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Guiding Principles on an Optional Approach for Developing and Implementing a Numeric Nutrient Criterion that Integrates Causal and Response Parameters

Purpose

The purpose of these guiding principles is to offer clarity to states about an optional approach for developing a numeric nutrient criterion that integrates causal (nitrogen and phosphorus) and response parameters into one water quality standard (WQS). The EPA recognizes that developing numeric values for both nitrogen and phosphorus may present challenges associated with the temporal and spatial variability, as well as the ability to tie them to environmental outcomes. As the EPA's understanding of nutrient science progresses, these guiding principles may be updated or supplemented with additional information.

States are, as always, encouraged to work closely with their EPA counterparts when developing numeric nutrient criteria, particularly if they are interested in following the approach outlined in these principles.

Disclaimer

These guiding principles do not impose legally binding requirements on the EPA, states, or the regulated community, nor do they confer legal rights or impose legal obligations upon any member of the public. The Clean Water Act (CWA) provisions and EPA regulations described in this document contain legally binding requirements. These guiding principles do not constitute a regulation, nor do they change or substitute for any CWA provision or EPA regulation.

I. Applicability

1. The integrated approach described in these guiding principles applies only to WQS for the nutrients nitrogen and phosphorus.
2. These guiding principles apply when states wish to rely on response parameters to indicate that a designated use is protected, even though a nitrogen and/or phosphorus level is/are above an adopted threshold. If a state prefers to apply causal and response parameters independently, the principles in II.C will not apply.
3. States interested in this approach should have a biological assessment program that confidently measures biological responses and other nutrient-related response parameters through a robust monitoring program to account for spatial and temporal variability to document the effects of nutrient pollution. This will allow the state to have the capability to: a) identify shifts in multiple biological assemblages (e.g., periphyton, benthic macroinvertebrates, fish) along a gradient of anthropogenic stress that can be tied to designated uses, and b) quantify the relationship between nitrogen and phosphorus concentrations and measures of biological assemblage response.

II. Criterion science and expression

A. Protectiveness

1. A criterion must protect the designated use of the water, and states should clearly identify the use(s) they are seeking to protect. Where a criterion is intended to protect multiple designated uses, states must ensure that it protects the most sensitive one (40 CFR 131.11(a)).
2. Numeric values for all parameters must be set at levels that protect uses (i.e., before adverse conditions that will require restoration).
3. In order to comply with 40 CFR 131.10(b), states must ensure that WQS provide for the attainment and maintenance of the WQS of downstream waters.

B. Sound science rationale

1. Documentation supporting the criterion should identify all applicable nutrient pathways, addressing all potential direct and indirect effects (e.g., as identified in a conceptual model that outlines the effects of nutrient pollution). Documentation for the criterion should describe which pathways are and are not accounted for and why.
2. It is important to select biological response parameters that are consistent with the Agency's definition of assessment endpoints in the *Ecological Risk Assessment Guidelines.* Assessment endpoints should be relevant to management goals (e.g., protect and maintain aquatic life) and should be sensitive to the stressor of interest (e.g., increased nitrogen and phosphorus concentrations). Appropriate biological response parameters will directly link nutrient concentrations to the protection of designated uses.

   Indicators that are most indicative of nutrient pollution in streams are intensively measured total phosphorus and total nitrogen, measures of primary productivity (e.g., benthic chlorophyll *a*, percent cover of macrophytes), measures of the algal assemblage (e.g., algal assemblage indices), and measures of ecosystem function (e.g., continuously monitored pH and dissolved oxygen).[1] On the other hand, reliance on higher trophic level indicators designed to measure general biological condition (fish or invertebrates) may not be adequately sensitive or diagnostic of nutrient pollution. Therefore, these general higher trophic level indicators may be used in a suite of response variables but should not be the predominant or sole indicator of nutrient pollution.

   The EPA recommends the use of one or multiple of these ideal response indicators when deriving a combined criterion. This criterion should demonstrate the sensitivity of the response indicator(s) to increased nutrient concentrations and quantify how these nutrient-response linkages will achieve the goal of protecting and maintaining aquatic communities.

   Appropriate type and quantity of response parameters may vary by state, ecosystem, and waterbody type.

3. It is important to have sufficient data to allow the development of quantitative relationships (e.g., via regression models). Sufficient data can also inform the

[1] This conclusion resulted from a 2013 EPA-hosted scientific workshop held in Washington, DC.

selection of reference sites for deriving a criterion using the reference condition approach and calibration of mechanistic models.

4. States should clearly and thoroughly document in their WQS (or supporting documentation)—for public review and submission to the EPA—how the criterion was developed and the technical aspects of their biological assessment protocols (including the assessment endpoints). This will ensure reproducibility, transparency, and defensibility. (See 40 CFR 131.6(b), 131.20(b)).[2]

C. Expression of the Criterion

1. In order to ensure that states evaluate causal and response components as one standard when determining whether a segment is meeting any applicable WQS for purposes of CWA §303(d)(1)(A) and 40 CFR 130.7, causal and response parameters must be combined into one criterion.
2. All causal and response parameters should be expressed numerically.
3. Duration and frequency components for all parameters should be included in the criterion in the state's WQS.
4. The criterion should be expressed in a way that clearly establishes the water quality goal that applies for permitting, assessment/listing, and total maximum daily load (TMDL) decisions. However, the criterion should not include provisions or conditions (e.g., minimum sample size) that restrict its use for any CWA implementing program, including permitting, assessment/listing, or TMDL activities.

   If a state identifies a scientifically defensible range of numeric values for the response parameters above which impairment of designated uses is known and below which designated uses are protected, the state should transparently identify and include as part of the criterion the decision framework it will use when waterbody conditions are within that range.
5. The criterion should be constructed in a way that integrates causal parameters and a suite of response parameters; clearly states the desired ambient condition of, or level of protection for, the waterbody; and allows for a transparent and reproducible assessment/listing decision. The criterion should make the following situations clear:
   a. If all causal and response parameters are met, then the water quality criterion is met and the waterbody is meeting its designated uses.
   b. If all response parameters are met, but one or more of the causal parameters is exceeded, then the criterion is met and the waterbody is meeting its designated uses.
   c. If a causal parameter is exceeded and any applicable response parameter is exceeded, then the criterion is not met and the waterbody is not meeting its designated uses.
   d. If a causal parameter is exceeded and data are unavailable for any applicable response parameters, then the criterion is not met and the waterbody is not meeting its designated uses.

[2] For example, the submittal should have sufficient detail so that the public and the EPA can understand and evaluate the appropriateness of the metrics, QA/QC of data, thresholds for determining biological attainment/nonattainment, evaluation of upstream/downstream conditions, and how trends in biological and chemical quality will be considered, when available.

e. If a causal parameter is not exceeded but an applicable response variable is exceeded, then the criterion is not met and the waterbody is not meeting its designated uses (in this scenario, further investigation may be warranted to determine if nutrient pollution is the cause).

III. Implementation

A. Section 303(d) Assessment and Listing

1. The CWA Section 303(d) assessment methodology should be consistent with the criterion.
2. CWA Section 303(d) requirement that states identify water quality-limited segments still requiring TMDLs where pollution controls are not stringent enough to implement any WQS still applies.
3. If a causal parameter is significantly exceeded but no response parameters are exceeded, then the state should pursue additional studies to determine whether site-specific criteria are appropriate.
4. States should have a process for monitoring response parameters downstream when assessing upstream conditions.

B. Permitting

1. States should develop NPDES permitting implementation procedures to ensure a consistent application of the criterion.
2. NPDES permits must contain limits for any pollutants or pollutant parameters that are or may be discharged at levels that will cause, have reasonable potential to cause, or contribute to an excursion above any WQS. (40 CFR 122.44(d)(1)). Such limits must be sufficiently stringent to achieve all applicable WQSs. Under this approach, where reasonable potential exists, permit writers must include limits in permits to achieve the WQS and, in doing so, should develop water quality-based effluent limits based on the numeric nutrient causal parameters.