

**COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF ENVIRONMENTAL PROTECTION
BUREAU OF CLEAN WATER**

TRIENNIAL REVIEW OF WATER QUALITY STANDARDS

**RATIONALE FOR THE DEVELOPMENT OF
AMBIENT WATER QUALITY CRITERIA FOR**

BACTERIA

PROTECTION OF RECREATIONAL USE

Introduction

The United States Environmental Protection Agency (US EPA) has released its 2012 recreational water quality criteria (RWQC) recommendations for protecting human health in all coastal and non-coastal waters designated for primary contact recreation use. These recommendations are intended as guidance to states, territories and authorized tribes in developing water quality standards to protect swimmers from exposure to water that contains organisms that indicate the presence of fecal contamination (US EPA, 2012b). State-wide application of these nationally recommended recreational use bacteria criteria would provide an appropriate level of protection for those recreating in Pennsylvania's surface waters.

Pennsylvania's Current Recreational Use Bacteria Criteria

PA DEP (25 Pa Code; Chapter 93): Pennsylvania's recreational use bacteria criteria during the swimming season have been based upon a maximum fecal coliform level of 200 colony forming units per 100 mL (cfu/100 mL) since the early 1970's. The 2000 Water Quality Regulatory Basics Initiative Triennial Review (PA DEP, 2000) gives Pennsylvania its current bacteria criteria as indicated below. The bacteria water quality criteria currently found in §93.7 (Table 3) of Pennsylvania's water quality standards (25 Pa Code; Chapter 93) are still based on fecal and/or total coliform indicator organisms, and are as follows:

§ 93.7. Specific water quality criteria.

(a) Table 3 displays specific water quality criteria and associated critical uses. The criteria associated with the Statewide water uses listed in § 93.4, Table 2 apply to all surface waters, unless a specific exception is indicated in §§ 93.9a—93.9z. Other specific water quality criteria apply to surface waters as specified in §§ 93.9a—93.9z. All applicable criteria shall be applied in accordance with this chapter, Chapter 96 (relating to water quality standards implementation) and other applicable State and Federal laws and regulations.

TABLE 3

<i>Parameter</i>	<i>Symbol</i>	<i>Criteria</i>	<i>Critical Use*</i>

Bacteria	Bac ₁	(Fecal coliforms/ 100 ml)—During the swimming season (May 1 through September 30), the maximum fecal coliform level shall be a geometric mean of 200 per 100 milliliters (ml) based on a minimum of five consecutive samples each sample collected on different days during a 30-day period. No more than 10% of the total samples taken during a 30-day period may exceed 400 per 100 ml. For the remainder of the year, the maximum fecal coliform level shall be a geometric mean of 2,000 per 100 milliliters (ml) based on a minimum of five consecutive samples collected on different days during a 30-day period.	WC
	Bac ₂	(Coliforms/100 ml)—Maximum of 5,000/100 ml as a monthly average value, no more than this number in more than 20% of the samples collected during a month, nor more than 20,000/100 ml in more than 5% of the samples.	PWS

Bac₁ is designed to be protective of activities involving water contact sports (WC). The Bac₁ criterion is systematically applied to all surface waters in the Commonwealth unless otherwise specified in other portions of Pennsylvania’s water quality standards.

Historically, the Bac₂ criterion was originally implemented as a site-specific criterion to protect the potable water supply (PWS), where the WC use was removed. Bac₂ has always only been implemented in select waters where the WC use was removed. As such, Bac₂ is currently only applicable in the outer Erie Harbor and Presque Isle Bay; specifically, in the harbor area and central channel dredged and maintained by the United States Army Corps of Engineers.

Bac₁ affords a better level of use protection to drinking water (PWS) than would be offered by Bac₂ since Bac₁ is based on much lower concentrations of indicator organisms and Bac₁ is applicable to all waters statewide, where WC has not been removed.

Reference to 2004 Bacteria Rule in Drainage List X: The Beaches Environmental Assessment and Coastal Health (BEACH) Act of 2000 (US EPA, 2000) required each state and territory with coastal recreation waters to adopt into their water quality standards by April 10, 2004, bacteria criteria that were "as protective of human health as" the nationally recommended 1986 bacteria criteria (US EPA, 1986). The BEACH Act defined coastal recreation waters as the Great Lakes and coastal waters (including coastal estuaries) that states, territories, and authorized tribes officially recognize (or "designate") for swimming, bathing, surfing, or similar activities in the water. The 2004 Bacteria Rule for Coastal and Great Lakes Recreation Waters (2004 Bacteria Rule)(US EPA, 2004) established federal standards for those states and territories with coastal recreation waters that had not yet adopted bacteria criteria as protective of health as the 1986 criteria into their water quality standards. This federal promulgation included swimming

beaches in Lake Erie and Presque Isle in Pennsylvania and therefore 40 CFR 131.41 is referenced in Drainage List X (25 Pa Code §93.9x), where applicable. This reference was added to Drainage List X during Pennsylvania's 2009 Triennial Review of Water Quality Standards (TR-2009) which became effective upon publication of the final rulemaking on May 16, 2009 (39 Pa.B. 2523).

PDOH (28 Pa Code; Chapter 18): The Pennsylvania Department of Health (PDOH) maintains regulations at Title 28; §18.28. These PDOH regulations have primary jurisdiction at all those places in Pennsylvania designated as bathing beaches to protect swimmers from contamination. The current PDOH regulations apply statewide, not just to the Lake Erie coastal recreation waters. These PDOH regulations are based on the previous nationally recommended 1986 bacteria criteria (US EPA, 1986) and are given below.

§ 18.28. Bathing beach contamination.

(a) Use of a bathing beach found to be contaminated shall be discontinued until written approval to reopen the bathing beach for swimming or bathing is obtained from the Department. The permittee shall prominently post legible signs measuring at least 8" by 11" at all entrances to the bathing beach area informing the public that the bathing beach is closed and that swimming or bathing is prohibited. The approval will be given by the Department when the Department finds that the waters of the bathing beach are no longer contaminated.

(b) The water in bathing beaches will be considered contaminated for bathing purposes when one of the following conditions exists:

(1) The Department determines that a substance is being discharged or may be discharged into the water and is or may be hazardous to the health of persons using the bathing beach.

(2) The E. coli density of a water sample taken from the bathing beach exceeds 235 per 100 milliliters.

(3) The E. coli density in all water samples taken from the bathing beach, in any 30-day period during the bathing beach's operating season, exceeds a geometric mean of 126 per 100 milliliters.

Reference to PA DOH Regulations in Drainage List X: Specific reference to PDOH regulations at Title 28; §18.28 for Lake Erie and Presque Isle in Drainage List X as an exception to specific criteria, was added during TR-2009. This reference to the PDOH regulations was added as a result of the 2004 Bacteria Rule which promulgated bacteria criteria for these waters. Although these PDOH regulations are only currently referenced in the Department's Water Quality Standards (25 Pa Code §93) as Exceptions to Specific Criteria in List X, they do apply to all designated bathing beaches everywhere in Pennsylvania.

Current National Recommendation: 2012 RWQC

EPA last issued ambient water quality criteria recommendations for recreational waters in 1986. EPA issues such recommendations under the authority of the Clean Water Act (CWA). Amendments to the CWA by the BEACH Act of 2000 direct EPA to conduct studies associated with pathogens and human health, and to publish new or revised criteria recommendations for pathogens and pathogen indicators based on those studies. The 2012 RWQC recommendations meet those requirements set forth by the BEACH Act of 2000 (US EPA, 2012b).

The 2012 RWQC rely on the latest research and science, including studies that show a link between illness and fecal contamination in recreational waters. They are based on the use of two bacterial indicators of fecal contamination, *Escherichia coli* (*E. coli*) and enterococci (USEPA, 2012b). Culturable *E. coli* and enterococci are now known to be better indicators of fecal contamination than the previously used general indicators, total coliforms and fecal coliforms (USEPA, 2012a). The new criteria are designed to protect primary contact recreation, including swimming, bathing, surfing, water skiing, tubing, water play by children, and similar water contact activities where a high degree of bodily contact with the water, immersion, and ingestion are likely (US EPA, 2012a).

Most water quality criteria, including the 2012 RWQC, have three components which are magnitude, duration, and frequency. The magnitude of the 2012 RWQC is given as two sets of recommendations. The recommendations differ because they are calculated based on different illness rates. States and tribes may select either one of the two recommended sets of numeric concentration thresholds which comprise the magnitude. US EPA maintains that either of these magnitude recommendations would protect the public from exposure to harmful levels of pathogens (US EPA, 2012a). States and tribes have the flexibility to choose whichever of the two risk paradigms is most appropriate for them. The magnitude of both of the two different recommendations of the 2012 RWQC is summarized in the table below and each recommendation includes both a geometric mean (GM) and a statistical threshold value (STV). The STV approximates the 90th percentile of the water quality distribution. The STV is intended to be implemented so that it should not be exceeded in more than ten percent of the samples taken (US EPA, 2012a). The duration given for the final criteria is 30 days. The GM of the samples should not exceed the selected GM magnitude in any 30-day period. There should not be greater than a ten percent excursion frequency of the selected STV magnitude in the same 30-day interval (US EPA, 2012a & US EPA, 2012b).

Criteria Elements	Recommendation 1		Recommendation 2	
	Estimated illness rate = 36/1,000		Estimated illness rate = 32/1,000	
Indicator	GM (cfu/100 ml)	STV (cfu/100 ml)	GM (cfu/100 ml)	STV (cfu/100 ml)
Enterococci (marine & fresh)	35	130	30	110
E. coli (fresh)	126	410	100	320

Pennsylvania's Recommended Criteria

The Department is recommending changes to its bacteria criteria which will include replacing the current fecal coliform – based criteria for water contact sports (WC), during the swimming season (May 1 to September 30) with US EPA's 2012 RWQC in Pennsylvania's surface waters. This change is designed to protect those engaging in water contact sports (defined as the use of the water for swimming and related activities) from fecal contamination. There are two sets of recommendations based on two different risk paradigms (32 illnesses per 1000 swimmers and 36 illnesses per 1000 swimmers). EPA maintains that both risk paradigms are adequately protective (US EPA 2012a). The Department recommends adopting the *Escherichia coli* freshwater levels associated with the 36 per 1,000 illness rate (Recommendation 1). The *E. coli* levels associated with this risk paradigm (GM = 126 cfu/100 ml & STV = 410 cfu/100ml) are most closely akin to the current PDOH standards at Title 28; §18.28 (which apply to bathing beaches). The criteria values for the current DOH standards and the criteria values that were promulgated under the BEACH Act for Lake Erie beaches including Presque Isle Bay are a geometric mean value of 126 cfu/100 ml and a single sample maximum value of 235 cfu/100 ml. In order to achieve the most consistent approach and because EPA considers both risk paradigms to be equally protective, the Department favors the criteria based on Recommendation 1. The Department believes that will result in a more seamless transition.

The Department recommends that the current non-swimming season (when only secondary contact recreation occurs) fecal coliform-based numerical criterion, which is a geometric mean maximum value of 2,000 cfu/100 ml (found at 25 Pa Code; §93.3; Table 3) shall be retained and should continue to be applied statewide in all surface waters from October 1 to April 30. The US EPA is currently conducting research to help in designing criteria that will be protective of secondary contact recreation. When the US EPA finalizes and recommends these new Federal secondary contact recreational criteria, the Department will evaluate these recommendations and propose to adopt them if they are appropriate for Pennsylvania.

The current Bac₂ total coliform-based criterion with a critical use of PWS (also found at 25 Pa Code; §93.3; Table 3) has always been implemented as a site-specific criterion rather than a statewide criterion. This current total coliform-based criterion applies to specific waters, where the water contact sports (WC) use has been removed, and currently only to portions of Lake Erie (§93.9x; Drainage List X) in the outer Erie Harbor and Presque Isle Bay. The Bac₁ criterion is a more restrictive standard than Bac₂ with respect to the number of indicator organisms per unit volume, and it will continue to provide statewide protection for both WC and PWS. This site-specific Bac₂ criterion should, therefore, be deleted from Table 3 and incorporated into Drainage List X as an Exception to Specific Criteria.

Since the PDOH bathing beach regulations at Title 28; §18.28 apply to all regulated beaches, statewide, the Department recommends deleting references to the PDOH regulations found in 25 Pa Code §93.9x since they are not limited to Lake Erie. The Department also recommends deleting the language currently found at 25 Pa Code §93.9x, which refers to the promulgated Federal regulations (USEPA 2004 Bacteria Rule, 40 CFR 131.41) pertaining to Lake Erie and Presque Isle beaches. These references to 40 CFR 131.41 and Title 28; §18.28 as *Exceptions to Specific Criteria* are no longer necessary since the proposed *E. coli* WC criteria in Bac₁ will be

applied statewide, and the PDOH regulations already apply statewide. Recommended amendments to Table 3 and §93.9x are shown below.

TABLE 3

Parameter Symbol Criteria

*Critical Use**

Bacteria	Bac ₁	<p>[(Fecal coliforms/ 100 ml)] (<u>Escherichia coli/100 ml</u>) —During the swimming season (May 1 through September 30), the maximum [fecal coliform] <u>E. coli</u> level shall be a geometric mean of [200] <u>126</u> per 100 milliliters (ml) based on [a minimum of five] consecutive samples, each sample collected on different days, during a 30-day period. No more than 10% of the total samples taken during a 30-day period may exceed [400] <u>410</u> per 100 ml. (Fecal coliforms/ 100 ml)—For the remainder of the year, the maximum fecal coliform level shall be a geometric mean of 2,000 per 100 milliliters (ml) based on a minimum of five consecutive samples collected on different days during a 30-day period.</p>	WC
	[Bac ₂	<p>(Coliforms/100 ml)—Maximum of 5,000/100 ml as a monthly average value, no more than this number in more than 20% of the samples collected during a month, nor more than 20,000/100 ml in more than 5% of the samples.</p>	PWS]

§ 93.9x. Drainage List X.

Lake Erie					
Stream	Zone	County	Water Uses Protected	Exceptions to Specific Criteria	
1—Lake Erie	All sections of lake in PA except Outer Erie Harbor and Presque Isle Bay	Erie	CWF	<p>Delete Fe[,] and DO₁ [and Bac1] See GLWQA [Add E. coli per 40 CFR 131.41 (Except (f)) and See 28 Pa. Code § 18.28(b)(2) and (3)]</p>	

1—Lake Erie (Outer Erie Harbor and Presque Isle Bay)	Portion of lake bordered by Presque Isle on west, longitude 80° 01' 50" on east, and latitude 42° 10' 18" on north, except harbor area and central channel dredged and maintained by United States Army Corps of Engineers		Erie	WWF	<i>Delete</i> pH <i>Add</i> pH between 7 and 9 [<i>Add E. coli per 40 CFR 131.41 (Except (f)) and See 28 Pa. Code § 18.28(b)(2) and (3)</i>]
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<u>The following criterion is specific to Lake Erie (Outer Erie Harbor and Presque Isle Bay) waters in the Harbor area and central channel dredged and maintained by United States Army Corps of Engineers, based on special studies.</u>			
<u>Parameter</u>	<u>Symbol</u>	<u>Criteria</u>	<u>Critical Use</u>
<u>Bacteria</u>	<u>Bac₂</u>	<u>Total Coliforms/100 ml. Maximum of 5,000/100 ml as a monthly average value, no more than this number in more than 20% of the samples collected during a month, nor more than 20,000/100 ml in more than 5% of the samples.</u>	<u>PWS</u>

1—Lake Erie (Outer Erie Harbor and Presque Isle Bay)	Harbor area and central channel dredged and maintained by United States Army Corps of Engineers		Erie	WWF, <i>Delete</i> WC	<i>Delete</i> pH and Bac ₁ <i>Add</i> pH between 7 and 9, Bac ₂
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