Analytical Methods Approved for Compliance Monitoring under the Long Term 2 Enhanced Surface Water Treatment Rule

Analysis for the following contaminants shall be conducted in accordance with the methods in the following table or their equivalent as determined by EPA. The methods for *Cryptosporidium* are listed at 40 CFR 141.704, methods for enumeration of *E. coli* in source water are listed in Table 1H at 40 CFR 136.3(a) and the methods for turbidity are listed at 40 CFR 141.74. Additional methods are listed in Appendix A to Subpart C of Part 141. The monitoring requirements for these contaminants are specified in 40 CFR 141.701-703.

"The CFR is the legal reference for approved methods and takes precedent over this table. The table should accurately reflect the analytical methods information published in 40 CFR 136 and 141. If you find discrepancies, please notify The Safe Drinking Water Hotline (800-426-4791) so that EPA can correct the table."

Contaminant Method	Organization	ReferenceTitle	Date	EPA Publication Number	Publication Order Number	Source of Method
Cryptosporidium	Systems must analyze at least a 10 L sample or a packed pellet volume of at least 2 mL. Systems unable to process a 10 L sample must analyze as much sample volume as can be filtered by two filters approved by EPA for the methods listed, up to a packed pellet volume of at least 2 mL.					
1622	EPA	*Cryptosporidium* in Water by Filtration/IMS/FA	2005	EPA-815-R-05-001		http://www.epa.gov/nerlcwww/online.htm
1623	EPA	*Cryptosporidium* and Giardia in Water by Filtration/IMS/FA	2005	EPA-815-R-05-002		http://www.epa.gov/nerlcwww/online.htm

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Escherichia coli	The time from sample collection to initiation of analysis may not exceed 30 hours unless the State determines, on a case-by-case basis, that analyzing an *E. coli* sample within 30 hours is not feasible. *E. coli* samples held between 30 to 48 hours must be analyzed by the Colilert reagent version of Standard Method 9223 B. Systems must maintain samples between 0°C and 10°C during storage and transit to the laboratory. The method must be specified when results are reported.					
1103.1	EPA	*Escherichia coli* (*E. coli*) in Water by Membrane Filtration Using membrane-Thermotolerant *Escherichia coli* Agar (mTEC)	July 2006	EPA-821-R-06-010		http://www.epa.gov/waterscience/methods/
		Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.				
1603	EPA	*Escherichia coli* (*E. coli*) in Water by Membrane Filtration Using Modified membrane-Thermotolerant *Escherichia coli* Agar (modified mTEC)	July 2006	EPA-821-R-06-011		http://www.epa.gov/waterscience/methods/
		Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.				

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1604	EPA	Total Coliforms and *Escherichia coli* (*E. coli*) in Water by Membrane Filtration by Using a Simultaneous Detection Technique (MI Medium)	September 2002	EPA 821-R-02-024		http://www.epa.gov/nerlcwww/online.htm
		Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.				
9213 D	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 18th Edition	1992			Standard Methods
		Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.				

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9213 D	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 19th Edition	1995			Standard Methods
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9213 D	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 20th Edition	1998			Standard Methods
	Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.					

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9221 B.1/9221 F	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 19th Edition	1995			Standard Methods
	Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. The multiple-tube fermentation test is used in 9221 B.1. Lactose broth may be used in lieu of lauryl tryptose broth (LTB), if at least 25 parallel tests are conducted between this broth and LTB using the water samples normally tested, and this comparison demonstrates that the false-positive rate and false-negative rate for total coliform using lactose broth is less than 10 percent. No requirement exists to run the completed phase on 10 percent of all total coliform-positive tubes on a seasonal basis. After prior enrichment in a presumptive medium for total coliform using 9221 B.1, all presumptive tubes or bottles showing any amount of gas, growth or acidity within 48 h ± 3 h of incubation shall be submitted to 9221 F. Commercially available EC-MUG media or EC media supplemented in the laboratory with 50 µg/mL of MUG may be used. Samples shall be enumerated by the multiple-tube or multiple-well procedure. Using multiple-tube procedures, employ an appropriate tube and dilution configuration of the sample as needed and report the Most Probable Number (MPN). Samples tested with Colilert may be enumerated with the multiple-well procedures, Quanti-Tray or Quanti-Tray 2000, and the MPN calculated from the table provided by the manufacturer.				
9221 B.1/9221 F	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 20th Edition	1998			Standard Methods
	Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. The multiple-tube fermentation test is used in 9221 B.1. Lactose broth may be used in lieu of lauryl tryptose broth (LTB), if at least 25 parallel tests are conducted between this broth and LTB using the water samples normally tested, and this comparison demonstrates that the false-positive rate and false-negative rate for total coliform using lactose broth is less than 10 percent. No requirement exists to run the completed phase on 10 percent of all total coliform-positive tubes on a seasonal basis. After prior enrichment in a presumptive medium for total coliform using 9221 B.1, all presumptive tubes or bottles showing any amount of gas, growth or acidity within 48 h ± 3 h of incubation shall be submitted to 9221 F. Commercially available EC-MUG media or EC media supplemented in the laboratory with 50 µg/mL of MUG may be used. Samples shall be enumerated by the multiple-tube or multiple-well procedure. Using multiple-tube procedures, employ an appropriate tube and dilution configuration of the sample as needed and report the Most Probable Number (MPN). Samples tested with Colilert may be enumerated with the multiple-well procedures, Quanti-Tray or Quanti-Tray 2000, and the MPN calculated from the table provided by the manufacturer.				

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9222 B/9222 G	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 19th Edition	1995			Standard Methods
	Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results. Subject total coliform positive samples determined by 9222 B or other membrane filter procedure to 9222 G using NA-MUG media.				
9222 B/9222 G	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 20th Edition	1998			Standard Methods
	Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results. Subject total coliform positive samples determined by 9222 B or other membrane filter procedure to 9222 G using NA-MUG media.				

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9223	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 18th Edition	1992			Standard Methods
	These tests are collectively known as defined enzyme substrate tests, where, for example, a substrate is used to detect the enzyme B-glucuronidase produced by *E. coli*.					
9223	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 19th Edition	1995			Standard Methods
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9223	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 21st Edition	2005			Standard Methods
	These tests are collectively known as defined enzyme substrate tests, where, for example, a substrate is used to detect the enzyme B-glucuronidase produced by *E. coli.*					
9223 B-97	Standard Methods Online	Online version of Standard Methods for the Examination of Water and Wastewater. Approval year by Standard Methods Committee is designated by last 2 digits. This is the only online version that is approved.				http://www.standardmethods.org/
	These tests are collectively known as defined enzyme substrate tests, where, for example, a substrate is used to detect the enzyme B-glucuronidase produced by *E. coli*.					
991.15	AOAC	Official Methods of Analysis of AOAC International, 16th Edition, Volume I, Chapter 17	1995			AOAC International
Colilert	IDEXX Laboratories, Inc.	Colilert Test	June 1992			IDEXX Laboratories, Inc.
	These tests are collectively known as defined enzyme substrate tests, where, for example, a substrate is used to detect the enzyme B-glucuronidase produced by *E. coli*.					
Colilert-18	IDEXX Laboratories, Inc.	Colilert-18 Test				IDEXX Laboratories, Inc.
	These tests are collectively known as defined enzyme substrate tests, where, for example, a substrate is used to detect the enzyme B-glucuronidase produced by *E. coli*. Colilert-18® is an optimized formulation of the Colilert® for the determination of total coliforms and *E. coli* that provides results within 18 h of incubation at 35°C rather than the 24 h required for the Colilert® test and is recommended for marine water samples.					

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D5392-93	ASTM International	Annual Book of ASTM Standards, Vol. 11.02				http://www.astm.org
		Tests must be conducted to provide organism enumeration (density). Select the appropriate configuration of tubes/filtrations and dilutions/volumes to account for the quality, character, consistency, and anticipated organism density of the water sample. To assess the comparability of results obtained with individual methods, it is suggested that side-by-side tests be conducted across seasons of the year with the water samples routinely tested in accordance with the most current Standard Methods for the Examination of Water and Wastewater or EPA alternate test procedure (ATP) guidelines. Use a 0.45 µm membrane filter (MF) or other pore size certified by the manufacturer to fully retain organisms to be cultivated and to be free of extractables which could interfere with their growth. When the MF method has not been used previously to test waters with high turbidity, large number of noncoliform bacteria, or samples that may contain organisms stressed by chlorine, a parallel test should be conducted with a multiple-tube technique to demonstrate applicability and comparability of results.				
m-ColiBlue24® Test	Hach Co.	m-ColiBlue 24 Test, "Total Coliforms and *E. coli* Membrane Filtration Method with m-ColiBlue 24 Broth," Method No. 10029, Revision 2.	August 17, 1999			Hach Company
Turbidity	Styrene divinyl benzene beads (e.g. AMCO-AEPA-1 or equivalent) and stabilized formazin (e.g. Hach StablCal™ or equivalent) are acceptable substitutes for formazin.					
10133 Rev. 2.0	Hach Co.	Hach Filter Track Method, "Determination of Turbidity by Laser Nephelometry," Revision 2.0	January 2000			Hach Company
180.1 Rev 2.0	EPA	In Methods for the Determination of Inorganic Substances in Environmental Samples	August 1993	EPA/600/R-93/100	PB94-120821	http://www.nemi.gov
2130 B	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 18th Edition	1992			Standard Methods

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Turbidity	Styrene divinyl benzene beads (e.g. AMCO-AEPA-1 or equivalent) and stabilized formazin (e.g. Hach StablCal™ or equivalent) are acceptable substitutes for formazin.					
2130 B	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 19th Edition	1995			Standard Methods
2130 B	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 20th Edition	1998			Standard Methods
2130 B	Standard Methods	Standard Methods for the Examination of Water and Wastewater, 21st Edition	2005			Standard Methods
2130 B-01	Standard Methods Online	Online version of Standard Methods for the Examination of Water and Wastewater. Approval year by Standard Methods Committee is designated by last 2 digits. This is the only online version that is approved.				http://www.standardmethods.org/
Method 2	Great Lakes Instruments, Inc.	GLI Method 2, "Turbidity"	November 2, 1992			Great Lakes Instruments, Inc.

Contact information for methods that are not available on the Internet are summarized in the report titled "Sources of Approved Analytical Methods for National Drinking Water Regulations."