567—41.2(455B) Biological maximum contaminant level (MCL), treatment technique (TT), and monitoring requirements.

41.2(1) *Coliform bacteria and Escherichia coli (E. coli).* The provisions of this subrule include both MCL and TT requirements and apply to all PWSs. Failure to comply with the applicable requirements in this subrule is a violation of the national primary drinking water regulations.

a. MCL. A PWS must determine compliance with the *E. coli* MCL for each month in which the system is required to monitor for total coliforms. A system is in compliance with the *E. coli* MCL for samples taken under this subrule unless any of the following conditions occur. For purposes of the public notification (PN) requirements in rule 567—40.5(455B), MCL violation may pose an acute health risk. A system is not in compliance if it:

(1) Has an *E. coli*-positive repeat sample following a total coliform-positive routine sample;

(2) Has a total coliform-positive repeat sample following an *E. coli*-positive routine sample;

(3) Fails to take all required repeat samples following an *E. coli*-positive routine sample; or

(4) Fails to test for *E. coli* when any repeat sample tests positive for total coliform.

b. Analytical methodology.

(1) Sample volume. The standard sample volume required for analysis is 100 mL, regardless of the analytical method used.

(2) Presence/absence (P/A) required. Only the P/A of total coliforms and *E. coli* must be determined in any compliance sample; a determination of density is acceptable but is not required.

(3) Holding time and temperature. The time from sample collection to initiation of test medium incubation shall not exceed 30 hours. Systems are encouraged but not required to hold samples below 10 degrees Celsius during transit.

(4) Dechlorinating agent required for chlorinated water. If water having a residual chlorine (measured as free, combined, or total chlorine) will be analyzed, sufficient sodium thiosulfate (Na2S2O3) must be added to the sample bottle before sterilization to neutralize any residual chlorine in the water sample. Dechlorination procedures are addressed in Standard Methods (SM) Section 9060A.2, 20th and 21st editions.

(5) Systems must conduct total coliform and E. coli analyses in accordance with one of the analytical methods in the following table.

Bacteria Analytical Methods

Methodology Category	Method Name[1]	Method Citation[1]
Total Coliform Bacteria Methods:		
Lactose Fermentation	Standard Total Coliform Fermentation Technique	SM 9221 B.1, B.2 (20th, 21st, and 22nd ed.)[2, 3] SM Online 9221 B.1, B.2-99, B-06[2, 3]
	P/A Coliform Test	SM 9221 D.1, D.2 (20th and 21st ed.)[2, 7] SM Online 9221 D.1, D.2-99[2, 7]
Membrane Filtration	Standard Total Coliform Membrane Filter Procedure	SM 9222 B, C (20th and 21st ed.)[2, 4] SM Online 9222 B-97[2, 4], 9222 C-97[2, 4]
	Membrane Filtration using MI Medium	EPA Method 1604[2]
	m-ColiBlue24 Test[2, 4]	
	Chromocult[2, 4]	
Enzyme Substrate	Colilert	SM 9223 B (20th, 21st and 22nd ed.)[2, 5] SM Online 9223 B-97, B-04[2, 5]
	Colilert-18	SM 9223 B (21st and 22nd ed.)[2, 5] SM Online 9223 B-04[2, 5]
	Colisure	SM 9223 B (20th, 21st and 22nd ed.)[2, 5, 6] SM Online 9223 B-97, B-04[2, 5, 6]
	E*Colite Test[2]	
	Readycult Test[2]	

Methodology Category	Method Name[1]	Method Citation[1]
	modified Colitag Test[2]	
	Tecta EC/TC Test[2]	
***E. coli* Methods:**		
E. coli Procedures (following Lactose Fermentation Methods)	EC-MUG Medium	SM 9221 F.1 (20th, 21st and 22nd ed.)[2] SM Online 9221 F-06[2]
E. coli Partition	EC broth with MUG (EC-MUG)	SM 9222 G.1*c*(2) (20th and 21st ed.)[2, 8]
	NA-MUG Medium	SM 9222 G.1*c*(1) (20th and 21st ed.)[2]
Membrane Filtration	Membrane Filtration using MI Medium	EPA Method 1604[2]
	m-ColiBlue24 Test[2, 4]	
	Chromocult[2, 4]	
Enzyme Substrate	Colilert	SM 9223 B (20th, 21st and 22nd ed.)[2, 5] SM Online 9223 B-97, B-04[2, 5, 6]
	Colilert-18	SM 9223 B (21st and 22nd ed.)[2, 5] SM Online 9223 B-04[2, 5]
	Colisure	SM 9223 B (20th, 21st and 22nd ed.)[2, 5, 6] SM Online 9223 B-97, 04[2, 5, 6]
	E*Colite Test[2]	
	Readycult[2]	
	modified Colitag Test[2]	
	Tecta EC/TC Test[2]	

[1] Methods are listed in 41.2(1)*"b"*(6). For SM, either the 20th (1998) or 21st (2005) edition may be used. For SM Online, the year in which each method was approved is designated by the last two digits following the hyphen in the method number, and the methods listed are the only online versions that may be used. For vendor methods, the date in 41.2(1)*"b"*(6) is the date/version of the approved method, and the methods listed are the only versions that may be used. Laboratories should use only the approved versions of the methods, as product package inserts may not match the approved versions.

[2]Incorporated by reference. See 41.2(1)*"b"*(6).

[3]Lactose broth may be used in lieu of lauryl tryptose broth (LTB) if the system conducts at least 25 parallel tests between lactose broth and LTB using the water normally tested and if the findings from this comparison demonstrate that the false-positive rate and the false-negative rate for total coliforms, using lactose broth, is less than 10 percent.

[4]All filtration series must begin with membrane filtration equipment that has been sterilized by autoclaving. Exposure of filtration equipment to UV light is not adequate to ensure sterilization. Subsequent to the initial autoclaving, exposure of the filtration equipment to UV light may be used to sanitize the funnels between filtrations within a filtration series. Alternatively, membrane filtration equipment that is presterilized by the manufacturer may be used.

[5]Multiple-tube and multi-well enumerative formats for this method are approved for use in P/A determination under this subrule.

[6]Colisure results may be read after an incubation time of 24 hours.

[7]A multiple-tube enumerative format, as described in SM for the Examination of Water and Wastewater 9221, is approved for this method for use in P/A determination under this subrule.

[8]The following changes must be made to the EC broth with MUG (EC-MUG) formulation: Potassium dihydrogen phosphate, KH_2PO_4, must be 1.5 g, and 4-methylumbelliferyl-beta-D-glucuronide must be 0.05 g.

(6) Methods incorporated by reference. The methods in this subrule are incorporated by reference with the approval of the Director of the Federal Register under 5 U.S.C. 552(a) and 1 CFR Part 51. All approved material is available for inspection at www.regulations.gov, in hard copy at the EPA's Drinking Water Docket, (Docket ID EPA-HQ-OW-2008-0878), or from NARA.

1. APHA, SM 20th edition (1998):

- SM 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique;" D.1, D.2, "Presence-Absence (P/A) Coliform Test;" and F.1, "Escherichia coli Procedure: EC-MUG Medium."
- SM 9222, "Membrane Filter Technique for Members of the Coliform Group," B, "Standard Total Coliform Membrane Filter Procedure," C, "Delayed-Incubation Total Coliform Procedure," G.1c(1),

"Escherichia coli Partition Method: NA-MUG Medium," and G.1c(2), "Escherichia coli Partition Method: EC Broth with MUG (EC-MUG)."

- SM 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.

2. SM, 21st edition (2005):

- SM 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique;" D.1, D.2, "Presence-Absence (P/A) Coliform Test," and F.1, "Escherichia coli Procedure: EC-MUG Medium."
- SM 9222, "Membrane Filter Technique for Members of the Coliform Group," B, "Standard Total Coliform Membrane Filter Procedure;" C, "Delayed-Incubation Total Coliform Procedure;" G.1.c(1), "Escherichia coli Partition Method: NA-MUG Medium;" and G.1.c(2), "Escherichia coli Partition Method: EC Broth with MUG (EC-MUG)."
- SM 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.

3. SM Online:

- SM 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group" (1999), B.1, B.2-99, B-06, "Standard Total Coliform Fermentation Technique" and D.1, D.2-99, "Presence-Absence (P/A) Coliform Test."
- SM 9222, "Membrane Filter Technique for Members of the Coliform Group" (1997), B-97, "Standard Total Coliform Membrane Filter Procedure" and C-97, "Delayed-Incubation Total Coliform Procedure."
- SM 9223, "Enzyme Substrate Coliform Test" (1997), B-97, "Enzyme Substrate Test," Colilert and Colisure.

4. Charm Sciences, Inc., 659 Andover Street, Lawrence, MA 01843-1032: E*Colite—"Charm E*Colite Presence/Absence Test for Detection and Identification of Coliform Bacteria and Escherichia coli in Drinking Water," January 9, 1998.

5. CPI International, Inc., 5580 Skylane Blvd., Santa Rosa, CA 95403: modified Colitag, ATP D05-0035—"Modified Colitag Test Method for the Simultaneous Detection of *E. coli* and other Total Coliforms in Water," August 28, 2009.

6. EMD Millipore (a division of Merck KGaA, Darmstadt, Germany), 290 Concord Road, Billerica, MA 01821:

- Chromocult—"Chromocult Coliform Agar Presence/Absence Membrane Filter Test Method for Detection and Identification of Coliform Bacteria and Escherichia coli for Finished Waters," November 2000, Version 1.0.
- Readycult—"Readycult Coliforms 100 Presence/Absence Test for Detection and Identification of Coliform Bacteria and Escherichia coli in Finished Waters," January 2007, Version 1.1.

7. EPA's Water Resource Center (MC-4100T), EPA Method 1604, EPA 821-R-02-024—"EPA Method 1604: Total Coliforms and Escherichia coli in Water by Membrane Filtration Using a Simultaneous Detection Technique (MI Medium)," September 2002, www.nemi.gov.

8. Hach Company, www.hach.com: m-ColiBlue24—"Membrane Filtration Method m-ColiBlue24 Broth," Revision 2, August 17, 1999.

9. SM, 22nd edition (2012):

- SM 9221, "Multiple-Tube Fermentation Technique for Members of the Coliform Group," B.1, B.2, "Standard Total Coliform Fermentation Technique," and F.1, "Escherichia coli Procedure: EC-MUG Medium."
- SM 9223, "Enzyme Substrate Coliform Test," B, "Enzyme Substrate Test," Colilert and Colisure.

10. Veolia Water Solutions and Technologies, Suite 4697, Biosciences Complex, 116 Barrie Street, Kingston, Ontario, Canada K7L 3N6: Tecta EC/TC. "Presence/Absence Method for Simultaneous Detection of Total Coliforms and Escherichia coli in Drinking Water," April 2014.

(7) Laboratory certification. Systems must have all compliance samples required under this subrule analyzed by a laboratory certified in accordance with 567—Chapter 83. The laboratory used by the system must be certified for each method and associated contaminant used for compliance monitoring analyses under this subrule.

c. Sampling plan.

(1) Written sampling plan required. Systems must collect total coliform samples according to their written sampling plan.

1. Systems must develop a written sampling plan that identifies sample locations and a sample collection schedule that are representative of water throughout the distribution system. Major elements of the plan shall include, but not be limited to, the following:

- Map of the distribution system served by the system;
- List of routine compliance sample locations for each sample period;
- List of repeat compliance sample locations for each routine compliance sample location;
- Any other sample locations necessary to meet the requirements of this subrule;
- Sample collection schedule;
- Proper sampling technique instructions;
- Log of samples taken; and
- For GW systems subject to 567—41.7(455B), triggered source water monitoring plan.

2. The system shall review the sampling plan every two years, update it as needed, and retain it on file at the facility. The plan must be made available to the department upon request and for review during sanitary surveys and must be revised at the department's direction.

3. Monitoring under this subrule may take place at a customer's premises, dedicated sampling station, or other designated compliance sampling location.

(2) Sampling schedule. Systems must collect routine samples at regular time intervals throughout the month. Systems that use only GW and serve 4,900 or fewer people, or regional water systems that use only GW and serve less than 121 miles of pipe, may collect all required routine samples on a single day, if the samples are taken from different sites.

(3) Minimum number of routine samples. Systems must take at least the minimum number of required routine samples even if the system has had an *E. coli* MCL violation or has exceeded the coliform TT triggers in 41.2(1)*"i."* Such samples must be designated as "routine" when submitted to the laboratory.

(4) Additional sampling. A system may conduct more compliance monitoring than is required to uncover or investigate potential problems in the distribution system. A system may take more than the minimum number of required routine samples, and must include the additional routine sample results when calculating whether the coliform TT trigger in 41.2(1)*"i"*(1)"1" and "2" has been exceeded, only if the samples are taken in accordance with the existing sampling plan and are representative of water throughout the distribution system. Such samples must be designated as "routine" when submitted to the laboratory.

(5) Repeat samples. Systems must identify repeat monitoring locations in the sampling plan. Repeat samples must be analyzed at the same laboratory as the corresponding original routine sample(s), unless written approval for use of a different laboratory is granted by the department. A system must collect at least one repeat sample at the following locations: from the sampling tap where the original routine total coliform-positive sample was taken, at a tap within five service connections upstream of the original sample location, and at a tap within five service connections downstream of the original sample location. Such samples must be designated as "repeat" when submitted to the laboratory.

1. If the sampling location of a total coliform-positive sample is at or within one service connection from the end of the distribution system, the system must still take all required repeat samples. However, the department may allow an alternative sampling location in lieu of one of the upstream or downstream sampling locations.

2. A GW system with two or more wells that is required to conduct triggered source water monitoring under 41.7(3) must collect GW source sample(s) in addition to the required repeat samples.

3. A GW system with a single well that is required to conduct triggered source water monitoring may, with written department approval, collect one of its required repeat samples at the triggered source water sample monitoring location. The system must demonstrate to the department's satisfaction that the sampling plan remains representative of water quality in the distribution system. If approved, the sample result may be used to meet the requirements of 41.7(3) and this subrule. If a repeat sample taken at the triggered source water monitoring location is *E. coli*-positive, the system has violated the *E. coli* MCL, and must also comply with the requirements for additional source water samples under 41.7(3)*"a"*(3).

4. The department may review, revise, and approve, as appropriate, repeat sampling proposed by a system under 41.2(1)*"c"*(5). The system must demonstrate that the sampling plan remains representative of the water quality in the distribution system.

(6) Special purpose samples. Special purpose samples, such as those taken to determine whether disinfection practices are sufficient following pipe placement, replacement, or repair, must not be used to determine whether the coliform TT trigger has been exceeded. Such samples must be designated as "special" when submitted to the laboratory and cannot be used for compliance. Repeat samples are not considered special purpose samples and must be used to determine whether the coliform TT trigger has been exceeded.

(7) Residual disinfectant measurement. Any system adding a chemical disinfectant to the water must meet the requirements of 567—subparagraph 40.8(3)*"b"*(1). The minimum required residual disinfectant measurements are as follows, unless otherwise directed by the department in writing:

1. GW systems. A system that uses only GW and adds a chemical disinfectant, or provides water that contains a disinfectant, must measure and record the free and total chlorine residual disinfectant concentration at least at the same points in the distribution system and at the same time as routine and repeat total coliform bacteria samples are collected, as specified in 41.2(1)*"e"* through *"g."* The system shall report the total residual disinfectant concentration to the laboratory with the bacteria sample and comply with the reporting requirements in 567—subrule 40.8(3). If a system is chloraminating, it may measure and report only the total chlorine residual.

2. Surface water (SW) and influenced groundwater (IGW) systems.

- Any SW or IGW PWS must meet the requirements for minimum residual disinfectant entering the distribution system pursuant to 567—paragraph 43.5(4)*"b"*(2)"1"; and
- A system that uses SW or IGW must comply with the requirements in 567—subparagraph 43.5(4)*"b"*(2)"2" for daily distribution system residual disinfectant monitoring. The system must measure and record the free and total chlorine residual disinfectant concentration at least at the same points in the distribution system and at the same time as routine and repeat total coliform bacteria samples are collected, as specified in 41.2(1)*"e"* through *"g."* The residual disinfectant measurements required in this subrule may be used to satisfy the requirement in 567—paragraph 43.5(4)*"b"*(2)"2" on the day(s) when a routine or repeat total coliform bacteria sample(s) is collected, in lieu of separate samples. The system shall report the residual disinfectant concentration to the laboratory with the bacteria sample and comply with the applicable reporting requirements of 567—subrule 40.8(3).

d. Invalidation of total coliform samples. A total coliform-positive sample invalidated under this paragraph does not count toward meeting the minimum monitoring requirements of this subrule.

(1) The department may invalidate a total coliform-positive sample only if the following conditions are met:

1. The laboratory establishes that improper sample analysis caused the total coliform-positive result.

2. The department, on the basis of the results of the required repeat samples, determines that the total coliform-positive sample resulted from a domestic or other non-distribution system plumbing problem. "Domestic or other non-distribution system plumbing problem" means a coliform contamination problem in a PWS with more than one service connection that is limited to the specific service connection from which the coliform-positive sample was taken. The department cannot invalidate a total coliform-positive sample on the basis of repeat samples unless all repeat samples collected at the same tap as the original total coliform-positive sample are also total coliform-positive and all repeat samples collected at a location other than the original tap are total coliform-negative. The department cannot invalidate a total coliform-positive sample on the basis of repeat samples if all the repeat samples are total coliform-negative or if the system has only one service connection.

3. The department has substantial grounds to believe that the total coliform-positive result is due to a circumstance or condition that does not reflect water quality in the distribution system. The system must still collect all repeat samples required under 41.2(1)*"g"* and use them to determine whether a coliform TT trigger in 41.2(1)*"i"* has been exceeded.

The decision and supporting rationale for invalidating a total coliform-positive sample under this subparagraph must be in writing and signed by the supervisor of the water supply operations section or

water supply engineering section and the department official who recommended the decision. The department must make this document available to EPA and the public. The documentation must state the specific cause of the total coliform-positive sample and what action the system has taken, or will take, to correct this problem. The department may not invalidate a total coliform-positive sample solely on the grounds that all repeat samples are total coliform-negative or because of poor sampling technique.

(2) Laboratory invalidation. A laboratory must invalidate a total coliform sample (unless total coliforms are detected, in which case the sample is valid) if the sample produces a turbid culture in the absence of gas production using an analytical method where gas formation is examined, produces a turbid culture in the absence of an acid reaction in the P/A coliform test, or exhibits confluent growth or produces colonies too numerous to count with an analytical method using a membrane filter. If a laboratory invalidates a sample because of such interference, the system must collect another sample from the same location as that of the original within 24 hours of being notified of the interference and must have the sample analyzed for the presence of total coliforms. The system must continue to resample within 24 hours and have the samples analyzed until a valid result is obtained. The department may waive the 24-hour time limit on a case-by-case basis.

e. Routine monitoring for specific groundwater (GW) NCWS serving 1,000 or fewer people. This paragraph applies to NCWS using only GW (not IGW) as a source and serving 1,000 or fewer people. GW NCWS that serve schools, preschools, and child care facilities and all PWSs owned or managed by state agencies must monitor at the same frequency as a like-sized CWS in accordance with 41.2(1)*"f"*(1), *"f"*(2), or *"f"*(3).

(1) General. Following any total coliform-positive sample taken under this paragraph, systems must comply with the repeat monitoring and *E. coli* analytical requirements in 41.2(1)*"g."* Once all monitoring required by this paragraph and 41.2(1)*"g"* for a calendar month has been completed, systems must determine whether any coliform TT triggers in 41.2(1)*"i"* have been exceeded. If any trigger has been exceeded, systems must complete the assessments required by 41.2(1)*"i."*

(2) Monitoring frequency for total coliforms. Systems must monitor each calendar quarter that they provide water to the public, with the following exceptions:

1. A system on quarterly monitoring that experiences any of the following events must begin monthly monitoring in the month following the event. A system must continue on monthly monitoring until it meets the requirements for returning to quarterly monitoring. The events include:

- An *E. coli* MCL violation;
- The triggering of one Level 2 assessment under 41.2(1)*"i"* in a rolling 12-month period.
- The triggering of two Level 1 assessments under 41.2(1)*"i"* in a rolling 12-month period.
- One coliform TT violation.
- Two coliform monitoring violations in a rolling 12-month period.
- One monitoring coliform violation and one Level 1 assessment under 41.2(1)*"i"* in a rolling 12-month period.

2. A system on monthly monitoring for reasons other than those identified above in 41.2(1)*"e"*(2)"1" is not considered to be on increased monitoring for the purposes of 41.2(1).

3. Seasonal systems must sample each month in which they are in operation. All seasonal systems must demonstrate completion of a department-approved start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

(3) Sampling frequency evaluation during a sanitary survey. During each sanitary survey, the department must evaluate the status of a system, including the distribution system, to determine whether the system is on an appropriate monitoring schedule. The department may modify a system's monitoring schedule, as necessary, or may allow a system to stay on its existing monitoring schedule, consistent with this paragraph.

(4) Returning from monthly to quarterly sampling for nonseasonal NCWSs. The department may reduce the monitoring frequency for a nonseasonal NCWS on monthly monitoring triggered under 41.2(1)*"e"*(2)"1" to quarterly monitoring if the system meets the following criteria. For the purposes of this subparagraph, "protected water source" means either the well meets separation distances from sources of

microbial contamination pursuant to 567—subrule 43.3(7), Table A; or the system has department-approved 4-log virus inactivation treatment in continuous usage.

1. The system must have a completed sanitary survey or voluntary Level 2 assessment within the previous 12 months, be free of sanitary defects, and have a protected water source;

2. The system must have a clean compliance history for at least the previous 12 months; and

3. The department must review the approved sampling plan, which must designate the monitoring time period(s) based on site-specific considerations (e.g., during periods of highest demand or highest vulnerability to contamination). The system must collect compliance samples during these time periods.

(5) Additional routine monitoring for systems on quarterly sampling in the month following a total coliform-positive routine sample. Systems collecting samples on a quarterly frequency must conduct additional routine monitoring the month following one or more total coliform-positive samples (with or without a Level 1 TT trigger). Systems must collect at least three routine samples during the next month. Systems may either collect samples at regular time intervals throughout the month or may collect all required routine samples on a single day if samples are taken from different sites. Systems must use the results of additional routine samples in coliform TT trigger calculations under 41.2(1)*"i."*

f. Routine monitoring requirements for other systems.

(1) GW CWS serving 1,000 or fewer people. This subparagraph applies to CWS using only GW (not IGW) as a source and serving 1,000 or fewer people. The routine total coliforms monitoring frequency for such systems is one sample per month.

(2) SW/IGW PWS serving 1,000 or fewer people. This subparagraph applies to all PWSs serving 1,000 or fewer people that use SW/IGW sources, including consecutive systems.

1. The routine total coliforms monitoring frequency for such systems is one sample per month. Systems may not reduce monitoring frequency.

2. Seasonal systems must sample each month in which they are in operation, and the monitoring frequency cannot be reduced. All seasonal systems must demonstrate completion of a department-approved start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

(3) PWSs serving more than 1,000 people. This subparagraph applies to all PWSs serving more than 1,000 people, except regional water systems. The regional water system requirements are in 41.2(1)*"f"*(4) below.

1. The routine total coliforms monitoring frequency for PWSs serving more than 1,000 people is based upon the population served by the system, as follows:

Population Served	Minimum Number of Routine Samples per Month	Population Served	Minimum Number of Routine Samples per Month
1,001 to 2,500	2	41,001 to 50,000	50
2,501 to 3,300	3	50,001 to 59,000	60
3,301 to 4,100	4	59,001 to 70,000	70
4,101 to 4,900	5	70,001 to 83,000	80
4,901 to 5,800	6	83,001 to 96,000	90
5,801 to 6,700	7	96,001 to 130,000	100
6,701 to 7,600	8	130,001 to 220,000	120
7,601 to 8,500	9	220,001 to 320,000	150
8,501 to 12,900	10	320,001 to 450,000	180
12,901 to 17,200	15	450,001 to 600,000	210
17,201 to 21,500	20	600,001 to 780,000	240
21,501 to 25,000	25	780,001 to 970,000	270
25,001 to 33,000	30	970,001 to 1,230,000	300
33,001 to 41,000	40		

2. Seasonal systems must sample each month in which they are in operation, and the monitoring frequency cannot be reduced. All seasonal systems must demonstrate completion of a department-approved

start-up procedure before serving water to the public, which includes a requirement for a coliform-negative start-up sample.

3. CWSs may not reduce the number of required routine samples.

4. If the department, on the basis of a sanitary survey or monitoring results history, determines that some greater monitoring frequency is more appropriate, that frequency shall be the frequency required under these rules. The increased frequency shall be confirmed or changed on the basis of subsequent surveys.

(4) Regional PWSs. This subparagraph applies to all regional water systems. The supplier of water for a regional PWS shall sample for coliform bacteria at a frequency based upon the miles of pipe in its distribution system.

1. The routine total coliforms monitoring frequency for regional PWSs is based on the miles of pipe in a system's distribution system, as indicated in the following table. The sampling frequency for a regional water system shall not be less than as set forth in this subparagraph, based upon the population equivalent served. The following table represents sampling frequency per miles of pipe in a distribution system and is determined by calculating one-half the square root of the miles of pipe.

Miles of Pipe	Minimum Number of Routine Samples per Month	Miles of Pipe	Minimum Number of Routine Samples per Month
0 – 9	1	1,850 – 2,025	22
10 – 25	2	2,026 – 2,209	23
26 – 49	3	2,210 – 2,401	24
50 – 81	4	2,402 – 2,601	25
82 – 121	5	2,602 – 2,809	26
122 – 169	6	2,810 – 3,025	27
170 – 225	7	3,026 – 3,249	28
226 – 289	8	3,250 – 3,481	29
290 – 361	9	3,482 – 3,721	30
362 – 441	10	3,722 – 3,969	31
442 – 529	11	3,970 – 4,225	32
530 – 625	12	4,226 – 4,489	33
626 – 729	13	4,490 – 4,671	34
730 – 841	14	4,672 – 5,041	35
842 – 961	15	5,042 – 5,329	36
962 – 1,089	16	5,330 – 5,625	37
1,090 – 1,225	17	5,626 – 5,929	38
1,226 – 1,364	18	5,930 – 6,241	39
1,365 – 1,521	19	6,242 – 6,561	40
1,522 – 1,681	20	6,562 and greater	41
1,682 – 1,849	21		

2. Regional PWSs may not reduce the number of required routine samples.

3. If the department, on the basis of a sanitary survey or monitoring results history, determines that some greater monitoring frequency for a regional PWS is more appropriate, that frequency shall be the frequency required under these rules. The increased frequency shall be confirmed or changed on the basis of subsequent surveys.

(5) Requirements for all systems subject to this paragraph. Following any total coliform-positive sample taken under this paragraph, systems must comply with the repeat monitoring requirements and *E. coli* analytical requirements in 41.2(1)*"g."* Once all monitoring required by this paragraph and 41.2(1)*"g"* for a calendar month has been completed, systems must determine whether any coliform TT triggers in 41.2(1)*"i"* have been exceeded. If any trigger has been exceeded, systems must complete assessments pursuant to 41.2(1)*"i."*

g. Repeat monitoring. If a routine sample taken under 41.2(1)*"e"* and *"f"* is total coliform-positive, a system must collect a set of repeat samples. The department cannot waive this requirement.

(1) A system must:

1. Collect no fewer than three repeat samples for each total coliform-positive routine sample.

2. Collect repeat samples within 24 hours of receipt of the positive result. The department may extend the 24-hour limit on a case-by-case basis if the system has a logistical problem collecting the repeat samples within 24 hours that is beyond its control. In the case of an extension, the department must specify how much time a system has to collect the repeat samples.

3. Collect all repeat samples on the same day, except that the department may allow a system with a single service connection to collect the required set of repeat samples over a three-day period. "System with a single service connection" means a system that supplies drinking water to consumers through a single service line.

4. Collect an additional set of repeat samples as specified above in 41.2(1)*"g"*(1)"1" through 41.2(1)*"g"*(1)"3" if one or more repeat samples in the current set of repeat samples is total coliform-positive. A system must collect the additional set of repeat samples within 24 hours of receipt of a positive result, unless the department extends the time limit in 41.2(1)*"g"*(1)"2." A system must continue to collect additional sets of repeat samples until either total coliforms are not detected in one complete set of repeat samples or it determines that a coliform TT trigger in 41.2(1)*"i"* has been exceeded as a result of a total coliform-positive repeat sample and notifies the department. If a TT trigger is exceeded as a result of a total coliform-positive routine sample, systems only need to conduct one round of repeat monitoring for each total coliform-positive routine sample.

(2) Results of all routine and repeat samples taken under 41.2(1)*"e"* through *"g"* that are not invalidated by the department must be used to determine whether a coliform TT trigger in 41.2(1)*"i"* has been exceeded.

h. E. coli testing requirements.

(1) If any routine or repeat sample is total coliform-positive, a system must analyze that total coliform-positive culture medium to determine the presence of *E. coli*. If *E. coli* are present, the system must notify the department by the end of the same day the system receives notification of the test result. If the notification is outside of the department's routine office hours, the system shall call the department's Environmental Emergency Reporting Hotline at 515.725.8694.

(2) The department has the discretion to allow a system, on a case-by-case basis, to forgo E. coli testing on a total coliform-positive sample if that system assumes that the total coliform-positive sample is *E. coli*-positive. Accordingly, the system must notify the department as specified above in 41.2(1)*"h"*(1), and the provisions of 41.2(1)*"a"* apply.

i. Coliform TT triggers. Systems must conduct assessments in accordance with 41.2(1)*"j"* after exceeding any TT trigger.

(1) Level 1 TT triggers.

1. For systems taking 40 or more samples per month, the system exceeds 5.0 percent total coliform-positive samples for the month.

2. For systems taking fewer than 40 samples per month, the system has two or more total coliform-positive samples in the same month.

3. The system fails to take every required repeat sample after any single total coliform-positive sample.

(2) Level 2 TT triggers.

1. An *E. coli* MCL violation, as specified in 41.2(1)*"m"*(1).

2. A second Level 1 trigger as defined above in 41.2(1)*"i"*(1) within a rolling 12-month period, unless the department has determined a likely reason that the samples that caused the first Level 1 TT trigger were total coliform-positive and has established that the system has corrected the problem.

j. Assessment requirements. Systems must ensure that Level 1 and 2 assessments are conducted to identify the possible presence of sanitary defects and defects in distribution system coliform monitoring practices. Level 1 assessments may be conducted by a system owner or operator. Level 2 assessments must be conducted by the department with the assistance of the system owner or operator.

(1) General. Systems must conduct assessments consistent with any department directives and ensure that the assessor evaluates minimum elements, including:

1. A review and identification of inadequacies in sample sites;
2. Sampling protocol and processing;
3. Atypical events that could affect or indicate an impairment in distributed water quality;
4. Changes in distribution system operation or maintenance that could affect distributed water quality (including water storage);
5. Source and treatment considerations that bear on distributed water quality, where appropriate (e.g., small GW systems); and
6. Existing water quality monitoring data.

(2) Level 1 assessment. A system must conduct a Level 1 assessment if it exceeds one of the TT triggers in 41.2(1)*"i"*(1).

1. A system must complete a Level 1 assessment as soon as practical after any trigger in 41.2(1)*"i"*(1). The assessment form must describe the sanitary defects detected and corrective actions completed and include a proposed timetable for any other corrective action completion. It may also be noted on the assessment form that no sanitary defects were identified. A system must submit the completed Level 1 assessment form to the department within 30 days of learning that it has exceeded a trigger.
2. If the department reviews the completed Level 1 assessment and determines that it is not sufficient (including any proposed timetable for corrective action completion), the department must consult with the system. If the department requires revisions after consultation, the system must submit a revised assessment form to the department on an agreed-upon schedule, not to exceed 30 days.
3. Upon submission of an assessment form, the department must determine if the system has identified the likely cause for the Level 1 trigger and, if so, establish that the system has corrected the problem or has included an acceptable schedule to correct the problem.

(3) Level 2 assessment. A system must ensure that a Level 2 assessment is conducted if it exceeds one of the TT triggers in 41.2(1)*"i"*(2). A system must comply with any department-required expedited or additional actions in the case of an E. coli MCL violation.

1. A system must ensure that a Level 2 assessment is completed by the department as soon as practical after any trigger in 41.2(1)*"i"*(2). The assessment form must describe the sanitary defects detected and corrective actions completed and include a proposed timetable for any other corrective action completion. It may also be noted on the assessment form that no sanitary defects were identified. A system must submit a completed Level 2 assessment form to the department within 30 days of learning that the system has exceeded a trigger.
2. If the department reviews the completed Level 2 assessment and determines that it is not sufficient (including any proposed timetable for corrective action completion), the department must consult with the system. If the department requires revisions after consultation, the system must submit a revised assessment form to the department on an agreed-upon schedule, not to exceed 30 days.
3. Upon submission of an assessment form, the department must determine if a system has identified the likely cause for the Level 2 trigger and determine whether the system has corrected the problem or has included an acceptable schedule to correct the problem.

(4) Corrective actions. A system must correct sanitary defects found through either a Level 1 or 2 assessment. Corrective action(s) that are not completed by a system prior to the submission of the assessment form must be completed in compliance with a timetable approved by the department in consultation with the system. Systems must notify the department when each scheduled corrective action is completed.

(5) Consultation. At any time during the assessment or corrective actions phase, either the system or the department may request a consultation with the other party to determine appropriate actions. A system may consult with the department on all relevant information that may impact its ability to comply with this subrule.

k. Reporting requirements.

(1) *E. coli.*

1. A system must notify the department by the end of the same day when it learns of an *E. coli*-positive violation or routine sample.

2. If a notification is outside of the department's routine office hours, the system shall call the department's Environmental Emergency Reporting Hotline at 515.725.8694.

(2) A system that has violated the coliform TT in 41.2(1)*"i"* must report the violation to the department no later than the end of the next business day after learning of the violation and must provide PN in accordance with rule 567—40.5(455B).

(3) A system required to conduct an assessment under the provisions of 41.2(1)*"i"* must submit an assessment form within 30 days. Systems must notify the department in accordance with 41.2(1)*"j"*(4) when each scheduled corrective action is completed.

(4) A system that has failed to comply with a coliform monitoring requirement must report the monitoring violation to the department within ten days of discovering the violation and must provide PN in accordance with rule 567—40.5(455B).

(5) A seasonal system must certify, prior to serving water to the public, that it has complied with the department-approved start-up procedure.

l. Recordkeeping requirements. Additional recordkeeping requirements are listed in 567—subrule 40.9(10).

m. Violations. A system is in violation and must conduct PN in accordance with rule 567—40.5(455B) in any of the following instances.

(1) *E. coli* MCL violation. A system is in violation of the MCL for *E. coli* when any of the following occurs:

1. An *E. coli*-positive repeat sample following a total coliform-positive routine sample;
2. A total coliform-positive repeat sample following an *E. coli*-positive routine sample;
3. Failure to take all required repeat samples following an *E. coli*-positive routine sample; or
4. Failure to test for *E. coli* when any repeat sample tests positive for total coliform.

(2) TT violation. A system is in violation of a TT trigger when any of the following occurs:

1. Exceedance of a TT trigger specified in 41.2(1)*"i"* and failure to conduct the required assessment within the time frame specified in 41.2(1)*"j"*;
2. Exceedance of a TT trigger specified in 41.2(1)*"i"* and failure to conduct the required corrective actions within the time frame specified in 41.2(1)*"j"*(4); or
3. A seasonal system failing to complete a department-approved start-up procedure prior to serving water to the public, including collection of a finished water sample that tests total coliform-negative.

(3) Monitoring violation. A system is in violation of monitoring requirements if it fails to either:

1. Take every required routine or additional routine sample in a compliance period; or
2. To analyze for *E. coli* following a total coliform-positive routine sample.

(4) Reporting violation. A system is in violation of the reporting requirements if it fails to:

1. Submit a monitoring report in a timely manner after a system properly conducts monitoring;
2. Submit a completed assessment form in a timely manner after a system properly conducts an assessment;
3. Notify the department in a timely manner following an *E. coli*-positive sample, as required by 41.2(1)*"h"*(1); or
4. Submit the certification of completion of department-approved start-up procedure by a seasonal system.

n. Best available technology (BAT). The EPA identifies, and the department has adopted, the following as the best technology, TTs, or other means available for all systems in achieving compliance with the *E. coli* MCL in 41.2(1)*"a."* The following is also identified as affordable technology, TTs, or other means available to systems serving 10,000 or fewer people for achieving compliance with the *E. coli* MCL.

(1) Protection of wells from fecal contamination by appropriate placement and construction.

(2) Maintenance of a disinfectant residual throughout the distribution system.

(3) Proper distribution system maintenance, including appropriate pipe replacement and repair procedures, main flushing programs, proper operation and maintenance of storage tanks and reservoirs, cross-connection control, and continual maintenance of a minimum positive water pressure of 20 psi in all parts of the distribution system at all times.

(4) Filtration or disinfection of surface water (SW) or influenced groundwater (IGW) in accordance with rules 567—43.5(455B), 567—43.9(455B), and 567—43.10(455B) or disinfection of GW in accordance with rule 567—41.7(455B) using strong oxidants such as, but not limited to, chlorine, chlorine dioxide, or ozone.

(5) For GW systems, compliance with the requirements of the department's wellhead protection program.

41.2(2) *Heterotrophic plate count (HPC) bacteria.*

a. Applicability. All PWSs that use a SW source or source under the direct influence of SW must provide treatment consisting of disinfection, as specified in 567—subrule 43.5(2), and filtration treatment, as specified in 567—subrule 43.5(3). The HPC is an alternate method to demonstrate a detectable disinfectant residual in accordance with 567—paragraph 43.5(2)*"d."*

b. Analytical methodology. PWSs shall conduct HPC bacteria analysis in accordance with 567—subrule 43.5(2) and the following analytical methods. When HPC bacteria are being measured in lieu of a detectable residual disinfectant pursuant to 567—paragraph 43.5(2)*"d,"* measurements must be conducted by a laboratory certified by the department to do such analysis. The time from sample collection to initiation of analysis may not exceed eight hours, and systems must hold the samples below 10 degrees Celsius during transit to the laboratory.

(1) Methods. The HPC shall be performed in accordance with one of the following methods:

1. Method 9215B Pour Plate Method, SM, 18th (1992), 19th (1995), 20th (1998), 21st (2005), and 22nd (2012) editions. The cited method in any of these editions may be used. SM Online method 9215 B-04 may be used.

2. SimPlate Method, "IDEXX SimPlate TM HPC Test Method for Heterotrophs in Water," November 2000, IDEXX Laboratories, Inc., One IDEXX Drive, Westbrook, ME 04092.

(2) Reporting. A PWS shall report the results of HPC bacteria in accordance with 567—subparagraph 40.8(3)*"c"*(2).

41.2(3) *Macroscopic organisms and algae.*

a. Applicability. This subrule applies to CWSs, NTNCs, and TNCs using SW or IGW, as defined by 567—subrule 43.5(1).

b. MCLs for macroscopic organisms and algae. Finished water shall be free of any macroscopic organisms such as plankton, worms, or cysts. The finished water algal cell count shall not exceed 500 organisms per mL or 10 percent of the total cells found in the raw water, whichever is greater.

c. Analytical methodology. Algal cell measurement shall be in accordance with Method 10200F: Phytoplankton Counting Techniques, SM, 18th edition, pp. 10-13 to 10-16. Such measurement shall be required only when the department determines, on the basis of complaints or otherwise, that excessive algal cells may be present.

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