FAQ: NPDES Water-Quality Based Permit Limits for Recreational Water Quality Criteria

April 18, 2014

What is the purpose of this *Frequently Asked Questions* document?

This set of *Frequently Asked Questions* (FAQ) provides an overview of NPDES permitting **applicable to continuous dischargers** (such as POTWs) based on water quality standards for pathogens and pathogen indicators associated with fecal contamination in primary contact recreational waters. This FAQ answers questions to help EPA, state, tribal and territorial NPDES permit writers understand implications of changes to state water quality standards based on the 2012 Recreational Water Quality Criteria (RWQC), published November 29, 2012.

The 2012 RWQC recommendations are for two bacterial indicators of fecal contamination, enterococci and *E. coli*. Section 304(a)(9) of the Clean Water Act directed EPA to publish new or revised water quality criteria recommendations for pathogens and pathogen indicators for the purpose of protecting human health. A pathogen indicator, as defined in section 502(23) of the CWA, is "a substance that indicates the potential for human infectious disease." Most strains of enterococci and *E. coli* do not cause human illness (that is, they are not human pathogens); rather, they indicate the presence of fecal contamination.

> *These FAQs provide advice on how to establish water-quality-based permit limits in National Pollutant Discharge Elimination System permits for recreational water quality criteria. The statutes and regulations cited in this document contain the requirements applicable to NPDES permitting. The document does not impose legally binding requirements on EPA, states, tribes, other regulatory authorities, or the regulated community, and may not apply to a particular situation based upon the circumstances. EPA, state, tribal and other decision makers retain the discretion to adopt approaches on a case-by-case basis that differ from those provided in this guidance where appropriate and consistent with statutory and regulatory requirements. EPA may update this document in the future as new information becomes available.*

Contents

Figures

1. Introduction to Pathogens

Q1-1: Why is EPA concerned about pathogens?

A1-1: Microorganisms that have the potential to cause disease in a host are called *pathogens*, and those that are capable of causing human diseases are known as human pathogens. Exposure to pathogens, for example in recreational water, may occur by ingestion, inhalation, or entry into the body through an open skin wound. Commonly documented illnesses from swimming in contaminated recreational waters include gastrointestinal illnesses, respiratory illnesses, skin rashes, and ear, eye, and wound infections. While the vast majority of these illnesses are self-limiting, in rare cases some infections can result in death.

In recreational waters, three groups of pathogens—viruses, bacteria, and parasitic protozoa—are of concern. Human pathogens in recreational waters can be introduced through contamination from human feces or from feces of other warm-blooded animals. These pathogens can cause diseases in bathers and in other recreators.

Q1-2: What are fecal indicator bacteria and why are they used in NPDES permits to protect recreational waters?

A1-2: Fecal indicator bacteria (FIB) are bacteria that can be used to measure the presence of fecal contamination, which is likely to contain these and other pathogens. For over a century, protection of public health for those using recreational waters has been measured through the use of FIB. EPA recommended in the 1986 criteria and in the 2012 RWQC that States have water quality standards (WQS) based on FIB for all primary contact recreational waters. The utility of enterococci and *E. coli* as predictors of adverse health outcomes has recently been further corroborated by numerous epidemiology studies.

Q1-3: How are pathogenic organisms that co-occur with fecal contamination addressed in wastewater treatment plants?

A1-3: Modern wastewater treatment incorporates disinfection processes designed to kill or reduce the number of pathogenic organisms. Some of the most commonly used disinfectants include chlorine, ultraviolet (UV) radiation, and ozonation. Disinfection processes are differentially effective on different types of pathogenic organisms. For instance, chlorination is more effective in suppressing bacteria than viruses and protozoan parasites. More information on these technologies is available at http://water.epa.gov/scitech/wastetech/mtbfact.cfm.

2. Introduction to the 2012 Recreational Water Quality Criteria Recommendations

Q2-1: What is the history of EPA's water quality criteria recommendations for recreational waters?

A2-1: EPA first issued ambient water quality criteria recommendations in 1976 based on fecal coliform for the protection of waters designated for swimming and other primary contact recreational uses. Subsequent epidemiological studies led EPA to conclude that *E. coli* and *Enterococcus* are better indicators of human fecal contamination because they are statistically associated with gastrointestinal illness. The same studies also indicated that fecal coliforms are not an appropriate predictor of disease potential because the relationship between fecal coliforms and swimming-associated disease was not

significant. In 1986 EPA issued revised recommendations that states, tribes and territories[1] adopt either *E. coli* or *Enterococcus* for fresh waters, and *Enterococcus* for marine waters. EPA again updated and revised recommendations for recreational water quality criteria in December 2012.

Q2-2: What are the new elements in the 2012 Recreational Water Quality Criteria (RWQC) recommendations that are important for NPDES permitting?

A2-2: These new criteria establish magnitude, duration and frequency of exceedance that should be specified in a state's WQS. However, EPA's 1986 criteria recommendations for bacteria did not include recommendations for specifying the duration and frequency of exceedance in state standards. For example, the 1986 criteria recommendations for duration of the geometric mean (e.g., whether 30 day or seasonal) and frequency of exceedance of the single sample maximum were not explicit. By comparison, the 2012 RWQC recommends an explicit duration of 30 days for both the geometric mean (GM) and the statistical threshold value (STV) and an explicit frequency of zero excursions of the GM and less than 10% excursions of the STV over the 30 day duration. Other changes are noted in Figure 1.

For more information, please refer to the 2012 RWQC fact sheet, December 2012, EPA-820-F-12-061, available at: http://water.epa.gov/scitech/swguidance/standards/criteria/health/recreation/upload/factsheet2012.pdf.

Figure 1

What is new or different in the 2012 RWQC compared to the 1986 Criteria?

- The 2012 RWQC are expressed as both a geometric mean (GM) and a statistical threshold value (STV).
- The 2012 RWQC now comprise a magnitude, duration, and frequency of excursion for both the GM and STV.
- The 2012 RWQC were developed based on the studies utilized in creating the 1986 WQC as well as more recent scientific information including the National Epidemiological and Environmental Assessment of Recreational Water (NEEAR) data.
- EPA is including two sets of recommended criteria values that protect the designated use of primary contact recreation.
- The criteria recommendations for marine and fresh waters are no longer based on different illness rates.
- There are no longer different criteria recommendations for different use intensities.
- EPA is providing information for states that want to adopt WQS based on a quantitative polymerase chain reaction (qPCR)* method that EPA has developed and validated.
- EPA is providing states with Beach Action Values (BAVs) for use in notification programs.
- EPA is providing additional information on tools for assessing and managing recreational waters, such as predictive modeling and sanitary surveys.
- EPA is providing information on tools for developing alternative RWQC on a site-specific basis, such as epidemiological studies in both marine and fresh waters and quantitative microbial risk assessment (QMRA).

* Note: qPCR is included here with reference to establishing water quality standards. The implications of using qPCR in NPDES permitting have not been evaluated.

Q2-3: How do states use national criteria recommendations for pathogens to develop their state water quality criteria and standards?

A2-3: States and authorized tribes adopt WQS that protect public health or welfare, enhance the quality of the water, and serve the purpose of the CWA (in accordance with section 303(c)(2)(A) of the CWA). This includes establishing designated uses, adopting criteria to protect those uses, and establishing antidegradation policies and implementation methods. EPA's primary role under the Clean Water Act, is to review and approve or disapprove state WQS within certain statutory timeframes. EPA's recommendations for water quality criteria are developed to assist states and tribes in adopting scientifically defensible water quality criteria in their state standards that are also protective of the designated uses of the waterbody, in this case, primary contact

[1] Hereafter throughout this document, the term 'state' is used to mean 'states, tribes and territories' unless the sentence is distinctly discussing tribes.

recreation. States and authorized tribes are expected to consider updating their WQS to reflect updated information during their reviews (at least once every three years) of their current WQS. As mentioned, over the years EPA's water quality criteria recommendations to protect waters designated for primary contact recreation have evolved to reflect updated scientific findings, including in 1976, 1986 and 2012.

Q2-4: How are state and tribal water quality criteria and water quality standards for recreational waters relevant for permit writers?

A2-4: State and tribal WQS establish the basis for developing water quality-based effluent limits (WQBELs) in NPDES permits where there is a reasonable potential for the discharge to cause or contribute to an excursion of the state standard. Section 301(b)(1)(C) of the CWA and the NPDES regulations at 40 CFR 122.44(d) require that permits contain limits as stringent as necessary to meet state WQS. Permit writers, therefore, rely on the applicable state WQS, and specifically the criteria values, to determine the need for and calculate WQBELs.

3. Identifying the Applicable Recreational Water Quality Standard to Implement in the NPDES Permit

Q3-1: Which criteria should the permit writer use for developing effluent limits in a discharge permit?

A-3-1: A permit writer must develop water quality-based permit limits (WQBELs) as necessary to meet the *state's* EPA-approved-WQS, or any more stringent standard adopted by the state, as required in the CWA section 301(b)(1)(C) and NPDES regulations at 40 CFR 122.44(d). A State may have criteria in their standards that is based on EPA's current or former criteria recommendations (1976, 1986 or 2012) or other scientifically defensible criteria that is protective of the primary contact recreation use. The State's criteria may have been adopted on a site-specific basis or on a state-wide basis, and may be part of the state's EPA- approved water quality standards to protect the applicable designated uses of the receiving water or may not yet have been approved by the EPA. Permit writers must include in the permit effluent limits based on the EPA-approved state water quality standard or any more stringent water quality standard adopted by the state. One exception is where EPA has promulgated water quality criteria for certain waters in a state. For example, there are currently some states still covered by EPA's 2004 promulgation of the 1986 recreational water quality criteria in coastal recreation waters (http://water.epa.gov/lawsregs/lawsguidance/beachrules/bacteria-rule.cfm). For those waters still covered by the EPA's rule, the permit writer would use the federal water quality standards in 40 CFR Part 131.41., or any more stringent water quality standard adopted by the state.

A repository of EPA approved WQS is available at:
http://water.epa.gov/scitech/swguidance/standards/wqslibrary/index.cfm.

Q3-2: What should a permit writer do if the state's water quality standard includes criteria for more than one indicator of fecal contamination?

A3-2: If a state or tribe has adopted WQSs for more than one indicator of fecal contamination, including indicators necessary to protect different types of designated uses (e.g., primary contact recreation, shellfish harvesting, drinking water supply), the permit writer must consider all applicable criteria when evaluating whether there is reasonable potential to cause or contribute to an excursion above the state or tribe's EPA-approved water quality standard.

Q3-3: If a state has a regulation with a performance standard for treatment of bacteria that differs from the EPA-approved state water quality standard, what should the permit writer use in establishing NPDES permit limits?

A3-3: In addition to the WQBEL, NPDES permits must include other effluent limits based on state regulations and standards that are in addition to those required under federal regulations. The CWA requires NPDES permits to include limitations necessary to meet applicable water quality standards (CWA section 301(b)(1)(C)). Thus, where the permitting authority finds that a pollutant or pollutant parameter will cause, have the reasonable potential to cause, or contribute to an excursion above any EPA-approved water quality standard, the permit must include limits that derive from and ensure compliance with such standard (40 CFR 122.44(d)(1)(i); 122.44(d)(1)(vi)(A)). The CWA also requires the permit to include "any more stringent limitation… necessary to meet… any State law or regulations" (CWA section 301(b)(1)(C)). Please see Q4-1 that addresses reasonable potential.

Q3-4: If the state adopts a new water quality standard before the end of the 5-year permit term, may the permit be modified to ensure that the effluent limit reflects the new standard?

A3-4: EPA regulations at 122.62 specify that permits may be modified before the end of the 5-year permit term for 'cause.' Causes include permit reopeners and changes in regulations with the consent of the permittee. Most typically, however, permits are revised to incorporate WQS based on new criteria at the time of renewal. However, if the permit writer anticipates the need for new data in advance of reissuing the permit after the 5-year permit term expires, CWA section 308 allows EPA to require the permittee to collect information that will be needed for the revised permit.

Q3-5: How will EPA develop WQBELs in NPDES permits for recreational waters in Indian country?

A3-5: To date, no tribe has obtained authorization to implement the NPDES program and therefore EPA is the permitting authority in Indian country. As with any part of the NPDES program, implementation depends upon several factors, including whether or not the tribe has an approved WQS program, whether it has adopted the newly published criteria into its tribal WQS, and whether EPA has approved them. In any case, permits will be written to reflect the approved WQS. Permit writers who have questions about implementation on tribal lands should contact their EPA regional office.

A list of which tribes have EPA-approved WQS programs and which have EPA-approved WQS in place is available at: http://water.epa.gov/scitech/swguidance/standards/wqslibrary/approvtable.cfm.

4. Determining Need for a WQBEL in a Permit

Q4-1: What approach should permit writers use for determining reasonable potential (RP) to cause or contribute to an excursion of the water quality standard for pathogens?

A4-1: Many states assess reasonable potential with respect to pathogen or pathogen indicator criteria based solely on the nature of the effluent discharge. Because pathogens are present at significant levels in all untreated municipal wastewater, some states have determined that all municipal wastewater treatment plants that discharge to recreational waters have a reasonable potential to cause or contribute to an excursion above the applicable recreational water quality standard. EPA supports this approach and believes that it is consistent with existing statutory and regulatory requirements.

EPA has not developed guidance specific to performing a quantitative RP analysis with respect to pathogens or pathogen indicators. If a state chooses to use a quantitative approach the procedures must be consistent with the requirements of 40 CFR 122.44(d)(1)(i) and (ii) and must ensure that discharges will

be controlled as necessary to meet applicable water quality standards, as required by CWA section 301(b)(1)(C).

5. Calculating the Water Quality-Based Effluent Limit (WQBEL)

Q5-1: Are both short- and long-term expressions for pathogen or pathogen indicator limits required in an NPDES permit when reasonable potential is demonstrated?

A5-1**:** Yes. Section 301(b)(1)(C) of the CWA requires permits to contain limits necessary to meet the state's EPA-approved WQS. EPA regulations at 40 CFR 122.45(d) require that effluent limits for continuous dischargers be expressed as both short-term and long-term limits, unless such expressions are "impracticable."

Because it has been long-standing practice in most states to implement both short- and long-term effluent limits for pathogens (including fecal coliform, *E. coli* and *Enterococcus*), EPA is not aware of any technical considerations that would make it "impracticable" to develop both short- and long-term limit expressions.

EPA recommends that permitting authorities calculate effluent limits using both the geometric mean and statistical threshold value, which will result in short- and long-term effluent limits that are as stringent as necessary to meet all applicable criteria expressions.

Q5-2: Where a state has only a single duration component of its criteria in its EPA-approved water quality standard, how can permit writers calculate both a short- and a long-term expression for the NPDES permit?

A5-2: One possible approach is the use of EPA's *Technical Support Document for Water Quality-Based Toxics Control* (TSD). The TSD, provides statistical methods that a permit writer can use to calculate short- and long-term permit limits based on a single duration expression of a criterion. For example, if the state WQS identifies a criterion duration expressed only as a monthly geometric mean, the short-term maximum daily limit (MDL) or average weekly limit (AWL), and the long-term average monthly limit (AML), can all be mathematically derived from this single criterion expression.

Q5-3: What methods are used by permit writers to calculate the short- and long-term permit limits for continuous dischargers?

A5-3: EPA is aware of at least two approaches currently used to establish short- and long-term effluent limits as stringent as necessary to meet WQS. These approaches are: 1) direct application of criteria values at end-of-pipe, and 2) the TSD approach. Permitting authorities considering other implementation alternatives may find it helpful to consult with EPA Regional NPDES permitting staff regarding whether the alternate procedures would be consistent with federal statutory and regulatory requirements.

EPA expects that the ***direct application of criteria values at end-of-pipe approach*** used by many NPDES permitting authorities, where water quality criteria are applied directly as permit limits at the discharge point, would be as stringent as necessary to meet state WQS. This is considered to be the simplest and most common method to develop the effluent limits for pathogens and pathogen indicators because there is no consideration of dilution or mixing with the receiving water.

Review of existing NPDES permit limits indicates that states that adopted EPA's 1986 criteria recommendations have frequently used an end-of-pipe approach by establishing average monthly permit limits (AML) as the geometric mean (GM) criterion value (e.g., 126 *E. coli* cfu/100 ml), and established the maximum daily limit (MDL) as the single sample maximum criterion value (e.g., 235 *E. coli* cfu/100

ml). Limits established in this manner clearly derive from and would be as stringent as necessary to meet state WQS.

Similarly, where the 2012 RWQC have been adopted into WQSs, its GM and STV could be directly applied as a discharger's AML and MDL, respectively. See Figure 2 for a summary of the recommended 2012 RWQC.

Figure 2

Summary of Recommended 2012 Recreational Water Quality Criteria

Recommended 2012 RWQC Criteria Elements	Estimated Illness Rate (NGI): 36 per 1,000 primary contact recreators			Estimated Illness Rate (NGI): 32 per 1,000 primary contact recreators	
	Magnitude			Magnitude	
Indicator	GM (cfu/100 mL)a	STV (cfu/100 mL)a	**OR**	GM (cfu/100 mL)a	STV (cfu/100 mL)a
Enterococci – marine and fresh	35	130		30	110
E. coli – fresh	126	410		100	320

Duration and Frequency: The waterbody geometric mean (GM) should not be greater than the selected GM magnitude in any 30-day interval. There should not be greater than a ten percent excursion frequency of the selected statistical threshold value (STV) magnitude in the same 30-day interval.

Q5-4: May permit writers still use the *end-of-pipe approach* if the state's water quality standard incorporates somewhat different values to express its criteria than those listed in Figure 1?

A5-4: Yes, as long as the state water quality standard has been approved by EPA. EPA is aware that states vary in how they develop and adopt water quality criteria and WQS (including site specific criteria) and therefore the actual values may differ from what is presented in Figure 1. In that case, the permit writer could apply the state's numbers to end-of-pipe as described above.

Q5-5: May permit writers use mixing zones, initial zones of dilution, or dilution factors for pathogens and pathogen indicators in inland and coastal waters designated for primary contact recreation?

A5-5: According to EPA regulations at 40 CFR 131.13, states may, at their discretion, include mixing zone policies in their WQS and such policies are subject to EPA's review and approval. In order to protect human health, it has been EPA's policy, as expressed in the *Water Quality Standard Handbook*[2], that mixing zones may not be appropriate in circumstances where they may pose significant human health risks (considering all likely pathways of exposure) or where they may endanger critical areas (e.g., recreational waters). One such situation could be where mixing zones allow for elevated levels of pathogens or pathogen indicators in rivers and streams designated for primary contact recreation. People recreating in a mixing zone (where pathogen levels may be elevated above the criteria levels) may be exposed to greater risk of gastrointestinal illness than would be allowed by the state water quality standard for protection of the recreation use.

[2] EPA-833-B-94-005a, 1994, available at: http://www.epa.gov/wqshandbook

Water quality-based NPDES permit limits must be as stringent as necessary to meet EPA-approved state or tribal WQS. Where the water quality standard prohibits mixing zones or consideration of dilution (either in general or for pathogens specifically), permitted point sources must discharge effluent that meets criteria at the point of discharge. Conversely, where the water quality standard allows mixing zones or consideration of dilution for pathogens or pathogen indicators, the water quality criteria must be met during design flow conditions after accounting for allowable dilution or at the edge of the regulatory mixing zone.

6. Methods and Monitoring

Q6-1: Which methods can be used for the monitoring requirements in NPDES permits?

A6-1: It depends on the applicable WQS. If the WQBEL in the permit is for a WQS based on enterococci or *E. coli* as measured by a culturable method (e.g. WQS based on EPA's 1986 and 2012 criteria recommendations), there are EPA approved methods promulgated in 40 CFR Part 136. Therefore, monitoring would need to be conducted according to a Part 136 approved method such as EPA Method 1600 to measure culturable enterococci and EPA method 1603 to measure culturable *E. coli*. Other methods may also be approved as specified by EPA's Alternative Test Procedures Program.[3] If the WQBEL is for a water quality standard based on a fecal indicator-method combination for which there is no approved method under Part 136, monitoring would need to be conducted according to a test procedure specified in the permit, per 40 CFR 122.44(i)(iv).

Q6-2: How many monitoring samples should be specified in the permit to ensure compliance with a WQBEL?

A6-2: Consistent with 40 CFR 122.48(b), a permit must specify effluent monitoring requirements (such as sampling frequency) sufficient to yield representative data. More frequent sampling is encouraged to capture a better representation of effluent variability. Regardless of sampling frequency, the permit record should always be clear about how the data collected will be used to assess compliance with short- and long-term effluent limits.

EPA provides biological methods and test procedures approved for measuring fecal indicators for wastewater effluent and sewage sludge in 40 CFR 136.3, *List of Approved Biological Methods for Wastewater and Sewage Sludge* (Table 1A). Approved methods for ambient water are found in *List of Approved Microbiological Methods for Ambient Water* (Table 1H).

EPA-approved methods for NPDES monitoring are included for indicators such as total coliform, fecal coliform, *Escherichia coli*, fecal streptococci, and enterococci. Methods include membrane filtration, multiple tube fermentation, and commercial test kits such as multiple well fermentation assays. Details for EPA-approved methods and procedures can be found on USEPA's website.[4]

[3] EPA Alternative Testing Procedures Program, available at: http://water.epa.gov/scitech/methods/cwa/atp/index.cfm

[4] http://water.epa.gov/scitech/methods/cwa/bioindicators/biological_index.cfm