

ORDER OF THE STATE OF WISCONSIN NATURAL RESOURCES BOARD  
REPEALING, RENUMBERING, AMENDING, REPEALING AND RECREATING AND CREATING  
RULES

The Wisconsin Natural Resources Board adopts an order to **repeal** NR 210.06 (4) to (6); to **renumber** NR 102.03 (6); to **amend** NR 102.04 (5) (a), 104.06 (2) (a) (intro.) and (b) (intro.), 104.20 (7), and 210.06 (2) (intro.) and (7); to **repeal and recreate** NR 102.04 (6), 210.06 (2) (a), 219.04 Table A and table notes 1 to 33, Table EM header row 2, parameters “Fecal Coliform”, “Salmonella” (including sub-rows), and “Dioxins and Furans” and table notes 8 and 11, and Table H and table notes 1 to 33; and to **create** NR 102.03 (9), 210.06 (1) (title), (2) (title), (b) (title) and (Note 2), and (3) (title), and 219.04 Table EM table notes 16 to 23 relating to updating Wisconsin’s water quality criteria for pathogens, specifically bacteria, to protect recreational uses; and updating related WPDES permit implementation procedures for the revised water quality standards to be consistent with EPA’s recreational water quality criteria, and affecting small business.

**WY-17-15**

**Analysis Prepared by the Department of Natural Resources**

**1. Statute Interpreted:**

Sections 281.15, 283.13, and 283.31, Wis. Stats.

**2. Statutory Authority:**

Sections 281.12, 281.13, 281.15, 283.13, 283.31, 283.37, 283.55, 283.83, and 227.11, Wis. Stats.

**3. Explanation of Agency Authority:**

Revisions to the recreational use, updated recreational water quality criteria, and newly developed impaired waters listing protocols will be promulgated pursuant to ss. 281.12, 281.13, and 281.15, Wis. Stats.:

- Section 281.12, Wis. Stats., grants the department general supervision and control to carry out the planning, management, and regulatory programs necessary for prevention/reduction of water pollution and for improvement of water quality.
- Sections 281.13(1)(a) and (b), Wis. Stats., grant the department the authority to create rules to research and assess water quality in the state.
- Section 281.15, Wis. Stats., mandates that the department promulgate water quality standards, including water quality criteria and designated uses. It recognizes that different use categories and criteria are appropriate for different types of waterbodies, and that the department shall establish criteria which are not more stringent than reasonably necessary to ensure attainment of the designated use for the waterbodies in question.

The Wisconsin Pollutant Discharge Elimination System (WPDES) permit program procedures to implement the revised standards will be promulgated under the following authority:

- Section 283.13(5), Wis. Stats., states that the department shall establish more stringent limitations than required under subs. 283.13(2) and (4), Wis. Stats., when necessary to comply with water quality standards.
- Section 283.31(3) and (4), Wis. Stats., state that the department may issue a permit upon condition that the permit contains limitations necessary to comply with any applicable federal law or regulation, state water quality standards, and total maximum daily loads.
- Section 283.37, Wis. Stats., grants the department authority to promulgate rules regarding permit

applications.

- Section 283.55, Wis. Stats., grants the department authority to impose monitoring and reporting requirements.
- Section 283.83, Wis. Stats., requires the department to establish a continuing planning process and that plans shall include implementation procedures including compliance schedule for revised water quality standards.
- Section 227.11(2), Wis. Stats., grants the department authority to promulgate rules that are necessary to administer the specific statutory directives in ch. 283, Wis. Stats.

#### **4. Related Statutes or Rules:**

These rules relate to surface water quality standards and the WPDES permit program. Related rules include chs. NR 102 and 104, Wis. Adm. Code, which comprise Wisconsin's surface water quality standards, and chs. NR 200 to 299, Wis. Adm. Code., which comprise the WPDES permit program.

#### **5. Plain Language Analysis:**

The Clean Water Act (CWA) requires states to adopt water quality standards to protect recreation in and on the water. Water quality standards include a recreation designated use and water quality criteria that protect this use. In addition to the CWA requirements, the Beaches Environmental Assessment and Coastal Health (BEACH) Act requires states with coastal waters (e.g., the Great Lakes) to adopt new or revised criteria for pathogens (including bacteria) to protect recreation not later than three years after the United States Environmental Protection Agency (EPA) publishes revised criteria to maintain eligibility for grant funding for communities. The EPA published revised national recommended recreation water quality criteria for bacteria in 2012.

Human waste contains a number of pathogens that can be spread through water and cause a wide range of diseases. The EPA employs the pathogen indicator concept for these criteria in which the indicator does not itself cause disease, but instead signals the potential for illness caused by human fecal contamination. Pathogen indicators, such as certain bacteria, are used because they tend to be more numerous than pathogens in human fecal matter and are cheaper, safer, and easier to measure. In their 2012 recommended criteria, EPA provides a choice for states to use either *E. coli* or enterococci as their pathogen indicator.

The goals of this rule package are to adequately protect the public while recreating in and on Wisconsin's waters; revise Wisconsin's bacteria water quality criteria to be consistent with EPA's latest recommendations; and update the permit requirements for sewage treatment works to ensure consistency with EPA's policies. To accomplish these goals, the department proposes to revise the bacteria water quality criteria for recreation in ch. NR 102, Wis. Adm. Code, remove fecal coliform criteria for individual waters from ch. NR 104, Wis. Adm. Code, revise the permit requirements for publicly owned and privately owned domestic sewage treatment works in ch. NR 210, Wis. Adm. Code, and update Tables A, EM, and H, or portions thereof related to bacteria, to incorporate EPA's most recent approved methods in ch. NR 219, Wis. Adm. Code.

#### Bacteria Water Quality Criteria for Recreation

In 2012, EPA recommended updates to bacteria criteria and provided states with a choice of criteria for *E. coli* and enterococci at two different risk levels. The department evaluated the pathogen indicator, risk level, and the frequency and duration of exceedances for assessment determinations. The department also added language to allow for the development of bacteria site-specific criteria and removed the fecal coliform "variance" criteria in ch. NR 104, Wis. Adm. Code.

### *Pathogen Indicator*

EPA provided states two options for their pathogen indicator: *E. coli* or enterococci. Since the adoption of the BEACH Act in 2004, permittees in Wisconsin and the other Great Lake States have monitored for *E. coli* in the Great Lakes basin. As such, there is a large amount of data on *E. coli* levels in the Great Lakes. Additionally, the department has been assessing inland and Great Lakes beaches against EPA's 1986 *E. coli* criteria. Given these reasons, the department chose to use *E. coli* as the pathogen indicator for the revised recreation criteria.

### *Criteria Magnitude*

EPA recommends that states assess for their selected indicator using two methods: the geometric mean (GM) and the statistical threshold value (STV). Use of both methods ensures that states not only assess the average over time with the GM, but also account for the frequency of bacterial level spikes with the STV.

Since 1986, EPA's recommended bacteria water quality criteria for recreation have consisted of long-term and short-term criteria. In the 1986 recommendations, a GM was used as the long-term criterion and a single sample maximum (SSM) as the short-term criterion. In the 2012 recommendations, the same geometric mean is used as the long-term criterion. However, the recommendations for short-term criteria replace the SSM with a different approach, the STV. The SSM criterion from 1986 set a "do not exceed" threshold which limited the ability to account for natural variation. The 2012 STV criterion corresponds to the 90th percentile of the water quality distribution data. This is intended to allow for occasional, but not frequent, spikes in bacteria levels, reflecting the expected variability in water quality measurements.

Previously, when the department was using fecal coliform as the pathogen indicator, the criterion was only applied as a geometric mean. The revised rule for *E. coli* contains both GM and STV criteria.

### *Illness Rate*

EPA provided two illness rates for states to choose from: either 32 or 36 cases of gastrointestinal illness out of 1,000 primary contact recreation users. The department selected the criteria based on the higher illness rate of 36 per 1,000 users. The criteria based on the higher illness rate are consistent with the level of protection provided by the EPA's previous and current criteria recommendations, and EPA concluded that criteria based on either of the illness rates would provide adequate human health protection. Criteria based on the lower illness rate would have been more stringent than criteria based on the higher illness rate. The department evaluated the impact of selecting the lower illness rate on permittees and impaired waters listings. Selecting the lower illness rate would unnecessarily require lower (more stringent) effluent limits for facilities and increase the number of impaired waters and beach advisories without a commensurate decrease in human health risk.

### *Criteria Duration*

A criterion's duration is the time period over which the criterion is assessed. The department selected a duration of 90 days, which means that samples from throughout a 90-day time period would be used for calculating attainment of the criteria. The duration of 90 days is proposed for both geometric mean and statistical threshold value criteria. It was selected to ensure adequate protection of the recreation designated use and to allow assessment of Wisconsin's waters in a comprehensive and informative manner. This duration allows the department to assess more waterbodies and allows for a clear evaluation of the waterbody's impairment status. The 90-day duration is consistent with a white paper produced by EPA clarifying that up to 90 days was determined to be an acceptable and scientifically defensible duration for *E. coli* criteria (U.S. EPA. 2015. *Narrative justification for longer duration period for recreational water quality criteria*).

### Bacteria Site-Specific Criteria (SSC)

When numeric criteria are established, they must be based on EPA's recommended water quality criteria, EPA's recommended water quality criteria modified to reflect site-specific conditions, or other scientifically defensible methods. The EPA must review and approve a state's criteria and does so only if the criteria are based on sound scientific rationale and contain sufficient parameters to protect the designated use. The EPA recognizes that there are sites where non-human and non-fecal sources may contribute to high bacteria levels while the probability of illness at these sites may be much lower than the probability of illness at sites with human sources. In such cases, the EPA allows for less-stringent site-specific criteria to be established if they are based on sound scientific rationale and contain sufficient parameters to protect the designated use.

This rule package includes language that allows the department to adopt bacteria SSC by rule for a specific waterbody. To ensure that bacteria SSC adopted by the state are appropriate, scientifically defensible and protective, the following conditions must be demonstrated: the proposed SSC were developed using an EPA approved method, procedure, or test, are based on sound scientific rationale, and the proposed SSC are as protective of the recreation use as the statewide *E. coli* criteria. For a less-stringent SSC, the request must also demonstrate that the predominant source of the bacteria must be non-human or non-fecal.

### Variance Criteria

The existing language in ch. NR 104, Wis. Adm. Code, contains fecal coliform variance criteria for certain individual waters. As part of this rule package, the department removed all references to these variance criteria because they are outdated and not adequately protective. These criteria were based on recommendations by the National Technology Advisory Committee in 1968 for secondary contact recreation. Fecal coliform is no longer recommended as a pathogen indicator because studies conducted in the 1970-80s did not find a correlation between fecal coliform levels and the rate of gastrointestinal illness. Additionally, the EPA does not currently have criteria recommendations for secondary contact waters and the department does not have a designated use category for secondary contact waters. Furthermore, the variance criteria were intended to be temporary with an expectation that waters meet these criteria by 1977 and the statewide criteria by July 1983.

### Permit Requirements

#### *Effluent Limitations*

In the existing language in ch. NR 210, Wis. Adm. Code, a fecal coliform limit of 400 cfu/100 mL applies to all facilities that are required to disinfect. This limit is a categorical limit (i.e., an effluent limit that applies to certain categories of wastewater dischargers) and not a water quality based limit (i.e., an effluent limit designed to meet a water quality standard in the receiving water). Facilities that are disinfecting should be able to maintain fecal coliform in their effluent below this level; however, this limit does not ensure that fecal coliform water quality criteria are met in the receiving water. The department replaced the fecal coliform limit with water quality based effluent limits (WQBELs) for *E. coli* during the disinfection time period to protect recreation (typically May-September, although the time period may be extended on a case-by-case basis). For facilities required to disinfect the rest of the year, they may continue to meet the *E. coli* limits or the currently existing fecal coliform limits will continue to apply.

Federal regulations require permit limits for publicly owned treatment works (POTWs) with continuous discharge to be expressed as both average monthly discharge limitations (long-term limits) and average weekly limitations (short-term limits) unless impracticable. The department elected to establish these limits using EPA's recommended "end-of-pipe" approach whereby both the GM and STV used in the criteria are applied to the end-of-pipe discharge as permit limits (U.S. EPA. 2015. *FAQ: NPDES Water-*

*Quality Based Permit Limits for Recreational Water Quality Criteria.*) The department initially evaluated use of a calculated weekly geometric mean limit as the short-term limit instead of the STV; however it was determined that this was impracticable because it would result in frequent exceedances of the STV criteria in surface waters near discharge locations. Application of the STV is more straightforward, is EPA's recommended approach, and is directly protective of both components of the water quality criteria given the variability in *E. coli* levels. Both the GM and STV permit limits will be applied on a calendar-month basis (rather than a rolling 90-day basis as in the criteria) for simplicity of application.

#### *Repeal of Redundant Language on Compliance Schedules and Public Notice*

The proposed rules repeal ss. NR 210.06 (4) to (6), Wis. Adm. Code, as they are redundant with more recent codes that provide more detailed information. Language in sub. (4) on compliance schedules is repealed because general language allowing compliance schedules for any point source discharger and any substance is found in s. NR 205.14, Wis. Adm. Code, with specific requirements provided in s. NR 106.117, Wis. Adm. Code. Language in subs. (5) and (6) on tentative and final determinations related to the permit, public notice processes, and review procedures are repealed because this information is provided in detail for all facilities in ch. NR 203, Wis. Adm. Code, "Wisconsin Pollutant Discharge Elimination System Public Participation Procedures," which covers public noticing of permit applications received and tentative and final determinations. It also covers permit actions such as final determinations and modifications or reissuance of permits. Part of sub. (7) is repealed that required perpetual maintenance of the same WPDES permit conditions as were established in 1986, because it is appropriate that permit terms and conditions evolve over time as needed.

#### *Update of tables with EPA-approved methodologies*

Chapter NR 219, Wis. Adm. Code, includes tables of EPA-approved methods for analyzing bacteria-related parameters. Tables A, EM, and H, or portions thereof related to bacteria, are updated to incorporate EPA's most recent approved methods.

### **6. Summary of, and Comparison with, Existing or Proposed Federal Statutes and Regulations:**

With the revisions contained in this rule package, the department rules will be consistent with the following federal regulations:

- Clean Water Act section 303(c), which requires states to periodically review and modify or adopt, if necessary, water quality standards for protection and propagation of fish and shellfish and recreation in and on the water;
- Clean Water Act section 303(i)(1)(B), which requires states to adopt water quality criteria for pathogens and pathogen indicators for coastal recreation waters based on federal criteria published by EPA;
- 40 CFR 131.10 and 11, which require states to develop water quality standards comprised of uses and criteria to protect the uses, and requires that criteria be based on federal guidance, federal guidance modified to reflect site-specific criteria, or other scientifically-defensible methods;
- 40 CFR 131.4 and 131.11, which allows states to adopt their own water quality criteria so long as these criteria are protective of human health or welfare, enhance the quality of the water, and serve the purposes of the Clean Water Act;
- 40 CFR 122.44(d), which provides that WQBELs must be derived from and comply with water quality standards and designated uses;
- 40 CFR 122.45(d), which requires that POTWs with continuous discharges receive limits expressed as monthly average and weekly average limits;
- 40 CFR 122.47, which specifies the protocols and restrictions for establishing compliance schedules in WPDES permits;

- 40 CFR Part 132, Appendix F, Procedure 9, which authorizes compliance schedule extensions within the Great Lakes Basin.

### **7. Comparison with Similar Rules in Adjacent States:**

For this rule package, comparisons were made to the other states in EPA Region 5 (Illinois, Indiana, Michigan, Minnesota, and Ohio) and Iowa. All of the Region 5 states are subject to the Clean Water Act (CWA), BEACH Act, and EPA regulations. As Iowa does not have any coastal waters, they are not subject to the BEACH Act but are still subject to the CWA and EPA regulations. A brief comparison with these states is provided below on the key issues addressed in this rule package.

#### Bacteria Water Quality Criteria for Recreation

The other states have different criteria for each of their recreation use subcategories. Because Wisconsin has a single recreation use category, only the criteria for the “full contact” category were considered in this comparison. Wisconsin is not considering a secondary contact use category at this time because EPA does not currently have recommended criteria for secondary contact waters. Because Illinois is currently revising its criteria for bacteria, they were not included in these comparisons.

#### *Pathogen Indicator*

All of the states that were used for this comparison, except Illinois, use *E. coli* as the pathogen indicator. Illinois is currently in the process of revising its criteria to use *E. coli*. In this rule package, the department selected *E. coli* as the pathogen indicator for Wisconsin’s criteria, consistent with these other states.

#### *Criteria Magnitude*

Indiana and Iowa have short- and long-term criteria based on EPA’s 1986 recommendations. Michigan also bases its criteria on EPA’s 1986 recommendations but uses single day GM instead of the SSM as its short-term criterion. Minnesota currently has criteria based on EPA’s 1986 recommendations. Ohio revised its criteria in 2016 based on EPA’s 2012 recommendations.

In this rule package, the department selected an approach that is consistent with Ohio. In the revised rule, EPA’s 2012 recommendations were used to establish Wisconsin’s criteria because they are based on the latest scientific knowledge and allow the natural variation in bacteria levels to be considered when assessing the waterbody.

#### *Illness Rate*

In its 2012 recommendations EPA developed criteria based on two illness rates, with the higher illness rate corresponding with the level of protection provided by the EPA’s 1986 recommendations. Ohio’s criteria are based on the higher illness rate. A comparison to the other states was not made as their criteria were not based on the 2012 recommendations.

In this rule package, the department selected an approach that is consistent with Ohio. In the revised rule, the department selected the criteria based on the higher illness rate because that rate is consistent with EPA’s previous and current recommended risk level, and selection of the lower illness rate would unnecessarily increase the number of impaired waters and beach advisories.

#### *Criteria Duration*

All of the other states, except for Iowa, have duration specified as part of their criteria. Michigan, Minnesota, and Indiana’s criteria are based on EPA’s 1986 recommendations. Both Michigan and Indiana use a monthly duration for both the GM and SSM criteria. Michigan uses geometric mean values for both its long- and short-term criteria and uses a duration of a month for the long-term criterion and a day for the short-term criterion. Ohio’s criteria are based on EPA’s 2012 recommendations and use a duration of

90 days for both its GM and STV criteria.

In this rule package, the department selected an approach that is consistent with Ohio and is acceptable to EPA. The revised rule specifies a duration of 90 days for both the GM and STV criteria because it allows the department to adequately protect the recreation designated use while assessing Wisconsin's waters in a comprehensive and informative manner.

#### Bacteria Site-Specific Criteria

None of the other states have language specific to the development of site-specific criteria for bacteria.

#### Variance Criteria

These variances, proposed for deletion, are specific to individual waterbodies in Wisconsin. A comparison to the other states was not conducted.

#### Permit Requirements

To ensure recreation is protected in Wisconsin's waters, dischargers of treated human waste are required to meet effluent limits for bacteria. The requirements described in this section apply to facilities that are subject to ch. NR 210, Wis. Adm. Code, including publicly owned treatment works and privately owned domestic sewage treatment works. Only the requirements for dischargers to "full contact" use waters were considered in this comparison as Wisconsin has a single recreation use category. Because Illinois is currently revising its permit requirements for bacteria, they were not included in these comparisons.

#### *Effluent Limitations*

Effluent limits vary by state. For this comparison, only the limits that apply during the time frame in which the bacteria criteria apply were included. Minnesota and Michigan have effluent limits for fecal coliform that are based on EPA's 1976 recommended criteria. Minnesota has a monthly limit equal to the geometric mean criterion and does not have specified monitoring requirements. Michigan has monthly and weekly limits, with the monthly limit equal to the GM criterion and the weekly limit equal to the "10% exceedance" criterion. Michigan requires a minimum of 5 samples for the monthly limit and 3 samples for the weekly limits.

Iowa and Indiana have effluent limits for *E. coli* that are based on EPA's 1986 recommended criteria. Iowa has a monthly limit equal to the GM criterion and requires a minimum of 5 samples a month, with monitoring conducted for one month during each quarter of the recreation season. Indiana has both monthly and daily limits. The monthly limit equals the GM criterion and the daily limit equals the SSM criterion for designated bathing beaches. The daily limit only applies when 10 or more samples have been collected in a month. Indiana bases its minimum monitoring requirements on the average design flow of the facility.

Ohio has monthly and weekly effluent limits for *E. coli*. Limits for dischargers to the Ohio River are based on EPA's 1986 recommended criteria while limits for dischargers to all other waters are based on EPA's 2012 recommended criteria. These limits differ because of specific requirements from the Ohio River Valley Water Sanitation Commission. For the Ohio River dischargers, the monthly limit equals the GM criterion (rounded) and the weekly limit equals the SSM criterion for designated bathing beaches (rounded). For dischargers to other Ohio waters, the monthly limit equals the GM criterion and the weekly limit is calculated using procedures in the EPA's *Technical Support Document for Water Quality-Based Toxics Control*.

In this rule package, the department selected EPA's recommended "end-of-pipe" approach of applying both the GM and STV criteria to the end-of-pipe discharge, which "is considered to be the simplest and

most common method to develop the effluent limits for pathogens and pathogen indicators” (U.S. EPA. 2015. *FAQ: NPDES Water-Quality Based Permit Limits for Recreational Water Quality Criteria*). The monthly geometric mean is used by several states. While neighboring states use a wide variety of approaches to the short-term limit, the STV (one type of short-term limit) is not currently applied by any of Wisconsin’s neighboring states.

**8. Summary of Factual Data and Analytical Methodologies Used and How Any Related Findings Support the Regulatory Approach Chosen:**

The methodology identified in this rule package is based on Clean Water Act and Great Lake Initiative requirements and on EPA guidance including the U.S. EPA (March 1991) Technical Support Document for Water Quality-based Toxics Control. PB91-127415: Office of Water.

**9. Analysis and Supporting Documents Used to Determine the Effect on Small Business or in Preparation of an Economic Impact Report:**

This rule is expected to have a moderate economic impact estimated at an annual cost of approximately \$2.1 million (rounded to two significant figures). The costs incurred will be due to increased disinfection needed for some facilities to comply with *E. coli* permit limits, and changes in analytical methods associated with monitoring each type of bacteria. These changes solely pertain to facilities subject to ch. NR 210, Wis. Adm. Code (i.e., publicly owned treatment works and privately owned domestic sewage treatment works). Of 354 total facilities that disinfect, over half (208) are expected to already meet permit limits based on *E. coli* with no additional treatment. The department estimates that 41% (146) will need to increase treatment, with a total annual cost of increased treatment for all facilities combined of \$2,100,000. We anticipate the total annual cost of sample analysis for facilities that monitor to be \$53,000. Cost savings for 20 facilities that will be able to reduce monitoring are estimated at \$22,000.

Costs for increased disinfection were estimated using a first-order kinetics model, in which a multiplier representing an increased level of ultraviolet or chlorine disinfection needed beyond the current treatment level was computed for each facility. The cost estimates developed in this analysis included capital costs and operation and management costs. Capital costs were amortized over 20 years using a nominal discount rate of 3.6%. Costs for lab analysis were estimated using information obtained from several commercial laboratories and manufacturers of lab equipment. Methods are described in this rule’s Fiscal Estimate/Economic Impact Analysis.

For small businesses, costs were determined in the same way. The total annual costs for small businesses are expected to be minimal, with an estimated total compliance cost of \$2,200 for five facilities combined.

**10. Effect on Small Business (initial regulatory flexibility analysis):**

Five of the identified facilities may be affected small businesses, such as mobile home parks or nursing homes. Costs for small businesses were estimated in the same way as costs for the overall group of facilities, but using just the subset of these five facilities. Some facilities may need to increase disinfection to comply with *E. coli* permit limits and/or change lab analysis procedures. The total annual compliance cost for these facilities combined is estimated at \$2,200. This includes an estimated cost of \$1,500 for increasing disinfection, and a cost of \$660 for switching analytical methods from fecal coliform to *E. coli* during the recreation period.

**11. Agency Contact Person:** Kristi Minahan, Wisconsin Department of Natural Resources, Bureau of Water Quality WY/3, P.O. Box 7921, Madison, WI 53707-7921;  
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**12. Place where comments are to be submitted and deadline for submission:**

Public hearings were held on April 18, April 23 and August 7, 2019. Written comments were accepted at the public hearings, by regular mail and by email.

The deadline for submitting public comments was August 20, 2019.

The consent of the Attorney General will be requested for the incorporation by reference of certain EPA-approved laboratory methods used to analyze bacteria samples. These are incorporated by reference in ch. NR 219.04 Tables A, EM, and H.

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**SECTION 1. NR 102.03 (6) is renumbered NR 210.03 (10m).**

**SECTION 2. NR 102.03 (9) is created to read:**

**NR 102.03 (9)** “U.S. EPA” means the United States environmental protection agency.

**SECTION 3. NR 102.04 (5) (a) is amended to read:**

**NR 102.04 (5) (a) General.** All surface waters shall be suitable for supporting recreational use and shall meet the criteria specified in sub. (6). ~~A sanitary survey or evaluation, or both to assure protection from fecal contamination is the chief criterion for determining the suitability of a water for recreational use.~~

**SECTION 4. NR 102.04 (6) is repealed and recreated to read:**

*[Note to LRB: NR 102.04 (6) (b) is created in Board Order WY-23-13.]*

**NR 102.04 (6) CRITERIA FOR RECREATIONAL USE.** Bacteria criteria are established as follows to protect humans from illness caused by fecal contamination due to recreational contact with surface water:

(a) *Bacteria.* 1. ‘Criteria’. All of the *Escherichia coli* (*E. coli*) criteria in Table A apply unless bacteria site-specific criteria have been adopted pursuant to subd. 2.

<b>Table A</b>	
<i>E. coli</i> (counts <sup>1</sup> per 100 mL)	
Geometric Mean <sup>2</sup>	Statistical Threshold Value <sup>3</sup>
126	410
1. For determining attainment or compliance, counts are considered equivalent to either colony forming units or most probable number.	

- |   |
|---|
| <ol style="list-style-type: none"><li>2. The geometric mean shall not be exceeded in any rolling 90-day period during the recreation season.</li><li>3. The statistical threshold value shall not be exceeded more than 10 percent of the time during any rolling 90-day period during the recreation season.</li></ol> |
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**Note:** The department developed the *E. coli* criteria in this section based on criteria developed by U.S. EPA. U.S. EPA developed the *E. coli* criteria using membrane filtration methods to count *E. coli* colony forming units. Entities wishing to use quantitative polymerase chain reaction (qPCR) and a conversion factor to compare resulting *E. coli* counts to the criteria in Table A may seek U.S. EPA and department approval for using alternative indicators and methods as outlined in U.S. EPA technical support document EPA-820-R-14-011.

**Note:** Under the department’s beach advisory program, a beach advisory is issued when a beach reaches the “Beach Action Value” of 235 counts per 100 mL and a beach closure is issued at 1000 counts per 100 mL, unless site-specific conditions indicate use of an alternate metric. More information on the beach advisory program is available at <http://wibeaches.us>.

2. ‘Site-specific criteria.’ a. The department may establish bacteria site-specific criteria by rule to protect a waterbody’s recreational use when it is determined that the statewide *E. coli* criteria under subd. 1 are inappropriate due to site-specific conditions. Once bacteria site-specific criteria are adopted in a rule and approved by U.S. EPA, those criteria supersede the statewide *E. coli* criteria under subd. 1 for that waterbody.

b. Any interested party may submit proposed bacteria site-specific criteria for a waterbody to the department for review and consideration. Any request for bacteria site-specific criteria must include a demonstration that the proposed site-specific criteria were developed using a U.S. EPA approved method, procedure, or test, are based on sound scientific rationale, and are as protective of the recreational use as the statewide *E. coli* criteria in subd. 1. A request for a less-stringent site-specific criteria must also demonstrate that the predominant source of the bacteria is non-human or non-fecal.

**SECTION 5. NR 104.06 (2) (a) (intro.) and (b) (intro.) are amended to read:**

**NR 104.06 (2) (a)** The following surface waters in the southeast district shall meet the standards for fish and aquatic life except that the dissolved oxygen shall not be lowered to less than 2 mg/L at any time, ~~nor shall the membrane filter fecal coliform count exceed 1,000 per 100~~

~~ml as a monthly geometric mean based on not less than 5 samples per month nor exceed 2,000 per 100 ml in more than 10% of all samples during any month:~~

(b) The following surface waters in the southeast district shall meet the standards for fish and aquatic life except that the dissolved oxygen may not be lowered to less than 2 mg/L at any time, ~~nor may the membrane filter fecal coliform count exceed 1,000 per 100 mL as a monthly geometric mean based on not less than 5 samples per month~~ nor may the ambient water temperature exceed 89°F at any time at the edge of the mixing zones established by the department under s. NR 102.05 (3):

**SECTION 6. NR 104.20 (7) is amended to read:**

**NR 104.20 (7)** The sector of Honey Creek above the Clarno-Cadiz town line shall meet the standards for fish and aquatic life except that the dissolved oxygen shall not be lowered to less than 2 mg/L at any time. ~~The membrane filter fecal coliform count in this sector shall not exceed 1,000 per 100 ml as a monthly geometric mean based on not less than 5 samples per month, nor exceed 2,000 per ml in more than 10% of all samples during any month.~~

**SECTION 7. NR 210.06 (1) (title) and (2) (title) are created to read:**

**NR 210.06 (1) (title)** DISINFECTION REQUIREMENTS.

**(2) (title)** EFFLUENT LIMITATIONS.

**SECTION 8. NR 210.06 (2) (intro.) is amended to read:**

**NR 210.06 (2)** Where and when disinfection is required, the following effluent limitations shall apply:

**SECTION 9. NR 210.06 (2) (a) is repealed and recreated to read:**

**NR 210.06 (2) (a) *Bacterial indicators.*** 1. 'Recreation protection.' During the period of disinfection to protect recreational uses as determined under sub. (1) (a) or (c), all of the following shall apply:

a. The geometric mean of *E. coli* bacteria in effluent samples collected in any calendar month may not exceed 126 counts/100 mL.

**Note:** To calculate the geometric mean, a value of 1 should be used for any result of 0.

**Note:** As specified in ch. NR 102, Table A, for determining attainment or compliance with bacteria criteria or limits, counts are equivalent to either colony forming units or most probable number.

b. No more than 10 percent of *E. coli* bacteria samples collected in any calendar month may exceed 410 counts/100 mL.

**Note:** U.S. EPA developed the *E. coli* criteria in s. NR 102.04 (6), on which these effluent limits are based using membrane filtration to count *E. coli* colony forming units.

2. ‘Public drinking water supply protection.’ If a facility is required to disinfect to protect public drinking water supplies outside of the recreation period specified in sub. (1) (a) or (c), it may either continue to meet the *E. coli* limits specified in par. (a) 1. year-round, or the geometric mean of the fecal coliform bacteria for effluent samples collected in a period of 30 consecutive days may not exceed 400 counts/100 mL.

**SECTION 10. NR 210.06 (2) (b) (title) and (Note 2), and (3) (title) are created to read:**

**NR 210.06 (2) (b) (title)** *Chlorine.*

**Note:** Compliance schedules for effluent limits established under this subsection are authorized in s. NR 205.14 and procedures are detailed in s. NR 106.117. Language on tentative and final determinations related to the permit, public notice processes, and review procedures are provided for all facilities in ch. NR 203.

**(3) (title)** DISINFECTION DETERMINATION.

**SECTION 11. NR 210.06 (4) to (6) are repealed.**

**SECTION 12. NR 210.06 (7) is amended to read:**

**NR 210.06 (7) DISINFECTION CONTINUATION.** In the absence of a specific determination under sub. (1), all dischargers which are required to disinfect as of ~~the effective date of this rule~~ November 1, 1986 or thereafter shall continue to disinfect ~~and comply with all terms of their WPDES permit in effect on that date.~~

**SECTION 13. NR 219.04 Table A and table notes 1 to 33, and Table EM header row 2, Parameters “Fecal Coliform”, “Salmonella” (including sub-rows), and “Dioxins and Furans”, and table notes 8 and 11 are repealed and recreated to read:**

Table A

## List of Approved Biological Methods for Wastewater and Sewage Sludge

Parameter and units	Analytical Technology <sup>1</sup>	EPA	Standard Methods <sup>25,26</sup>	AOAC, ASTM, USGS	Other
<b>Bacteria</b>					
1. Coliform (fecal), number per 100 mL or number per gram dry weight	Most Probable Number (MPN), 5 tube, 3 dilution, or	p. 132 <sup>3</sup> 1680 <sup>11,15</sup> 1681 <sup>11,20</sup>	9221 E-2014		
	Membrane filter (MF) <sup>2,5</sup> , single step	p. 124 <sup>3</sup>	9222 D-2015 <sup>29</sup>	B-0050-85 <sup>4</sup>	
2. Coliform (fecal), number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 132 <sup>3</sup>	9221 E-2014; 9221 F.2-2014 <sup>33</sup>		
	Multiple tube/multiple well, or				Colilert-18 <sup>®13,18,28</sup>
	MF <sup>2,5</sup> , single step <sup>5</sup>	p. 124 <sup>3</sup>	9222 D-2015 <sup>29</sup>		
3. Coliform (total), number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 114 <sup>3</sup>	9221 B-2014		
	MF <sup>2,5</sup> , single step or two step	p. 108 <sup>3</sup>	9222 B-2015 <sup>30</sup>	B-0025-85 <sup>4</sup>	
	MF <sup>2,5</sup> with enrichment	p. 111 <sup>3</sup>	9222 (B+B.4e)-2015 <sup>30</sup>		
4. <i>E. coli</i> , number per 100 mL	MPN <sup>6,8,16</sup> multiple tube, or		9221 B.3-2014/9221 F-2014 <sup>12,14,33</sup>		
	Multiple tube/multiple well, or		9223 B-2016 <sup>13</sup>	991.15 <sup>10</sup>	Colilert <sup>®</sup> <sup>13 18</sup> Colilert-18 <sup>®</sup> <sup>13,17,18</sup>
	MF <sup>2,5,6,7,8</sup> , two step, or		9222 B-2015/ 9222 I-2015 <sup>31</sup>		
	Single step	1603 <sup>21</sup>			m-ColiBlue24 <sup>®19</sup>
5. Fecal streptococci, number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 139 <sup>3</sup>	9230 B-2013		
	MF <sup>2</sup> , or	p. 136 <sup>3</sup>	9230 C-2013 <sup>32</sup>	B-0055-85 <sup>4</sup>	
	Plate count	p. 143 <sup>3</sup>			
6. Enterococci, number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 139 <sup>3</sup>	9230 B-2013		
	MPN <sup>6,8</sup> , multiple tube/multiple well, or		9230 D-2013	D6503-99 <sup>9</sup>	Enterolert <sup>®</sup> <sup>13,23</sup>
	MF <sup>2,5,6,7,8</sup> single step or	1600 <sup>24</sup>	9230 C-2013 <sup>32</sup>		
	Plate count	p. 143 <sup>3</sup>			
7. <i>Salmonella</i> number per gram dry weight <sup>11</sup>	MPN multiple tube	1682 <sup>22</sup>			
<b>Aquatic Toxicity</b>					

8. Toxicity, acute, fresh water organisms, percent effluent	Daphnia, <i>Ceriodaphnia dubia</i> , 48-h static-renewal mortality				Note 27
	Fathead Minnow, <i>Pimephales promelas</i> , 96-h static renewal mortality, or 96-h flow-through mortality				Note 27
9. Toxicity, chronic, fresh water organisms, percent effluent	Daphnia, <i>Ceriodaphnia dubia</i> , survival and reproduction				Note 27
	Fathead minnow, <i>Pimephales promelas</i> , larval survival and growth				Note 27

<sup>1</sup> The method must be specified when results are reported.

<sup>2</sup> 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.

<sup>3</sup> Microbiological Methods for Monitoring the Environment, Water, and Wastes, EPA/600/8-78/017. 1978. U.S. EPA.

<sup>4</sup> U.S. Geological Survey Techniques of Water-Resource Investigations, Book 5, Laboratory Analysis, Chapter A4, Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples. 1989. USGS.

<sup>5</sup> Because the MF technique usually yields low and variable recovery from chlorinated wastewaters, the Most Probable Number method will be required to resolve any controversies.

<sup>6</sup> 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.

<sup>7</sup> When the MF method has been used previously to test waters with high turbidity, large numbers 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.

<sup>8</sup> 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.

<sup>9</sup> Annual Book of ASTM Standards-Water and Environmental Technology, Section 11.02. 2000, 1999, 1996. ASTM International.

<sup>10</sup> Official Methods of Analysis of AOAC International. 16th Edition, 4th Revision, 1998. AOAC International.

<sup>11</sup> Recommended for enumeration of target organism in sewage sludge.

<sup>12</sup> The multiple-tube fermentation test is used in 9221B.2-2014. 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.

<sup>13</sup> These tests are collectively known as defined enzyme substrate tests.

<sup>14</sup> After prior enrichment in a presumptive medium for total coliform using 9221B.2-2014, all presumptive tubes or bottles showing any amount of gas, growth or acidity within 48 h ± 3 h of incubation shall be submitted to 9221F-2014. Commercially available EC-MUG media or EC media supplemented in the laboratory with 50 µg/mL of MUG may be used.

<sup>15</sup> Method 1680: Fecal Coliforms in Sewage Sludge (Biosolids) by Multiple-Tube Fermentation Using Lauryl-Tryptose Broth (LTB) and EC Medium, EPA-821-R-14-009. September 2014. U.S. EPA.

<sup>16</sup> 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®, Quanti-Tray®/2000 and the MPN calculated from the table provided by the manufacturer.

<sup>17</sup> 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.

<sup>18</sup> Descriptions of the Colilert®, Colilert-18®, Quanti-Tray®, and Quanti-Tray®/2000 may be obtained from IDEXX Laboratories, Inc.

<sup>19</sup> A description of the mColiBlue24® test, is available from Hach Company.

<sup>20</sup> Method 1681: Fecal Coliforms in Sewage Sludge (Biosolids) by Multiple-Tube Fermentation using A-1 Medium, EPA-821-R-06-013. July 2006. U.S. EPA.

<sup>21</sup> Method 1603: *Escherichia coli* (*E. coli*) in Water by Membrane Filtration Using Modified Membrane-Thermotolerant *Escherichia coli* Agar (modified mTEC), EPA-821-R-14-010. September 2014. U.S. EPA.

<sup>22</sup> Method 1682: *Salmonella* in Sewage Sludge (Biosolids) by Modified Semisolid Rappaport-Vassiliadis (MSRV) Medium, EPA-821-R-14-012. September 2014. U.S. EPA.

<sup>23</sup> A description of the Enterolert® test may be obtained from IDEXX Laboratories Inc.

<sup>24</sup> Method 1600: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-β-D-Glucoside Agar (mEI), EPA-821-R-14-011. September 2014. U.S. EPA.

<sup>25</sup> *Standard Methods for the Examination of Water and Wastewater*, Joint Editorial Board, American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 23<sup>rd</sup> Edition (2017), 22<sup>nd</sup> Edition (2012), 21<sup>st</sup> Edition (2005), 20<sup>th</sup> Edition (1998), 19<sup>th</sup> Edition (1995), and 18<sup>th</sup> Edition (1992).

<sup>26</sup> *Standard Methods for the Analysis of Water and Wastewater*. With the promulgation of Federal Register /Vol. 77, No. 97 / Friday, May 18, 2012, the EPA lists only the most recently EPA-approved version of a Standard Method (regardless of the printed or online edition) in 40 CFR Part 136, with few exceptions, to identify the method with the year of Standard Methods approval or adoption designated by the last four digits in the method number (e.g., Standard Method 3113B-2004). This approach clearly identifies the version of the standard method approved under Part 136 and no longer ties it to a particular compendium printing or edition of Standard Methods. Methods can be purchased at [www.standardmethods.org/](http://www.standardmethods.org/).

<sup>27</sup> Compliance monitoring must be performed in accordance with the specifications in the “State of Wisconsin Aquatic Life Toxicity Testing Methods Manual, 2<sup>nd</sup> Edition,” Wisconsin Department of Natural Resources, 2004. This publication is available for inspection at the offices of the Department of Natural Resources and the Legislative Reference Bureau. Copies are available from the Department of Natural Resources, Bureau of Science Services, P.O. Box 7921, Madison, WI 53707.

<sup>28</sup> To use Colilert-18® to assay for fecal coliforms, the incubation temperature is 44.5 ± 0.2 °C, and a water bath incubator is used.

<sup>29</sup> On a monthly basis, at least ten blue colonies from positive samples must be verified using Lauryl Tryptose Broth and EC broth, followed by count adjustment based on these results; and representative non-blue colonies should be verified using Lauryl Tryptose Broth. Where possible, verifications should be done from randomized sample sources.

<sup>30</sup> On a monthly basis, at least ten sheen colonies from positive samples must be verified using lauryl tryptose broth and brilliant green lactose bile broth, followed by count adjustment based on these results; and representative non-sheen colonies should be verified using lauryl tryptose broth. Where possible, verifications should be done from randomized sample sources.

<sup>31</sup> Subject coliform positive samples determined by 9222 B-2015 or other membrane filter procedure to 9222 I-2015 using NA-MUG media.

<sup>32</sup> Verification of colonies by incubation of BHI agar at  $10 \pm 0.5$  °C for  $48 \pm 3$  h is optional. As per the Errata to the 23rd Edition of *Standard Methods for the Examination of Water and Wastewater*, “Growth on a BHI agar plate incubated at  $10 \pm 0.5$  °C for  $48 \pm 3$  h is further verification that the colony belongs to the genus *Enterococcus*.”

<sup>33</sup> 9221 F. 2-2014: This procedure allows for simultaneous detection of *E. coli* and thermotolerant coliforms by adding inverted vials to EC-MUG; the inverted vials collect gas produced by thermotolerant coliforms.

**TABLE EM**  
**List of Approved Analytical Methods for Sludge**

Parameter	Analytical Technology	Sample Preparation		Determinative Method			
		SW-846 <sup>1</sup>	EPA <sup>4</sup>	SW-846 <sup>1</sup>	EPA <sup>2,3</sup>	Standard Methods [ed.] <sup>8,9</sup>	Other
Coliform (fecal), number per gram dry weight	Most Probable Number (MPN), 5 tube, 3 dilution, or		p. 132, <sup>16</sup> 1680, <sup>11,17</sup> 1681 <sup>11,18</sup>		p. 132, <sup>16</sup> 1680, <sup>11,17</sup> 1681 <sup>11,18</sup>	9221 E-2014	Appendix F <sup>10</sup>
	Membrane filter (MF) <sup>21,22</sup> single step		p. 124 <sup>16</sup>		p. 124 <sup>16</sup>	9222 D-2015 <sup>19</sup>	

<i>Salmonella</i> number per gram dry weight <sup>11</sup>	MPN multiple tube		1682 <sup>20</sup>		1682 <sup>20</sup>		
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Dioxins and Furans	Gas Chromatography/Mass Spectrometry	8290A	1613B	8290A	1613B		
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<sup>8</sup> *Standard Methods for the Examination of Water and Wastewater*, Joint Editorial Board, American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 23<sup>rd</sup> Edition (2017), 22<sup>nd</sup> Edition (2012), 21<sup>st</sup> Edition (2005), 20<sup>th</sup> Edition (1998), 19<sup>th</sup> Edition (1995), and 18<sup>th</sup> Edition (1992).

<sup>11</sup> Recommended for enumeration of target organism in sewage sludge.



**SECTION 14. NR 219.04 Table EM table notes 16 to 23 are created to read:**

**NR 219.04 Table EM**

<sup>16</sup> Microbiological Methods for Monitoring the Environment, Water, and Wastes, EPA/600/8-78/017. 1978. U.S. EPA.

<sup>17</sup> Method 1680: Fecal Coliforms in Sewage Sludge (Biosolids) by Multiple-Tube Fermentation Using Lauryl-Tryptose Broth (LTB) and EC Medium, EPA-821-R-14-009. September 2014. U.S. EPA.

<sup>18</sup> Method 1681: Fecal Coliforms in Sewage Sludge (Biosolids) by Multiple-Tube Fermentation using A-1 Medium, EPA-821-R-06-013. July 2006. U.S. EPA.

<sup>19</sup> On a monthly basis, at least ten blue colonies from positive samples must be verified using Lauryl Tryptose Broth and EC broth, followed by count adjustment based on these results; and representative non-blue colonies should be verified using Lauryl Tryptose Broth. Where possible, verifications should be done from randomized sample sources.

<sup>20</sup> Method 1682: *Salmonella* in Sewage Sludge (Biosolids) by Modified Semisolid Rappaport-Vassiliadis (MSRV) Medium, EPA-821-R-14-012. September 2014. U.S. EPA.

<sup>21</sup> 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.

<sup>22</sup> Because the MF technique usually yields low and variable recovery from chlorinated wastewaters, the Most Probable Number method will be required to resolve any controversies.

**SECTION 15. NR 219.04 Table H and table notes 1 to 33 are repealed and recreated to read:**

**NR 219.04**

**Table H**

**List of Approved Microbiological Methods for Ambient Water**

Parameter and units	Method <sup>1</sup>	EPA	Standard Methods <sup>33</sup>	AOAC, ASTM, USGS	Other
<b>Bacteria:</b>					
1. Coliform (fecal), number per 100 mL	Most Probable Number (MPN), 5 tube, 3 dilution, or	p. 132 <sup>3</sup>	9221 E-2014, 9221 F.2-2014 <sup>32</sup>		
	Membrane filter (MF), <sup>2</sup> single step	p. 124 <sup>3</sup>	9222 D-2015 <sup>26</sup>	B-0050-85 <sup>4</sup>	
2. Coliform (total), number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 114 <sup>3</sup>	9221 B-2014		
	MF, <sup>2</sup> single step or two step	p. 108 <sup>3</sup>	9222 B-2015 <sup>27</sup>	B-0025-85 <sup>4</sup>	
	MF <sup>2</sup> with enrichment	p. 111 <sup>3</sup>	9222 (B + B.4e)-2015 <sup>27</sup>		
3. <i>E. coli</i> , number per 100 mL	MPN <sup>5,7,13</sup> , multiple tube, or		9221 B.3-2014/9221 F-2014 <sup>10,12,32</sup>		

	Multiple tube/multiple well, or		9223 B-2016 <sup>11</sup>	991.15 <sup>9</sup>	Colilert <sup>®</sup> , <sup>11,15</sup> Colilert-18 <sup>®</sup> <sup>11,14,15</sup>
	MF <sup>2,5,6,7</sup> , two step, or	1103.1 <sup>18</sup>	9222 B-2015/9222 I-2015, <sup>17</sup> 9213 D-2007	D5392-93 <sup>8</sup>	
	Single step	1603 <sup>19</sup> 1604 <sup>20</sup>			m-ColiBlue 24 <sup>®</sup> <sup>16</sup> , KwikCount <sup>™</sup> EC <sup>28,29</sup>
4. Fecal streptococci, number per 100 mL	MPN, 5 tube, 3 dilution, or	p. 139 <sup>3</sup>	9230 B-2013		
	MF <sup>2</sup> , or	p. 136 <sup>3</sup>	9230 C-2013 <sup>30</sup>	B-0055-85 <sup>4</sup>	
	Plate count	p. 143 <sup>3</sup>			
5. Enterococci, number per 100 mL	MPN <sup>5,7</sup> , multiple tube/multiple well, or		9230 D-2013	D6503-99 <sup>8</sup>	Enterolert <sup>®</sup> <sup>11,21</sup>
	MF <sup>2,5,6,7</sup> two step, or	1106.1 <sup>22</sup>	9230 C-2013 <sup>30</sup>	D5259-92 <sup>8</sup>	
	Single step, or	1600 <sup>23</sup>	9230 C-2013 <sup>30</sup>		
	Plate count	p. 143 <sup>3</sup>			
<b>Protozoa:</b>					
6. <i>Cryptosporidium</i>	Filtration/IMS/FA	1622 <sup>24</sup> , 1623 <sup>25</sup> , 1623.1 <sup>25,31</sup>			
7. <i>Giardia</i>	Filtration/IMS/FA	1623 <sup>25</sup> , 1623.1 <sup>25,31</sup>			

<sup>1</sup> The method must be specified when results are reported.

<sup>2</sup> 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.

<sup>3</sup> Microbiological Methods for Monitoring the Environment, Water and Wastes. EPA/600/8-78/017. 1978. U.S. EPA.

<sup>4</sup> U.S. Geological Survey Techniques of Water-Resource Investigations, Book 5, Laboratory Analysis, Chapter A4, Methods for Collection and Analysis of Aquatic Biological and Microbiological Samples. 1989. USGS.

<sup>5</sup> 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.

<sup>6</sup> When the MF method has not been used previously to test waters with high turbidity, large numbers 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.

<sup>7</sup> 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.

<sup>8</sup> Annual Book of ASTM Standards—Water and Environmental Technology. Section 11.02. 2000, 1999, 1996. ASTM International.

<sup>9</sup> Official Methods of Analysis of AOAC International, 16th Edition, Volume I, Chapter 17. 1995. AOAC International.

<sup>10</sup> The multiple-tube fermentation test is used in 9221B.3-2014. 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.

<sup>11</sup> These tests are collectively known as defined enzyme substrate tests.

<sup>12</sup> After prior enrichment in a presumptive medium for total coliform using 9221B.3-2014, all presumptive tubes or bottles showing any amount of gas, growth or acidity within 48 h ± 3 h of incubation shall be submitted to 9221F-2014. Commercially available EC-MUG media or EC media supplemented in the laboratory with 50 µg/mL of MUG may be used.

<sup>13</sup> 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<sup>®</sup> may be enumerated with the multiple-well procedures, Quanti-Tray<sup>®</sup> or Quanti-Tray<sup>®</sup>/2000, and the MPN calculated from the table provided by the manufacturer.

<sup>14</sup> Colilert-18<sup>®</sup> is an optimized formulation of the Colilert<sup>®</sup> 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<sup>®</sup> test, and is recommended for marine water samples.

<sup>15</sup> Descriptions of the Colilert<sup>®</sup>, Colilert-18<sup>®</sup>, Quanti-Tray<sup>®</sup>, and Quanti-Tray<sup>®</sup>/2000 may be obtained from IDEXX Laboratories Inc.

<sup>16</sup> A description of the mColiBlue24<sup>®</sup> test may be obtained from Hach Company.

<sup>17</sup> Subject coliform positive samples determined by 9222B-2015 or other membrane filter procedure to 9222I-2015 using NA-MUG media.

<sup>18</sup> Method 1103.1: *Escherichia coli* (*E. coli*) in Water by Membrane Filtration Using membrane-Thermotolerant *Escherichia coli* Agar (mTEC), EPA-821-R-10-002. March 2010. U.S. EPA.

<sup>19</sup> Method 1603: *Escherichia coli* (*E. coli*) in Water by Membrane Filtration Using Modified membrane-Thermotolerant *Escherichia coli* Agar (Modified mTEC), EPA-821-R-14-010. September 2014. U.S. EPA.

<sup>20</sup> Method 1604: Total Coliforms and *Escherichia coli* (*E. coli*) in Water by Membrane Filtration by Using a Simultaneous Detection Technique (MI Medium), EPA 821-R-02-024. September 2002. U.S. EPA.

<sup>21</sup> A description of the Enterolert<sup>®</sup> test may be obtained from IDEXX Laboratories Inc.

<sup>22</sup> Method 1106.1: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus-Esculin Iron Agar (mE-EIA), EPA-821-R-09-015. December 2009. U.S. EPA.

<sup>23</sup> Method 1600: Enterococci in Water by Membrane Filtration Using membrane-Enterococcus Indoxyl-β-D-Glucoside Agar (mEI), EPA-821-R-14-011. September 2014. U.S. EPA.

<sup>24</sup> Method 1622 uses a filtration, concentration, immunomagnetic separation of oocysts from captured material, immunofluorescence assay to determine concentrations, and confirmation through vital dye staining and differential interference contrast microscopy for the detection of *Cryptosporidium*. Method 1622: *Cryptosporidium* in Water by Filtration/IMS/FA, EPA-821-R-05-001. December 2005. U.S. EPA.

<sup>25</sup> Methods 1623 and 1623.1 use a filtration, concentration, immunomagnetic separation of oocysts and cysts from captured material, immunofluorescence assay to determine concentrations, and confirmation through vital dye staining and differential interference contrast microscopy for the simultaneous detection of *Cryptosporidium* and

*Giardia* oocysts and cysts. Method 1623: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA. EPA-821-R-05-002. December 2005. US EPA. Method 1623.1: *Cryptosporidium* and *Giardia* in Water by Filtration/IMS/FA. EPA 816-R-12-001. January 2012. U.S. EPA.

<sup>26</sup> On a monthly basis, at least ten blue colonies from positive samples must be verified using Lauryl Tryptose Broth and EC broth, followed by count adjustment based on these results; and representative non-blue colonies should be verified using Lauryl Tryptose Broth. Where possible, verifications should be done from randomized sample sources.

<sup>27</sup> On a monthly basis, at least ten sheen colonies from positive samples must be verified using Lauryl Tryptose Broth and brilliant green lactose bile broth, followed by count adjustment based on these results; and representative non-sheen colonies should be verified using Lauryl Tryptose Broth. Where possible, verifications should be done from randomized sample sources.

<sup>28</sup> A description of KwikCount™ EC may be obtained from Micrology Laboratories LLC.

<sup>29</sup> Approved for the analyses of *E. coli* in freshwater only.

<sup>30</sup> Verification of colonies by incubation of BHI agar at  $10 \pm 0.5$  °C for  $48 \pm 3$  h is optional. As per the Errata to the 23rd Edition of *Standard Methods for the Examination of Water and Wastewater*, “Growth on a BHI agar plate incubated at  $10 \pm 0.5$  °C for  $48 \pm 3$  h is further verification that the colony belongs to the genus *Enterococcus*.”

<sup>31</sup> Method 1623.1 includes updated acceptance criteria for IPR, OPR, and MS/MSD and clarifications and revisions based on the use of Method 1623 for years and technical support questions.

<sup>32</sup> 9221 F.2-2014: This procedure allows for simultaneous detection of *E. coli* and thermotolerant coliforms by adding inverted vials to EC-MUG; the inverted vials collect gas produced by thermotolerant coliforms.

<sup>33</sup> *Standard Methods for the Examination of Water and Wastewater*, Joint Editorial Board, American Public Health Association, American Water Works Association, and Water Pollution Control Federation, 23<sup>rd</sup> Edition (2017), 22<sup>nd</sup> Edition (2012), 21<sup>st</sup> Edition (2005), 20<sup>th</sup> Edition (1998), 19<sup>th</sup> Edition (1995), and 18<sup>th</sup> Edition (1992).

**SECTION 16. EFFECTIVE DATE.** This rule takes effect on the first day of the month following publication in the Wisconsin Administrative Register as provided in s. 227.22 (2) (intro.), Wis. Stats.

**SECTION 17. BOARD ADOPTION.** This rule was approved and adopted by the State of Wisconsin Natural Resources Board on October 23, 2019.

Dated at Madison, Wisconsin \_\_\_\_\_.

STATE OF WISCONSIN

DEPARTMENT OF NATURAL RESOURCES

BY \_\_\_\_\_

Preston D. Cole, Secretary