	1954		1738							
Sodium plus potassium, meq/L (no reference)	dna		1739							
Sodium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1735							
Sodium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3735			5735		

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Sodium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3736					
Sodium, percent (Fishman and Friedman, 1989)	1954		1740							
Solids, gravimetry, residue on evaporation at 105 deg. (Fishman and Friedman, 1989)	1975		1749							
Solids, gravimetry, residue on evaporation at 105 deg. (Fishman and Friedman, 1989)	1975				3750					
Solids, gravimetry, residue on evaporation at 180 deg. (Fishman and Friedman, 1989)	1954		1750							
Solids, nonvolatile-on-ignition, calculation (Fishman and Friedman, 1989)	1975	dna	1752		3752					
Solids, nonvolatile-on-ignition, suspended, calculation (Fishman and Friedman, 1989)	1975	dna			3766					
Solids, residue at 105 deg., suspended, gravimetry (Fishman and Friedman, 1989)	1954				3765					
Solids, sum of constituents, calculation (Fishman and Friedman, 1989)	1954		1751							
Solids, volatile-on-ignition, gravimetry (Fishman and Friedman, 1989)	1975		1753		3753		5753			
Solids, volatile-on-ignition, suspended, gravimetry (Fishman and Friedman, 1989)	1975				3767					
Specific conductance, electrometry, Wheatstone bridge (Fishman and Friedman, 1989)	1954		1780							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Specific conductance, electrometry, Wheatstone bridge (Fishman and Friedman, 1989)	1978			2781						
Strontium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1800							
Strontium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3800		5800			
Strontium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1801							
Subsampling, bottom material, coring, 0810 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Subsampling, bottom material, splitting, 0811 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Sulfate, colorimetry, complexometric, methylthymol blue, seg. flow (Fishman and Friedman, 1989)	1976	1983		2822						
Sulfate, titrimetry, thorin (Fishman and Friedman, 1989)	1954	1976	1820							
Sulfate, turbidimetry, barium sulfate, discrete (Fishman and Friedman, 1989)	1983	1990		2823						
Sulfide, titrimetry, iodometric (Fishman and Friedman, 1989)	1954				3840					
Thallium, atomic absorption spectrometry, graphite furnace (Fishman and Friedman, 1989)	1981		1866							
Tin, atomic absorption spectrometry, direct (Skougstad and others, 1979)	1975	1980	1850		3850					
Tin, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	dna	dna		2851		4851		6851		

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Titanium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1856							
Turbidity, nephelometry, JTU (Brown and others, 1970)	1954	1977			3861					
Turbidity, nephelometry, NTU (Fishman and Friedman, 1989)	1977				3860					
Vanadium, colorimetry, catalytic oxidation (Fishman and Friedman, 1989)	1965	1975	1880							
Vanadium, colorimetry, catalytic oxidation (Fishman, 1993)	1975			2880						
Zinc, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1900							
Zinc, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3900		5900			
Zinc, atomic absorption spectrometry, graphite furnace (Fishman and Friedman, 1989)	1984		1901							
Zirconium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1911							
Organic methods (O)[17]										
Acid extractable compounds, total recoverable, gas chromatography/mass spectrometry (Wershaw and others, 1987)	1982	1986			3117					
Base/neutral and acid extractable compounds, gas chromatography/mass spectrometry (Fishman, 1993)	1986				3116					
Base/neutral extractable compounds, total recoverable, gas chromatography/mass spectrometry (Wershaw and others, 1987)	1982	1986			3118					

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Manual
Organic methods (O)[17]--Continued										
Carbamate pesticides, total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1984	1987			3107					
Carbamates, high-performance liquid chromatography (Werner and Johnson, 1994)	1987				3123					
Carbon, inorganic plus organic, total-in-bottom material, dry weight, induction furnace (Wershaw and others, 1987)	1970						5101			
Carbon, inorganic, total-in-bottom material, modified Van Slyke (Wershaw and others, 1987)	1970						5102			
Carbon, organic, dissolved, fractionation (Wershaw and others, 1987)	1983	1986	1103							
Carbon, organic, dissolved, uv-promoted persulfate oxidation and infrared spectrometry (Brenton and Arnett, 1993)	1986		1122							
Carbon, organic, dissolved, wet oxidation (Wershaw and others, 1987)	1970		1100							
Carbon, organic, suspended, wet oxidation (Wershaw and others, 1987)	1970								7100	
Carbon, organic, total, wet oxidation (Wershaw and others, 1987)	1970				3100					
Chlorophenoxy acids, dissolved, gas chromatography (Wershaw and others, 1987)	1967		1105							
Chlorophenoxy acids, recoverable from bottom material, gas chromatography (Wershaw and others, 1987)	1970						5105			
Chlorophenoxy acids, recoverable from suspended sediment, gas chromatography (Wershaw and others, 1987)	1970								7105	

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Organic methods (O)[17]--Continued				
Chlorophenoxy acids, total recoverable, gas chromatography (Wershaw and others, 1987)	1967				3105					
1,2-dibromoethane and 1,2-dibromo-3-chloropropane, gas chromatography/ microextraction (Fishman, 1993)	1990				3120					
Ethylene and propane, total recoverable, gas chromatography, purge and trap (Wershaw and others, 1987)	1983				3114					
Fuel oils, light, total recoverable, gas chromatography (Wershaw and others, 1987)	nu				3109					
Methylene blue active substances, total recoverable, colorimetry (Wershaw and others, 1987)	1970				3111					
Nitroaromatic compounds, dissolved, high-performance liquid chromatography (Lindley and others, 1994)	1994		1124							
Oil and grease, extractable from bottom material, extraction-gravimetry (Wershaw and others, 1987)	1976						5108			
Oil and grease, extractable, extraction-gravimetry (Wershaw and others, 1987)	1976				3108					
Organic compounds, recoverable from bottom material, gas chromatography/ mass spectrometry (Wershaw and others, 1983)	1983	dna					5116			
Organochlorine and organophosphorous compounds, dissolved, gas chromatography (Wershaw and others, 1987)	1978		1104							

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Organic methods (O)[17]--Continued										
Organochlorine and organophosphorous compounds, recoverable from bottom material, gas chromatography (Wershaw and others, 1987)	1978						5104			
Organochlorine and organophosphorous compounds, recoverable from suspended sediment, gas chromatography (Wershaw and others, 1987)	1978								7104	
Organochlorine and organophosphorous compounds, total recoverable, gas chromatography (Wershaw and others, 1987)	1978				3104					
Organochlorine compounds, recoverable from fish tissue, gas chromatography (Wershaw and others, 1987)	dna	dna								9104
Organonitrogen herbicides, solid-phase extraction and capillary-column gas chromatography/mass spectrometry, selective ion (Sandstrom and others, 1992)	1990		1121							
Phenols, total recoverable, colorimetry, 4-aminoantipyrine (Wershaw and others, 1987)	1970				3110					
Polynuclear aromatic hydrocarbons (PNA), total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1982	1986			3113					
Purgeable organic compounds, total recoverable, gas chromatography/mass spectrometry, purge and trap (Wershaw and others, 1987)	1980				3115					
Tannin and lignin, total recoverable, colorimetry, tungstophosphoric and molybdophosphoric acids (no reference)	1970				3119					

Table 1. Approved inorganic and organic methodology, 1954–94, in alphabetical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Organic methods (O)[17]--Continued										
TNT, RDX, and picric acid, total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1976				3112					
Triazines, total recoverable, gas chromatography (Markovchick and others, 1994)	1980				3106					

[1]The method is still in use if there is a blank in the end-date column.

[2]Each method is identified by a four-digit number. The first digit of the identifying number indicates sample type and mode of analysis (manual or automated).

[3]Between 1985 and 1990, the method was used to determine Br, Cl, F, NO_3, NO_2, PO_4, and SO_4. The method was modified in March 1990 and included only the three constituents. Chloride was deleted from method from December 1992 to January 1994. Chloride was resumed in the method in January 1994. Fluoride was deleted from method in January 1994. (See following footnotes 4 and 5.)

[4]Method was used until March 1990. It was used again from December 1992 to January 1994. Options remain open for future use.

[5]Method was used until March 1990. Use of method resumed in January 1994.

[6]The reporting limit for dissolved and whole-water samples was changed in 1986 from 1 to 5 micrograms per liter.

[7]Constituents determined include Ca, Cu, Fe, K, Li, Mg, Mn, Na, Sr, and Zn.

[8]Constituents determined include Ba, Be, Ca, Cd, Co, Cu, Fe, Li, Mg, Mn, Mo, Na, Pb, SiO_2, Sr, V, and Zn. Added in August 1987 were Ag, Cr, and Ni.

[9]Constituents determined include Ag, Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Ge, K, Li, Mg, Mn, Mo, Na, Ni, Pb, SiO_2, Sb, Sn, Sr, Ti, V, Zn, and Zr.

[10]Constituents determined include Ag, Al, Ba, Be, Co, Cd, Cr, Cu, Mn, Mo, Ni, Pb, Sb, U, and Zn.

[11]Constituents extracted include Ag, Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sn, Sr, and Zn.

[12]Constituents determined include Al, Ca, Fe, K, Mg, Mn, Na, and Si.

[13]Constituents determined include Al, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Ni, Pb, Sr, Ti, and Zn.

[14]This method was modified in 1990. See Fishman (1993) for details.

[15]This method was modified in 1988. See Fishman (1993) for details.

[16]This method was modified in 1989. See Fishman (1993) for details.

[17]Numerous compounds are determined in many of the organic methods listed. The reader is referred to the various publications cited for a complete list of compounds.

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order

[LIS, low ionic strength; dna, date not available; dc, direct current; seg., segmented; EPA, U.S. Environmental Protection Agency; ICP, inductively coupled plasma; dig.-dist., digestion-distillation; lab, laboratory; meq/L, milliequivalents per liter; deg., degree; NTU, nephelometric turbidity unit; JTU, Jackson turbidity unit; nu, never used; uv, ultraviolet]

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)					
Acidity, electrometric titration (Fishman and Friedman, 1989)	1960		1020							
Acidity, electrometric titration, LIS (Fishman, 1993)	1987			2022						
Alkalinity, electrometric titration (Fishman and Friedman, 1989)	1954	1972	1030							
Alkalinity, electrometric titration (Fishman and Friedman, 1989)	1972			2030						
Alkalinity, electrometric titration, field (as HCO_3) (no reference)	1977	dna	1031							
Alkalinity, electrometric titration, field (as CO_3) (no reference)	1977	dna	1032							
Alkalinity, electrometric titration, field (as OH) (no reference)	1977	dna	1033							
Alkalinity, electrometric titration, LIS (as $CaCO_3$) (Fishman, 1993)	1986			2034						
Aluminum, colorimetry, ferron orthophenanthroline (Skougstad and others, 1979)	1954	1975	1050							
Aluminum, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1975	1984	1051		3051		5051			
Aluminum, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1986	1052		3052					
Aluminum, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1053							
Aluminum, atomic emission spectrometry, dc plasma (Fishman, 1993)	1984		1054		3054					
Aluminum, atomic emission spectrometry, dc plasma (Fishman, 1993)	1986						5054			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)–Continued					
Antimony, atomic absorption spectrometry, hydride (Brown and McLain, 1994)	1979			2055		4055				
Antimony, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1976	1979	1055		3055		5055			
Anions, ion-exchange chromatography (Cl, F, SO_4) (Fishman, 1993)	1990	--[3]		2057						
Anions, ion-exchange chromatography, LIS (Br, Cl, F, NO_3-N, PO_4-P, SO_4) (Fishman and Friedman, 1989)	1981			2058						
Arsenic, colorimetry, silver diethyldithio-carbamate (Fishman and Friedman, 1989)	1954	1976	1060							
Arsenic, colorimetry, silver diethyldithio-carbamate (Fishman and Friedman, 1989)	1972	1976			3060		5060			
Arsenic, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1973	1979	1062		3062		5062			
Arsenic, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1979			2062		4062		6062		
Barium, gravimetry (Skougstad and others, 1979)	1954	dna	1080							
Barium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1084							
Barium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3084		5084			
Barium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1085							
Beryllium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1095							
Beryllium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3095		5095			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Beryllium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1096							
Bismuth, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1100							
Boron, colorimetry, dianthrimide (Fishman and Friedman, 1989)	1954	1984	1110							
Boron, colorimetry, dianthrimide (Fishman and Friedman, 1989)	1972	1984			3110		5110			
Boron, colorimetry, carminic acid (Skougstad and others, 1979)	1954	1977	1111							
Boron, colorimetry, carminic acid (Skougstad and others, 1979)	1972	1977			3111		5111			
Boron, colorimetry, curcumin (Fishman and Friedman, 1989)	dna		1112		3112					
Boron, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1113							
Boron, atomic emission spectrometry, dc plasma (Fishman, 1993)	1984		1114		3114		5114			
Boron, colorimetry, azomethine H, seg. flow (Fishman and Friedman, 1989)	1978	1979		2115						
Bromide, titrimetry, hypochlorite oxidation (Fishman and Friedman, 1989)	1954	1985	1125							
Bromide, colorimetry, catalytic oxidation (Skougstad and others, 1979)	1963	1984	1127							
Bromide, ion-exchange chromatography-electrochemical (Fishman and Friedman, 1989)	1982	1986		2128						
Bromide, colorimetry, fluorescein, seg. flow (Fishman and Friedman, 1989)	1984			2129						
Cadmium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1968		1135							

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)–Continued					
Cadmium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3135		5135			
Cadmium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1136							
Cadmium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3136					
Cadmium, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1137							
Cadmium, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2138		4138				
Calcium, titrimetry complexometric (Brown and others, 1970)	1954	1970	1150							
Calcium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1152							
Calcium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3152		5152			
Calcium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3153					
Carbon, inorganic, Van Slyke (no reference)	dna						5157			
Carbon dioxide, calculation (Fishman and Friedman, 1989)	1954	dna	1160							
Chloride, titrimetry, Mohr (Fishman and Friedman, 1989)	1954	1970	1183							
Chloride, titrimetry, mercurimetric (Fishman and Friedman, 1989)	1960	1970	1184							
Chloride, potentiometry (Fishman and Feist, 1970)	1970	1971		2186						

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)–Continued										
Chloride, colorimetry, ferric thiocyanate (Fishman and Friedman, 1989)	1960	1970	1187							
Chloride, colorimetry, ferric thiocyanate, seg. flow (Fishman and Friedman, 1989)	1967	--[4]		2187						
Chloride, colorimetry, ferric thiocyanate, discrete (Fishman and Friedman, 1989)	1981	1988		2188						
Chlorine, residual orthotolidine-arsenite (Brown and others, 1970)	dna		1200							
Chlorine, residual, idometry (no reference)	dna		1201							
Chlorine, residual, amperometry (no reference)	dna		1202							
Chromium, atomic emission spectrometry, dc plasma (Fishman, 1993)	1987	1994	1229		3229					
Chromium, hexavalent, colorimetry, diphenylcarbazide (Fishman and Friedman, 1989)	1954	1980	1230							
Chromium, hexavalent, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969		1232							
Chromium, atomic absorption spectrophotometry, graphite furnace (McLain, 1993)	1993		1233		3233					
Chromium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1234							
Chromium, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1235							
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970	1987	1236							
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972	1987			3236					
Chromium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972						5236			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Automated	Manual	Automated	Manual	Automated	Manual	Manual
Inorganic methods (I)–Continued										
Chromium, colorimetry, permanganate-azide (Skougstad and others, 1979)	1954	1979	1237							
Chromium, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1987	1238		3238					
Cobalt, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970		1239							
Cobalt, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3239		5239			
Cobalt, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1968	1989	1240							
Cobalt, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3240					
Cobalt, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1241							
Cobalt, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1242							
Cobalt, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2243		4243				
Color, electrometry, visual comparison (Fishman and Friedman, 1989)	1954		1250							
Copper, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1270							
Copper, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3270		5270			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)—Continued										
Copper, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1271							
Copper, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3271					
Copper, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1272							
Copper, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1273							
Copper, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2274		4274				
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1970	1976	1300							
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1972	1976			3300					
Cyanide, colorimetry, pyridine-pyrazolone (Fishman and Friedman, 1989)	1972	1983					5300			
Cyanide, colorimetry, barbituric acid, seg. flow (Fishman and Friedman, 1989)	1976			2302		4302				
Cyanide, colorimetry, barbituric acid, seg. flow (Fishman and Friedman, 1989)	1983							6302		
Density, gravimetry (Fishman and Friedman, 1989)	1956		1312							
Fluoride, colorimetry, zirconium-eriochrome (Fishman and Friedman, 1989)	1960	1975	1325							
Fluoride, colorimetry, zirconium-eriochrome (Fishman and Friedman, 1989)	1972	1975			3325					
Fluoride, colorimetry, SPADNS (no reference)	dna	dna	1326		3326					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1968	1975	1327							
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1975	1990	--[5]	2327						
Fluoride, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	1975	1984				4327				
Gallium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1330							
Germanium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1335							
Hardness, titrimetry, complexometric (Fishman and Friedman, 1989)	1956	1970	1338							
Hardness, calculation (Fishman and Friedman, 1989)	1956	1981	1340							
Hardness, calculation, noncarbonate (Fishman and Friedman, 1989)	1956	1981	1344							
Iodide, titrimetry, bromine oxidation (Fishman and Friedman, 1989)	1956	1985	1370							
Iodide, colorimetry, ceric-arsenious oxidation (Fishman and Friedman, 1989)	1965	1985	1371							
Iodide, colorimetry, ceric-arsenious oxidation (Fishman and Friedman, 1989)	1984			2371						
Iron, colorimetry, bipyridine (Skougstad and others, 1979)	1956	1978	1379							
Iron, colorimetry, bipyridine (Skougstad and others, 1979)	1971	1981		2379		4379		6379		
Iron, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1967		1381							
Iron, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3381		5381			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Iron, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1382							
Iron, ferrous, colorimetry, bipyridine (Skougstad and others, 1979)	1956	1978	1388							
Lead, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970		1399							
Lead, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3399		5399			
Lead, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)[6]	1968	1989	1400							
Lead, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3400					
Lead, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1401							
Lead, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1402							
Lead, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2403		4403				
Lithium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1425							
Lithium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3425		5425			
Magnesium, indirect, titrimetry, complexometric (Brown and others, 1970)	1956	1970	1445							
Magnesium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1447							
Magnesium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3447		5447			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)–Continued										
Magnesium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3448					
Manganese, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1454							
Manganese, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3454		5454			
Manganese, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1455							
Manganese, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1967	1972	1456							
Manganese, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1457							
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1970	1977	1462							
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1972				3462		5462			
Mercury, atomic absorption spectrometry, flameless (Fishman and Friedman, 1989)	1975			2462						
Mercury, total, atomic absorption spectrophotometry, flameless (Fishman, 1993)	1985							6463		
Metals, atomic absorption spectrometry (Skougstad and others, 1979)[7]	1970	1989		2470		4470				
Metals, atomic emission spectrometry, ICP, semiquantitative (never published)[8]	1979	1981	1471							
Metals, atomic emission spectrometry, ICP (Fishman, 1993)[9]	1979		1472							

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Metals, major, total-in-sediment, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)[10]	1984						5473			
Metals, major and minor, total-in-sediment, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)[11]	1984						5474			
Metals, As, Sb, Se, total-in-sediment, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1985						5475			
Metals, ICP-mass spectrometry (Faires, 1993)[12]	1992			2477						
Metals, extraction procedure, acid digestion (Fishman and Friedman, 1989)[13]	1972				3485		5485			
Molybdenum, colorimetry, dithiol (Brown and others, 1970)	1965	1974	1489							
Molybdenum, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1974		1490		3490		5490			
Molybdenum, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1491							
Nickel, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1966		1499							
Nickel, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3499		5499			
Nickel, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1968	1989	1500							
Nickel, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3500					
Nickel, atomic absorption spectrometry, graphite furnace, LIS (Fishman and Friedman, 1989)	1984		1501							

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)--Continued				
Nickel, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1502							
Nickel, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2503		4503				
Nitrogen, pyrochemiluminescence, total, dissolved (Fishman, 1993)	1989			2511						
Nitrogen, ammonia plus organic, colorimetry, microblock digestor-salicylate hypochlorite (to be published)	1991			2515		4515				
Nitrogen, ammonia, calculation (no reference)	dna		1519		3519					
Sample preparation, bottom material, 0520 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Nitrogen, ammonia, colorimetry, distillation-nesslerization (Fishman and Friedman, 1989)	1956	1976	1520							
Nitrogen, ammonia, colorimetry, distillation-nesslerization (Fishman and Friedman, 1989)	1972	1976			3520					
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, discrete (Fishman and Friedman, 1989)	1984	1986		2521		4521				
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1984	1993				4522				
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow (Fishman, 1993)[14]	1984			2522				6522		
Nitrogen, ammonia, colorimetry, indophenol, seg. flow (Fishman and Friedman, 1989)	1973	1983		2523		4523		6523		

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)--Continued					
Nitrogen, ammonia, electrometry, ion-selective electrode (Fishman and Friedman, 1989)	dna	dna	1524		3524					
Nitrogen, ammonia, colorimetry, salicylate-hypochlorite, seg. flow, LIS (Fishman, 1993)	1986			2525						
Nitrogen, nitrate, colorimetry, brucine (Skougstad and others, 1979)	1969	1976	1530							
Nitrogen, nitrate, calculation (no reference)	1970		1531							
Nitrogen, nitrate, calculation (no reference)	1972				3531		5531			
Nitrogen, nitrite, colorimetry, diazotization, discrete (Fishman and Friedman, 1989)	1982	1986		2539		4539				
Nitrogen, nitrite, colorimetry, diazotization (Fishman and Friedman, 1989)	1956	1976	1540							
Nitrogen, nitrite, colorimetry, diazotization, seg. flow (Fishman and Friedman, 1989)	1973	1993				4540				
Nitrogen, nitrite, colorimetry, diazotization, seg. flow (Fishman, 1993)[14]	1973			2540						
Nitrogen, nitrite, colorimetry, diazotization, seg. flow, LIS (Fishman, 1993)	1986			2542						
Nitrogen, nitrite, colorimetry, diazotization, seg. flow, LIS (no reference)	1989	1993				4542				
Nitrogen, nitrite plus nitrate, colorimetry, hydrazine reduction-diazotization, discrete (Fishman and Friedman, 1989)	1982	1986		2543		4543				
Nitrogen, nitrite plus nitrate, colorimetry, hydrazine reduction-diazotization, seg. flow (never published)	1970	1975	2544							
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow (Fishman and Friedman, 1989)	1973	1993				4545				

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)–Continued										
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow (Fishman, 1993)[14]	1973		2545					6545		
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow, LIS (Fishman, 1993)[15]	1986		2546							
Nitrogen, nitrite plus nitrate, colorimetry, cadmium reduction-diazotization, seg. flow, LIS (no reference)	1989	1993			4546					
Nitrogen, organic, calculation from indophenol, organic N+NH_3-N method (no reference)	1973	1978		2547		4547		6547		
Nitrogen, organic, calculation from salicylate, organic N+NH_3-N method (no reference)	1978			2548		4548		6548		
Nitrogen, organic, calculation from nesslerization, organic N+NH_3-N method (no reference)	1956	1975	1549							
Nitrogen, ammonia plus organic, colorimetry, dig.-dist.-nesslerization (Fishman and Friedman, 1989)	1956	1975	1550							
Nitrogen, ammonia plus organic, colorimetry, dig.-dist.-indophenol, seg. flow (Skougstad and others, 1979)	1973	1978	2551			4551		6551		
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1978	1985						6552		
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, seg. flow (Fishman and Friedman, 1989)	1978	1991		2552		4552				

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
							Inorganic methods (I)--Continued			
Nitrogen, ammonia plus organic, titrimetry, dig.-dist. (Fishman, 1993)[16]	1956						5553			
Nitrogen, titrimetry, dig.-dist. (Fishman and Friedman, 1989)	1978	1988					5554			
Nitrogen, total, calculated (no reference)	1977	dna	1556		3556		5556			
Nitrogen, total as NO_3, calculated (no reference)	1970				3557					
Nitrogen, ammonia plus organic, colorimetry, block digestor, salicylate-hypochlorite, discrete (Fishman and Friedman, 1989)	1984	1986		2558		4558				
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation (Fishman and Friedman, 1989)	1965	1979			3560					
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation (Fishman and Friedman, 1989)	1965						5560			
Oxygen demand, chemical (COD), colorimetry, dichromate oxidation (Fishman and Friedman, 1989)	1978				3561					
Oxygen demand, chemical (COD), titrimetry, dichromate oxidation, low-level (Fishman and Friedman, 1989)	1965	1979			3562					
Oxygen, dissolved, titrimetry, Alsterberg (azide) (Skougstad and others, 1979)	dna		1575							
Oxygen, dissolved, polarography, probe (Skougstad and others, 1979)	dna		1576							
Oxygen demand, biological (BOD), Winkler, 5-day (no reference)	dna		1577							
Oxygen demand, biological (BOD), probe, 5-day (Skougstad and others, 1979)	dna		1578							
Oxygen demand, biological (BOD), 20-day (no reference)	dna		1579							

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)–Continued				
pH, electrometry, glass-electrode, field (Fishman and Friedman, 1989)	1956		1586							
pH, electrometry, glass-electrode, lab (Fishman and Friedman, 1989)	1978			2587						
pH, electrometry, glass-electrode, LIS (Fishman, 1993)	1987			2588						
Percent moisture, total-in-bottom material, gravimetry, 0590 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Phosphorus, ortho P, colorimetry, phosphomolybdate, discrete (Fishman and Friedman, 1989)	1985	1986		2598		4598				
Phosphorus, colorimetry, phosphomolybdate, discrete (Fishman and Friedman, 1989)	1985	1986		2599		4599				
Phosphorus, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1956	1974	1600							
Phosphorus, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973	1991		2600		4600				
Phosphorus, colorimetry, phosphomolybdate, seg. flow (Fishman, 1993)[14]	1973							6600		
Phosphorus, ortho P, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1956	1976	1601							
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973	1993				4601				
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow (Fishman, 1993)[14]	1973			2601						

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)–Continued										
Phosphorus, ortho P plus hydrolyzable, colorimetry, phosphomolybdate (Fishman and Friedman, 1989)	1965	1976	1602							
Phosphorus, ortho P plus hydrolyzable, colorimetry, phosphomolybdate, seg. flow (Fishman and Friedman, 1989)	1973			2602		4602				
Phosphorus, organic, calculation (no reference)	1965	1976	1603							
Phosphorus, organic, calculation (no reference)	1973	dna		2603		4603				
Phosphorus, ortho P as phosphate, calculation (no reference)	1965	1976	1604							
Phosphorus, ortho P as phosphate, calculation (no reference)	1973	dna		2604		4604				
Phosphorus, total P as phosphate, calculation (no reference)	1965	dna					5605			
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow, LIS (no reference)	1989	1993				4606				
Phosphorus, ortho P, colorimetry, phosphomolybdate, seg. flow, LIS (Fishman, 1993)	1986	dna		2606						
Phosphorus, colorimetry, phosphomolybdate, seg. flow, LIS (Fishman, 1993)	1990			2607		4607				
Phosphorus, colorimetry, phosphomolybdate, block digestor, seg. flow (Patton and Truitt, 1992)	1991			2610		4610				
Potassium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1630							
Potassium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3630		5630			
Potassium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3631					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
						Inorganic methods (I)–Continued				
Potassium, atomic absorption spectrometry, direct, flow injection (no reference)	1982	1985		2632		4632		6632		
Selenium, colorimetry, diaminobenzidine (Brown and others, 1970)	1960	1976	1665							
Selenium, colorimetry, diaminobenzidine (no reference)	1972	1976			3665		5665			
Selenium, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1973	1980	1667		3667		5667			
Selenium, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	1980			2667		4667		6667		
Silica, colorimetry, molybdate blue (Fishman and Friedman, 1989)	1954	1976	1700							
Silica, colorimetry, molybdate blue (Fishman and Friedman, 1989)	1976			2700						
Silica, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1970	1976	1702							
Silver, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1969	1989	1720							
Silver, atomic absorption spectrometry, chelation-extraction (Fishman and Friedman, 1989)	1972	1989			3720					
Silver, atomic absorption spectrometry, graphite furnace (no reference)	1978	dna	1721							
Silver, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1722							
Silver, atomic absorption spectrometry, direct (no reference)	1970	1976			3723					
Silver, atomic absorption spectrophotometry, graphite furnace (Fishman, 1993)	1989			2724		4724				

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)--Continued										
Silver, atomic absorption spectrophotometry, graphite furnace, LIS (Damrau, 1993)	1991			2725						
Sodium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1735							
Sodium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3735		5735			
Sodium, atomic absorption spectrometry, direct, EPA (Fishman and Friedman, 1989)	1977				3736					
Sodium absorption ratio, calculation (Fishman and Friedman, 1989)	1954		1738							
Sodium plus potassium, meq/L (no reference)	dna		1739							
Sodium, percent (Fishman and Friedman, 1989)	1954		1740							
Solids, gravimetry, residue on evaporation at 105 deg. (Fishman and Friedman, 1989)	1975		1749							
Solids, gravimetry, residue on evaporation at 105 deg. (Fishman and Friedman, 1989)	1975				3750					
Solids, gravimetry, residue on evaporation at 180 deg. (Fishman and Friedman, 1989)	1954		1750							
Solids, sum of constituents, calculation (Fishman and Friedman, 1989)	1954		1751							
Solids, nonvolatile-on-ignition, calculation (Fishman and Friedman, 1989)	1975	dna	1752		3752					
Solids, volatile-on-ignition, gravimetry (Fishman and Friedman, 1989)	1975		1753		3753		5753			
Solids, residue at 105 deg., suspended, gravimetry (Fishman and Friedman, 1989)	1954				3765					
Solids, nonvolatile-on-ignition, suspended, calculation (Fishman and Friedman, 1989)	1975	dna			3766					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
					Inorganic methods (I)—Continued					
Solids, volatile-on-ignition, suspended, gravimetry (Fishman and Friedman, 1989)	1975				3767					
Specific conductance, electrometry, Wheatstone bridge (Fishman and Friedman, 1989)	1954		1780							
Specific conductance, electrometry, Wheatstone bridge (Fishman and Friedman, 1989)	1978			2781						
Strontium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1800							
Strontium, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3800		5800			
Strontium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1801							
Subsampling, bottom material, coring, 0810 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Subsampling, bottom material, splitting, 0811 (sample preparation procedure) (Fishman and Friedman, 1989)	1972									
Sulfate, titrimetry, thorin (Fishman and Friedman, 1989)	1954	1976	1820							
Sulfate, colorimetry, complexometric, methylthymol blue, seg. flow (Fishman and Friedman, 1989)	1976	1983		2822						
Sulfate, turbidimetry, barium sulfate, discrete (Fishman and Friedman, 1989)	1983	1990		2823						
Sulfide, titrimetry, iodometric (Fishman and Friedman, 1989)	1954				3840					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Inorganic methods (I)–Continued										
Tin, atomic absorption spectrometry, direct (Skougstad and others, 1979)	1975	1980	1850		3850					
Tin, atomic absorption spectrometry, hydride (Fishman and Friedman, 1989)	dna	dna		2851		4851		6851		
Titanium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1856							
Turbidity, nephelometry, NTU (Fishman and Friedman, 1989)	1977				3860					
Turbidity, nephelometry, JTU (Brown and others, 1970)	1954	1977			3861					
Thallium, atomic absorption spectrometry, graphite furnace (Fishman and Friedman, 1989)	1981		1866							
Vanadium, colorimetry, catalytic oxidation (Fishman and Friedman, 1989)	1965	1975	1880							
Vanadium, colorimetry, catalytic oxidation (Fishman, 1993)	1975			2880						
Zinc, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1965		1900							
Zinc, atomic absorption spectrometry, direct (Fishman and Friedman, 1989)	1972				3900		5900			
Zinc, atomic absorption spectrometry, graphite furnace (Fishman and Friedman, 1989)	1984		1901							
Zirconium, spectroscopy, dc arc (Barnett and Mallory, 1971)	1956	1976	1911							
Organic methods (O)[17]										
Carbon, organic, dissolved, wet oxidation (Wershaw and others, 1987)	1970		1100							
Carbon, organic, suspended, wet oxidation (Wershaw and others, 1987)	1970								7100	
Carbon, organic, total, wet oxidation (Wershaw and others, 1987)	1970				3100					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
							Organic methods (O)[17]--Continued			
Carbon, inorganic plus organic, total-in-bottom material, dry weight, induction furnace (Wershaw and others, 1987)	1970						5101			
Carbon, inorganic, total-in-bottom material, modified Van Slyke (Wershaw and others, 1987)	1970						5102			
Carbon, organic, dissolved, fractionation (Wershaw and others, 1987)	1983	1986	1103							
Organochlorine and organophosphorous compounds, dissolved, gas chromatography (Wershaw and others, 1987)	1978		1104							
Organochlorine and organophosphorous compounds, recoverable from bottom material, gas chromatography (Wershaw and others, 1987)	1978						5104			
Organochlorine and organophosphorous compounds, recoverable from suspended sediment, gas chromatography (Wershaw and others, 1987)	1978								7104	
Organochlorine and organophosphorous compounds, total recoverable, gas chromatography (Wershaw and others, 1987)	1978				3104					
Organochlorine compounds, recoverable from fish tissue, gas chromatography (Wershaw and others, 1987)	dna	dna								9104
Chlorophenoxy acids, dissolved, gas chromatography (Wershaw and others, 1987)	1967		1105							
Chlorophenoxy acids, recoverable from bottom material, gas chromatography (Wershaw and others, 1987)	1970						5105			

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Organic methods (O)[17]--Continued										
Chlorophenoxy acids, recoverable from suspended sediment, gas chromatography (Wershaw and others, 1987)	1970								7105	
Chlorophenoxy acids, total recoverable, gas chromatography (Wershaw and others, 1987)	1967				3105					
Triazines, total recoverable, gas chromatography (Markovchick and others, 1994)	1980				3106					
Carbamate pesticides, total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1984				3107					
Oil and grease, extractable from bottom material, extraction-gravimetry (Wershaw and others, 1987)	1976						5108			
Oil and grease, extractable, extraction-gravimetry (Wershaw and others, 1987)	1976				3108					
Fuel oils, light, total recoverable, gas chromatography (Wershaw and others, 1987)	nu				3109					
Phenols, total recoverable, colorimetry, 4-aminoantipyrine (Wershaw and others, 1987)	1970				3110					
Methylene blue active substances, total recoverable, colorimetry (Wershaw and others, 1987)	1970				3111					
TNT, RDX, and picric acid, total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1976				3112					
Polynuclear aromatic hydrocarbons (PNA), total recoverable, high-performance liquid chromatography (Wershaw and others, 1987)	1982	1986			3113					
Ethylene and propane, total recoverable, gas chromatography, purge and trap (Wershaw and others, 1987)	1983				3114					

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
Organic methods (O)[17]–Continued										
Purgeable organic compounds, total recoverable, gas chromatography/mass spectrometry, purge and trap (Wershaw and others, 1987)	1980				3115					
Base/neutral and acid extractable compounds, gas chromatography/mass spectrometry (Fishman, 1993)	1986				3116					
Organic compounds, recoverable from bottom material, gas chromatography/mass spectrometry (Wershaw and others, 1983)	1983	dna					5116			
Acid extractable compounds, total recoverable, gas chromatography/mass spectrometry (Wershaw and others, 1987)	1982	1986			3117					
Base/neutral extractable compounds, total recoverable, gas chromatography/mass spectrometry (Wershaw and others, 1987)	1982	1986			3118					
Tannin and lignin, total recoverable, colorimetry, tungstophosphoric and molybdophosphoric acids (no reference)	1970				3119					
1,2-dibromoethane and 1,2-dibromo-3-chloropropane, gas chromatography/microextraction (Fishman, 1993)	1990				3120					
Organonitrogen herbicides, solid-phase extraction and capillary-column gas chromatography/mass spectrometry, selective ion (Sandstrom and others, 1992)	1990		1121							
Carbon, organic, dissolved, uv-promoted persulfate oxidation and infrared spectrometry (Brenton and Arnett, 1993)	1986		1122							

Table 2. Approved inorganic and organic methodology, 1954–94, in numerical order --Continued

Description and reference	Year[1]		Sample[2]							
			Dissolved		Whole water		Bottom material		Suspended sediment	Fish tissue
	Start	End	Manual	Auto-mated	Manual	Auto-mated	Manual	Auto-mated	Manual	Manual
							Organic methods (O)[17]--Continued			
Carbamates, high-performance liquid chromatography (Werner and Johnson, 1994)	1987				3123					
Nitroaromatic compounds, dissolved, high-performance liquid chromatography (Lindley and others, 1994)	1994		1124							

[1]The method is still in use if there is a blank in the end-date column.

[2]Each method is identified by a four-digit number. The first digit of the identifying number indicates sample type and mode of analysis (manual or automated).

[3]Between 1985 and 1990, the method was used to determine Br, Cl, F, NO_3, NO_2, PO_4, and SO_4. The method was modified in March 1990 and included only the three constituents. Chloride was deleted from method from December 1992 to January 1994. Use of the method resumed in January 1994. Fluoride was deleted from method in January 1994. (See following footnotes 4 and 5.)

[4]Method was used until March 1990. It was used again from December 1992 to January 1994. Options remain open for future use.

[5]Method was used until March 1990. Use of method resumed in January 1994.

[6]The reporting limit for dissolved and whole-water samples was changed in 1986 from 1 to 5 micrograms per liter.

[7]Constituents determined include Ca, Cu, Fe, K, Li, Mg, Mn, Na, Sr, and Zn.

[8]Constituents determined include Ag, Al, B, Ba, Be, Bi, Ca, Cd, Co, Cr, Cu, Fe, Ga, Ge, K, Li, Mg, Mn, Mo, Na, Ni, Pb, SiO_2, Sb, Sn, Sr, Ti, V, Zn, and Zr.

[9]Constituents determined include Ba, Be, Ca, Cd, Co, Cu, Fe, Li, Mg, Mn, Mo, Na, Pb, SiO_2, Sr, V, and Zn. Added in August 1987 were Ag, Cr, and Ni.

[10]Constituents determined include Al, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Na, Ni, Pb, Sr, Ti, and Zn.

[11]Constituents determined include Al, Ca, Fe, K, Mg, Mn, Na, and Si.

[12]Constituents determined include Ag, Al, Ba, Be, Co, Cd, Cr, Cu, Mn, Mo, Ni, Pb, Sb, U, and Zn.

[13]Constituents extracted include Ag, Al, Ba, Be, Ca, Cd, Co, Cr, Cu, Fe, K, Li, Mg, Mn, Mo, Na, Ni, Pb, Sn, Sr, and Zn.

[14]This method was modified in 1988. See Fishman (1993) for details.

[15]This method was modified in 1989. See Fishman (1993) for details.

[16]This method was modified in 1990. See Fishman (1993) for details.

[17]Numerous compounds are determined in many of the organic methods listed. The reader is referred to the various publications cited for a complete list of compounds.

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