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Submitted via: *regulations.gov*

Re: NACWA Comments on the *Draft Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs of the Conterminous United States: Information Supporting the Development of Numeric Nutrient Criteria* (EPA-HQ-OW-2019-0675)

Dear Dr. Yuan:

The National Association of Clean Water Agencies (NACWA) appreciates the opportunity to provide comments on the US Environmental Protection Agency's (EPA or Agency) *Draft Ambient Water Quality Criteria Recommendations for Lakes and Reservoirs of the Conterminous United States: Information Supporting the Development of Numeric Nutrient Criteria*.[1]

NACWA represents the interests of nearly 330 public clean water utilities that are responsible for managing billions of gallons of the nation's wastewater generated each day to ensure the continued protection of public health and the environment.

General Comments

Nutrient-related criteria are a critically important topic for the utilities and communities that NACWA represents. Over the years, NACWA has actively promoted science-based approaches for addressing nutrient challenges. Our membership has invested many billions of dollars in nutrient reduction at wastewater treatment facilities and will continue to serve as important partners with state and federal agencies on nutrient issues. The consistent tenets of NACWA's engagement are that nutrient goals and reduction strategies should:

- Utilize science-based, quantitative linkages to designated uses;
- Account for water body-specific responses to nutrient inputs;

[1] 85 Fed. Reg. 31,184 (May 22, 2020).

- Consider options other than numeric nutrient concentration criteria;
- Apply bioconfirmation to increase confidence in attainment decisions; and
- Equitably address all major sources.

We list these tenets here because they continue to provide the foundation for NACWA's perspectives on the 2020 draft criteria document, including areas of support and areas where we recommend modifications. We offer the following general comments on the draft criteria and EPA's associated efforts.

1. *NACWA appreciates EPA's efforts to improve upon the 2000-2001 ecoregional criteria*.

   The *Federal Register* notice states that, if adopted, the proposed criteria "will replace the EPA's previously recommended ambient nutrient criteria for lakes and reservoirs."[2] EPA derived the previous criteria in 2000-2001 as percentiles of available data on an ecoregional basis. NACWA (then called AMSA) commented extensively on the 2000-2001 ecoregional criteria (AMSA, 2001). To summarize those comments, NACWA concluded that the 2000-2001 ecoregional criteria:

   - Lacked meaningful relations with beneficial uses;
   - Were likely to create unnecessary regulatory burdens;
   - Represented a risk to fisheries;
   - Were generated from problematic datasets;
   - Lacked frequency and duration components; and
   - Were not ground-truthed.

   In reviewing the 2020 draft criteria, it is clear EPA has made an effort to improve upon the 2000-2001 ecoregional criteria. Examples include the effort to identify endpoints associated with specific uses, relating response variables to those endpoints, and the definition of a duration component. In NACWA's view, the most successful state and regional efforts to derive nutrient-related criteria have utilized quantitative linkages between use-related endpoints and criteria variables. Our comments below offer more specifics on the degree to which the 2020 draft document would or would not result in appropriate criteria. Notwithstanding these criticisms, the 2020 draft criteria document contains much more useful concepts for use-criteria linkages than the 2000-2001 ecoregional criteria, and some of these concepts could be incorporated into criteria derivation efforts at the state and water body-specific level. NACWA appreciates EPA's efforts to move beyond the 2000-2001 percentile-based approach and more directly consider use-criteria linkages.

2. *Nutrient criteria should be based on water body-specific relationships that consider state and local management goals, not national models or criteria*.

   As our broadest and most important critique, the 2020 draft national models are not appropriate for deriving broadly applicable nutrient criteria under Section 304(a) of the Clean Water Act. Rather, nutrient criteria derivation efforts should be developed from state- or stakeholder-led efforts that use local data, actual lake management goals, and water-body

[2] *Id.*

specific relationships. The EPA models are interesting for exploring patterns at a huge geographic scale but would result in inappropriate criteria for most individual water bodies. In addition to problems with some of the risk endpoints and limitations of the underlying dataset, a national statistical approach cannot define criteria-use relationships with a sufficient degree of geographic or temporal precision required for criteria to be defensible. Responses of lakes and reservoirs to nutrient inputs vary greatly, and criteria derived from EPA models would generally cause an unacceptably high rate of Type I assessment error (false finding of impairment) for most water bodies. These problems would persist even if the national dataset was supplemented with additional state data. In many cases, the criteria produced by the EPA models would be unattainable and damage lake fisheries.

Our more detailed comments below provide additional information on why NACWA has reached these conclusions. In the meantime, NACWA supports state and water body-specific efforts to derive nutrient-related criteria rather than the use of national approaches. Most states have either already successfully developed criteria for lakes and reservoirs (*e.g.*, Florida, Minnesota, and Virginia) or are currently implementing EPA-approved nutrient criteria development plans (*e.g.*, North Carolina, Mississippi, and Wyoming) that use other approaches. Nutrient criteria development approaches should use relevant databases, endpoints that reflect how the lake is actually assessed and managed, and water body-specific relationships.

3. *After comments are addressed, EPA should publish the method as a technical guidance document rather than as 304(a) criteria or models*.

   NACWA agrees that the 2000-2001 ecoregional criteria should be rescinded for the reasons stated under our first comment above. However, it is not necessary or appropriate to replace them with national criteria or models under section 304(a) of the Clean Water Act. Section 304(a) should be reserved for criteria that can be reasonably expected to have the same magnitude—or exhibit the same empirical relationships—over widely diverse geographies. This is the case for many toxic parameters, but it is not the case for nutrient criteria.

   NACWA understands that—if the material presented in the 2020 draft criteria document was finalized as 304(a) criteria/models—states could choose not to adopt them and provide justification through the triennial review process. However, this step should not be required of states. From a procedural and stakeholder interaction perspective, it is not necessary or beneficial for a majority of states to have to justify why they are not using the EPA models or resulting criteria. At best, this is an unnecessary administrative hurdle, but it also carries the potential of undermining state progress and momentum on approved nutrient criteria development plans.

   As an alternative, NACWA recommends that the concepts and methods of the 2020 draft criteria be published as a technical guidance document apart from Section 304(a). This would still allow states to adopt as much or as little of the content as desired into their criteria development activities. The document should be presented as an *example* of the process of setting use-related endpoints and making quantitative linkages of criteria variables to those endpoints. The document should emphasize that:

- Endpoints for criteria development should be selected in cooperation with stakeholders, and tailored to how water bodies are actually managed within a region;
- Criteria derivation efforts should utilize water body-specific data and relationships to the maximum degree practical; and
- A variety of methods to make quantitative linkages can be utilized, from empirical approaches to mechanistic models.

4. *EPA should differentiate between natural lakes and manmade reservoirs*.

As EPA is aware, there are many different types of lakes and reservoirs. It is understandable that an effort of national scale would lump many lake and reservoirs types for the purposes of seeking broad relationships. However, the fundamental differences between natural lakes and reservoirs should be explicitly recognized in any similar effort. In addition to morphological and hydrologic differences, natural lakes and reservoirs also have different histories and management expectations that could affect how risk endpoints are defined. For example, a "balanced indigenous population" of aquatic life could conceivably be defined for a natural lake based on the fish populations of similar, minimally disturbed lakes. This concept loses its meaning for artificial reservoirs with no natural reference condition and which are primarily managed for sport fishing and recreation. It is recommended that the EPA statistical models allow users to differentiate between lakes and reservoirs.

On this topic, the statistical method used data from "the deepest point of each lake…or in the mid-point of reservoirs." The mid-point of many reservoirs will be in the transitional zone rather than the lacustrine zone. Samples from the deep, lacustrine part of reservoirs (near the dam) might be considered more analogous to the deepest parts of lakes. EPA's combination of mid-point reservoir data with lake data might represent a mismatch and an additional source of variance. This would be an additional reason to distinguish between lakes and reservoirs in the evaluation.

Comments on N & P Criteria

5. *Nitrogen and phosphorus concentration criteria should be optional*.

The 2020 draft criteria document includes models to derive criteria for chlorophyll-*a*, total phosphorus and total nitrogen minus dissolved inorganic nitrogen. NACWA agrees that chlorophyll-*a* is a useful response variable for measuring eutrophication and is appropriate for criteria derivation. If EPA proceeds with publishing the document as 304(a) criteria, EPA should make criteria for nutrient concentrations optional. Nutrient concentrations are less proximal to actual use impacts than response variables, and thus less reliable for predicting impairments. Across the nation, many successful nutrient management strategies have used models or similar approaches to identify the nutrient load reductions necessary to meet response variable criteria, without the use of numeric nutrient concentration criteria. This includes EPA's nutrient control program for the Chesapeake Bay, which is based on dissolved oxygen, water clarity, and chlorophyll-*a*, and does not utilize nutrient concentration criteria.

In addition to being unnecessary, numeric nutrient concentration criteria can actually constrain implementation and hamper adaptive management. In many water bodies, response variables could be achieved by various combinations of N or P reduction. By setting both phosphorus and nitrogen criteria, the ratio of reduction of these parameters would be essentially locked in by regulation, even if another combination of load reductions would be more cost-effective or otherwise preferred. Under an adaptive management program, it would be very burdensome if stakeholders had to petition for a change to water quality criteria when an adjustment to the implementation approach would change the N to P ratio. NACWA recommends that the final 2020 criteria document make it clear that N and P concentration criteria are not necessary if other technical and regulatory mechanisms exist to achieve the response variable criteria.

6. *If N and P numeric concentration criteria are adopted, they should be placed in a bioconfirmation framework that gives priority to response variables for assessment*.

NACWA recommends that the 2020 draft lakes criteria document, whether issued as guidance or 304(a) criteria, include discussion of bioconfirmation concepts as outlined in USEPA's *Guiding Principles for Integrated Nutrient Criteria (Bioconfirmation)* (USEPA, 2013) and adopted by selected states. These approaches emphasize the response variables over nutrient concentrations for assessment and can greatly reduce assessment errors that would result from independently applicable nutrient concentration criteria. Bioconfirmation should be encouraged for states that desire to adopt nutrient concentration criteria.

Comments on Statistical Approach

EPA's 2020 draft criteria document presents an interesting statistical approach for relating endpoints, chlorophyll-*a*, and nutrient concentrations. The hierarchical Bayesian network method was an innovative approach to the daunting task of exploring empirical relations at the national level. Similarly, NACWA understands why EPA would make use of the National Lakes Assessment (NLA) data for a task of this geographic scope. NACWA's general view of the statistical approach is that it is useful for exploring patterns on a large geographic scale but is not appropriate for deriving broadly applicable criteria. The reasons for this conclusion are discussed in specific comments below.

7. *Criteria must be appropriate for individual water bodies*.

As a fundamental principle underlying NACWA's comments on the statistical approach, it is not sufficient for water quality criteria to simply be drawn from a cloud of highly variable data from many water bodies. Rather, there must also be reasonable confidence that the water quality criteria are appropriate targets for the individual water bodies to which they are applied. Ultimately, the Clean Water Act is not implemented on a national or state scale but is implemented (throughs permits and TMDLs) to attain water quality standards in individual water bodies and assessment units. Accordingly, it is imperative that states adopt criteria that are protective but not excessively overprotective, balancing the potential for Type I errors (false finding of impairment) and Type II error (false finding of attainment).

This principle applies to both toxics and nutrient criteria, but merits special attention for nutrients criteria due to the lack of simple dose-response relationships and the variable nature of nutrient-use relationships. The EPA models—or other approaches that rely on statistical patterns in huge national or state datasets—are not capable of verifying that criteria are appropriate for individual water bodies.

8. *<u>The NLA dataset is too spatially and temporally limited for deriving broadly applicable criteria</u>*.

   As described in the document, the NLA consist of data collected in just two years: 2007 and 2012. But for most water bodies, the dataset only contains data for a single monitoring event from one of those two years. These few data cannot adequately characterize the variance from seasonal or interannual variability. For some parts of the country, those data may be unrepresentative of the wider range of conditions that the water bodies experience. For example, 2007 was an extreme drought year in much of the southeast (Seager and others, 2009), and 2012 was also an historic drought year in much of the country (Rippey, 2015).

   Other sources of variance that the method did not fully incorporate include intra-lake and analytical variability. For example, most water bodies were only sampled at a single location. States monitor many water bodies at different locations and do not necessarily use the "mid-reservoir" location as the sole or primary basis for assessment. Reservoirs tend to have spatial gradients in water quality through the riverine, transitional, and lacustrine zones, and the data from only one location cannot represent this spatial variability. NACWA concludes that the actual variance of lake monitoring datasets could be significantly higher than represented in the EPA analysis, and that underlying relations could be biased toward the specific conditions of the year(s) monitored. These limitations might not prevent exploration of patterns at the national scale but would severely limit the ability to derive useful criteria at the state or water body scale.

   A dataset used to develop chlorophyll-*a* criteria should include data from the same locations and sampling periods that will be used for assessment. It should include sufficient data to characterize variability both within the growing season and between years. The data should include data from years with different climatic/hydrologic conditions. Finally, the data should allow characterization of the water body-specific relations between nutrient-related variables and responses.

9. *<u>The statistical relations are too weak or variable for deriving broadly applicable criteria</u>*.

   In the 2020 draft document, EPA presents many graphs of the relations between endpoints, chlorophyll, and nutrient concentrations. Many of these relations appear to be statistically significant but with a great deal of variance and poor predictive power for specific water bodies. The log-log scale of many of the plots serves to reduce the visual appearance of variability, and so the large uncertainty of these relations would be even more evident on standard axes. For many of the relations, the data show that the chlorophyll-*a* target associated with a particular endpoint or nutrient concentration can vary by *an order of magnitude or more*. Ideally, the uncertainty associated with criteria-response relations should not exceed 10-20%.

   In some cases, the results of the statistical models are contrary to results of state or regional studies. For example, extensive monitoring has shown that cyanotoxin concentrations tend to be low in North Carolina's Piedmont reservoirs, even where cyanobacteria are prevalent (Touchette and others, 2007). This suggests the exceedance rate of microcystin thresholds in these reservoirs is much lower than predicted by the EPA models. The genetic and environmental factors that control toxin production in cyanobacteria are very complex

(Boopathi and Ki, 2014), and it is doubtful that any national models can adequately predict lake-specific responses.

High variance and low predictive power are what one would expect from an analysis that aggregates data from so many different water bodies over such a large geographic scale. Relations between chlorophyll-*a*, endpoints, and nutrients are dependent upon climatic, morphological, hydrologic, and biological factors that not only vary between regions, but some of which also vary even between water bodies in the same region. The EPA models have some features that allow tailoring of the criteria to lake-specific characteristics such as maximum depth or DOC concentration. However, this does not make the models truly capable of deriving water body-specific criteria because the resulting relations still have a large amount of unexplained variance caused (in part) by differences between water bodies.

The problem of weak predictive power would persist or be exacerbated even if additional state data were added to or replaced the national data. Like a national dataset, a state dataset would include data from diverse water bodies with different relationships between chlorophyll-*a*, endpoints, and nutrients. For example, from the Iowa example of Appendix A, notes that the use of Iowa-only data was statistically problematic, and the combined use of Iowa-NLA data had greater uncertainty than the use of NLA-only data.

10. *The criteria resulting from the use of credible intervals would be inappropriate for many water bodies and would trigger significant and unnecessary economic impacts*.

EPA's primary approach for dealing with the high model uncertainty appears to be the use of credible intervals but this approach simply results in overly conservative criteria for most water bodies. Specifically, the use of 5-25% credible intervals would result in criteria that are excessively conservative for 75-95% of water bodies. This is probably a major reason that many state-led criteria development efforts have resulted in chlorophyll-*a* targets that are significantly higher than those that would result from the EPA models. Examples include:

- Missouri: 15-30 µg/L
- Florida: 6 – 20 µg /L
- Minnesota: 6-30 µg/L

In contrast, the EPA models would indicate values in the 0-2 µg /L range for the drinking water microcystin target, and less than 0-5 µg/L for the hypoxia target. The zooplankton- and recreational (microcystin)-based models are capable of producing chlorophyll-*a* targets within the range used by most states. However, even these models can produce overly conservative criteria for many water bodies, depending on the credible interval and other options selected.

EPA's approach helps control Type II assessment errors (i.e., false finding of attainment), but increases the likelihood of Type I assessment errors (false finding of impairment) to unacceptable levels. Under the Clean Water Act framework, the 303(d) listing of water bodies triggers a series of costly actions from permitting and TMDL development to expensive implementation. In some cases, lakes or reservoirs might be assigned unattainable criteria and 303(d)-listed in perpetuity. Without controlling for Type I errors, much of this economic impact would be unnecessary and wasteful. In contrast to the EPA approach, methods used by states such as Florida have explicitly sought to control both Type I and Type II assessment errors (FDEP, 2012a).

Comments on Risk Endpoints

The selection of appropriate risk endpoints is fundamental to deriving appropriate criteria. NACWA supports the concept of defining numeric or narrative risk endpoints that are directly related to attainment of specific uses. It is also important that risk endpoints are consistent with how states actually manage and monitor lakes and reservoirs. The comments in this section address four major risk endpoints that EPA described in the 2020 draft criteria document. These comments focus on the appropriateness of these risk endpoints as indicators of use attainment in their own right.

11. *Zooplankton rate of change is not an appropriate risk endpoint as presented in the 2020 draft criteria document*.

The 2020 draft criteria document presents the zooplankton rate of change relative to phytoplankton biomass as the primary indicator of aquatic life use support applicable to all lakes. The zooplankton rate of change is an interesting biological metric but not an appropriate indicator of use support. Very few states monitor zooplankton or would be able to confirm that EPA's predicted statistical relations between chlorophyll-*a* and zooplankton hold for their water bodies. NACWA is unaware of any states that have defined criteria for zooplankton rate of change or use this metric for 303(d) assessment.

More fundamentally, to accept this endpoint as an indicator of aquatic life use attainment, one would have to assume that aquatic life uses are harmed by any phytoplankton that is not accompanied by an increased in zooplankton. There is no scientific evidence to support this view. "Excess" phytoplankton might be benign or a non-issue until it reaches levels well above the point at which it is decoupled from zooplankton increases. The level at which excess phytoplankton impaired uses would depend on several factors such as the type of phytoplankton, toxin production, and the management goals for the lake or reservoir.

From an aquatic life standpoint, most lakes and reservoirs are managed for fish support. Healthy fish populations are not only an end goal in themselves, but they provide evidence of adequate food supply and quality to support higher trophic levels. EPA has presented no evidence that the zooplankton rate of change is a meaningful threshold above which fish populations are not supported. In fact, many lakes and reservoirs exceed the zooplankton-based chlorophyll-*a* thresholds predicted by the EPA models but have highly productive fisheries and adequate food webs to support those fisheries. Fishery production has been shown to increase over a wide range of chlorophyll-a levels, including those that greatly exceed the zooplankton-based chlorophyll-*a* targets of the EPA model (Bachmann and others 1996; Ney, 1996; Deines and others, 2015). The fisheries literature does show that, in some water bodies, the proportion of desirable fish species can decline at very high levels of eutrophication (Jones and Hoyer, 1982; Ney, 1996). However, this tends to occur at chlorophyll-*a* levels that significantly exceed the zooplankton-based chlorophyll-*a* targets of the EPA model.

The fisheries literature also provides examples of where nutrient reduction has actually harmed warmwater fisheries by decreasing the food supply (Axler and others, 1988; Ney, 1996; Maceina, 2001). For these water bodies, it might be desirable to set *minimum* chlorophyll-*a* goals to avoid a loss of fish production. The zooplankton rate of change concept might be useful for exploring chlorophyll-*a* levels below which the fish food supply would be reduced, and thus where fisheries could be adversely impacted. NACWA recommends that EPA amend the discussion of zooplankton rate of change as a risk endpoint for defining maximum chlorophyll-*a* levels to support aquatic life uses. It could be retained in the document as a potentially useful indicator for exploring phytoplankton-zooplankton relations, the minimum chlorophyll-a below which fish production might decrease, or the chlorophyll-*a* levels that would balance clarity with fishing uses.

12. *The hypo/metalimnetic DO-chlorophyll model is problematic*.

Vertical DO profiles in lakes and reservoirs are controlled by multiple factors including hydrodynamics, temperature, biological losses/inputs, and chemical oxidation (Wetzel, 2001). Empirical and mechanistic models of hypolimnetic oxygen depletion show that the mixing pattern and strength/timing vertical density stratification is the dominant factor controlling hypolimnetic DO in many water bodies (Nurnberg, 2002; Walker; 2006; Bouffard and Ackerman, 2013). In many strongly stratified reservoirs, no practical levels of nutrient controls would prevent DO from decreasing below targets during the summer. This is one of the reasons that many states only apply DO criteria to surface or epilimnetic measurements. It would be inappropriate for states to utilize this endpoint if it is unattainable or inconsistent with state water quality standards.

Based on a review of the fisheries literature (Coker and others, 2001; Hasnain and others, 2010), the "critical" temperatures cited by EPA are actually between optimal temperatures and those at which adverse impacts might occurs. We request that EPA provide additional information on how these critical temperatures were selected.

Moreover, NACWA is concerned that the EPA DO-chlorophyll model is overly complex and uncertain for general use. The model suffers from the same issue of high unexplained variance as the other models. But the problem appears to be exacerbated by additional uncertainties. For example, the NLA data lacked information on the timing of stratification and the starting DO level, introducing additional uncertainty into the model. The beta version of the deep DO-chlorophyll model results in very low chlorophyll-*a* criteria (0-4 μg/L) for most combination of parameters. These values are much lower than the observed chlorophyll-*a* concentrations in many successful cool water fisheries. For example, the Minnesota extensive scientific data analysis to set chlorophyll-a criteria of 6-30 μg/L (depending on region) for lakes supporting cool water fisheries (Heiskary and Wilson, 2008). The discrepancy suggests that the criteria from the EPA models are overly conservative.

NACWA recommends that DO in deeper waters not be used as an endpoint for nutrient criteria development unless states (1) actually apply DO criteria to deeper waters; and (2) hypolimnetic DO can be shown to be practically manageable by nutrient controls. NACWA agrees that hypolimnetic DO could be an appropriate nutrient-related management variable in a limited set of dimictic, cool/coldwater reservoirs. The need and practicality of managing bottom DO with chlorophyll-*a* or nutrient controls should be evaluated on a water body-specific basis. In some cases, the appropriate management endpoint will not be dissolved oxygen concentration but a related variable such as hypoxic volume days. Such evaluations should rely on water-body specific models or empirical relations, in lieu of national, state, or regional statistical models.

13. *Cyanotoxins are potentially useful risk endpoints for chlorophyll-a criteria development, but EPA should acknowledge the limitations and uncertainties of the microcystin thresholds*.

In NACWA's view, the recreational microcystin threshold was the most potentially useful of the four thresholds described. It is appropriate that the EPA document discuss cyanotoxins and their potential role in criteria development. The demonstration of water body-specific or consistent relations between chlorophyll-*a* and cyanotoxins would provide a promising basis for chlorophyll criteria. However, NACWA recommends that EPA acknowledge the limitations and conservative nature of the science underlying the microcystin thresholds presented in EPA (2015) and EPA (2019a). As summarized by NACWA (2017), these limitations include:

- A limited number of peer-review studies;
- Few studies of effects to human health;
- Use of outdated exposure estimates; and
- Assumption of very high ingestion rates.

As noted in comment #9, the potential for cyanotoxin production can vary a great deal by cyanobacteria species, strain, and a host of environmental factors. Thus, use of a cyanotoxin-based nutrient targets should be based on site-specific relations in water bodies where toxin production is a real concern.

14. *The microcystin target for finished drinking water (0.3 µg/L) should not be applied to raw water sources*.

The application of drinking water-based targets to raw water supplies should be limited to those constituents for which there can be no reasonable expectation of reduction through the drinking water process. EPA and other researchers have shown that many drinking water treatment processes are effective at removing cyanotoxins including microcystin (USEPA, 2016; USEPA, 2019b). These include conventional processes such as coagulation, sedimentation, and filtration, and other widely used processes such as activated carbon adsorption, flotation, and some types of chemical treatment. Many cyanobacteria are buoyant, and so EPA (2019) also cites the use of intakes at alternative depths as another effective management strategy.

Application of the EPA on-line tools shows that application of the 0.3 µg/L microcystin endpoint would result in extremely low (0-2 µg/L) chlorophyll-*a* criteria that would be unattainable in many reservoirs. Many drinking water utilities draw from reservoirs with chlorophyll-*a* concentrations much higher than these levels, without cyanotoxin-related problems. When deriving chlorophyll-*a* goals for drinking water reservoirs, states have generally set chlorophyll-*a* a targets significantly higher than the values resulting from the EPA chlorophyll-microcystin model. For example, Kansas applies a long-term average chlorophyll-*a* criterion of 10 µg/L for reservoirs with water supply uses. Even using the highest allowable exceedance probability and credible interval, the EPA model would indicate a criterion of 2.1 µg/L, less than a quarter the magnitude that Kansas has determined to be appropriate. Other states (*e.g.*, Florida, North Carolina, Missouri, and Minnesota) have determined that water supply uses can be met at even higher chlorophyll-*a* concentrations. As such, the discussion of the 0.3 µg/L microcystin target as an endpoint for raw surface waters needs to be deleted.

15. *The list of endpoints should include clarity and fishery metrics*.

None of the four metrics listed by the 2020 draft criteria document include direct measures of clarity or fish production. Yet in practical terms, this is how many lakes and reservoirs are actually managed. Clarity is an important factor for recreational uses—especially for water bodies at higher latitudes or elevations where users tend to expect high water clarity. From a narrative standpoint, the concept of clarity also encompasses the prevalence of "nuisance" algal blooms. Fishery metrics address both recreation and aquatic life uses and include fish abundance, size distribution, catch rates, proportion of desirable species, etc. The 2020 draft criteria document needs to acknowledge the importance of clarity and fishery metrics in assessing use support.

16. *Selection of endpoints should include consideration of a water body's historical condition and actual use attainment*.

Unlike with most toxics criteria, nutrient-related endpoints should be selected with an understanding of the historical condition of a water body and numeric and narrative information on which uses have actually been attained. User expectations are strongly affected by the long-time prevailing conditions of water bodies within a given geography, and use-related activities (*e.g.*, drinking water treatment) can also be adapted to a range of conditions. This does not mean that any historical condition is acceptable. Rather, it means that consideration of historical or geographically consistent conditions can result in very different endpoints for different water bodies, even if they have same uses.

For example, consider a reservoir that has been mesotrophic or eutrophic since its construction, versus a lake that was historically oligotrophic. Both might be considered to fully meet their uses by the public and drinking water utilities, even though the former has lower clarity, more fish, and requires somewhat higher levels of water treatment. Simple application of a few *a priori* endpoints would miss the important differences in reasonable goals for these two water bodies. NACWA recommends that EPA discussion of endpoints include acknowledgment of the need to consider historical conditions, reasonable expectations, and practical measures of use attainment. These can include numeric measures but also narrative indicators such as the frequency of nuisance blooms and fishery quality.

17. *Criteria should recognize the need to balance competing uses*.

Nutrient impacts to lakes are reservoirs are often best described as a gradational continuum of risks over a range of chlorophyll-*a* levels—rather than sharp threshold effects about which uses are not supported. For decades, multiple studies have addressed the fact that a desire for high water clarity and high fish production can be in tension (Wagner and Oglesby, 1984; Ney, 1996), and managers must often choose nutrient-related goals that balance these uses. In some cases, lake managers might accept a higher level of chlorophyll—with its associated risk level of use impacts—in order to support the historical or desired level of fish production. The 2020 draft criteria document should be revised to acknowledge the need to choose criteria that balance gradational risks between different potential indicators and uses and to consider reasonable expectations for individual water bodies. The strength of relationships between endpoints and designated uses should also be a factor weighed when determining criteria for a water body.

Comments on Temporal Components

18. *NACWA concurs with the recommendation of a growing season geometric mean for the duration component of chlorophyll-a criteria*.

    The geometric mean is appropriate for chlorophyll-*a* criteria. The geometric mean is an appropriate average for water quality variables that are typically lognormally or asymmetrically distributed, such as chlorophyll-*a*. The use of a relatively long-duration average is consistent with EPA statistical approach, which estimates the risk of effects integrated over time. The use of a seasonal geometric mean is also consistent with chlorophyll-a criteria adopted by many states (*e.g.*, Arkansas, Florida, Texas, and Virginia).

19. *The criteria should include an allowable frequency of exceedance (e.g., 1-in-3 or 2-in-6 years)*.

    NACWA strongly disagrees with EPA's recommendation of no allowable exceedance frequency. An allowable frequency of exceedance is required to acknowledge interannual variability, to acknowledge that beneficial uses can tolerate periodic exceedances, and to balance Type I and Type II assessment errors. For example, Florida adopted a 1-in-3 exceedance frequency in part to limit Type I errors to 10 percent (FDEP, 2012b). Missouri and Virginia have also adopted seasonal mean chlorophyll-*a* criteria with a 1-in-3 or 2-in-6 allowable exceedance frequency. NACWA recommends that the 2020 document be revised to encourage states to adopt an allowable exceedance frequency of at least 1-in-3 (or 2-in-6) years.

Conclusion

NACWA commends EPA for going significantly beyond the 2000-2001 criteria derivation approach and showing how endpoints, chlorophyll-*a*, and nutrient concentrations can be statistically linked on a broad geographic scale. Some of the use endpoints require revision or replacement, and the research would be more appropriately published as technical guidance rather than 304(a) criteria models.

NACWA expresses a strong preference for state- or stakeholder-led criteria derivation efforts that consider water body-specific characteristics, goals, and relationships. We recommend publication of the latest EPA material as technical guidance, presenting an example of the process for setting endpoints and making use-criteria linkages.

Thank you for your consideration of these comments. If you have any questions or would like to discuss these comments further, please contact me by phone at 202/533-1839 or email at eremmel@nacwa.org.

Sincerely,

Emily Remmel
Director of Regulatory Affairs

References

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