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The following are comments submitted on behalf of the Buffalo River Watershed Alliance in response to request from Arkansas Department of Environmental Quality for public input on the 2018 Assessment Methodology

Submitted electronically to **am-comments@adeq.state.ar.us**.

October 31, 2016

Because ADEQ's current assessment methodology for algae as it relates to water quality relies on a narrative description, the Alliance asks that numerical thresholds be added to augment enforcement and maintenance of water quality standards for recreation and drinking water. In addition, frequent and regular monitoring of waterways for algae should be included, defined and funded. These additions should conform to the recommended guidelines of the EPA and the WHO (World Health Organization), which have experience and understanding of this growing problem. Including such specific requirements is especially important in karst terrains where minimal filtering of point and nonpoint agricultural nutrients before they enter surface waterways can affect algal blooms and water quality both locally and up to hundreds of miles downstream. The importance of planning for protection of our surface waters for drinking and recreational uses can further be documented from the pattern of exponential proliferation of waste producing CAFOs near load bearing streams and rivers, with the effects of released nutrients such as phosphorus and nitrogen intensified through warmer weather effects on water quality.

In addition Regulation 2 must include the updated and latest 2012 EPA recommendations for pathogen thresholds. At every level, watershed, regional, state, and national, pathogens are proliferating in waterways due in the largest part to the increase in rural CAFO outputs through leakage and land over applications of nutrients and Ecoli, especially in karst terrains. (See Arkansas in CAFO map below). Note that this map is almost ten years old. Nitrates doubled in last seven years in drinking water in the EPA Region 6. (Forrest John on behalf of the EPA reported these significant rates of polluted drinking water.*)

http://www.factoryfarmmap.org/#animal:hogs;location:US;year:2007

Algal blooms have typically appeared seasonally on many surface waters, but at what point do these become an issue for modifying water quality regulations? For the few U.S. states that have Harmful Algal Blooms (HAB) standards in place, these were only established after those states had experienced the trauma of large drinking water reservoirs, or recreational waters, being affected, and by then the economic costs were exponentially greater than if proactive steps had been taken.

Tate Wentz from the ADEQ HAB (Harmful Algal Bloom) Working Group brought up Reg. 2.509 during his presentation as a means to approach algae and HABs in Arkansas at the recent Arkansas Water Resources Center (AWRC) Annual Water Conference in Fayetteville in July of 2016. This year's conference title was, **"Nutrients, Water Quality and Harmful Algal Blooms".** The Alliance agrees with Mr. Wentz that modifying this regulation would be the best approach.

Stratification of algal blooms in surface waters in the past had been perceived without alarm since when storm events or cooler temperatures occurred, algae turned over from the surface, and the algal cover on waterways seemed to disappear. This was generally considered a normal late summer occurrence. Now, because of extended warm weather periods (rising temperatures or climate change) affecting water temperatures, the return to cooler early fall weather doesn't kill off or reduce the algae to an acceptable degree. Depending on temperatures, these blooms, or their cell phases, lie in deeper layers in a more or less dormant stage to resurface with warmer temperatures to proliferate. Past seasonal characteristics no longer apply. Although research has documented this especially in lakes and reservoirs where vertical stratification is typical of deep waters, warmer extended temperatures affect all waterways. It would benefit ADEQ to be proactive and to change the way it assesses algae, especially ERWs (Extraordinary Resource Waters) in karst terrain.

Economic costs alone would imply that immediate, direct action be taken. For instance, recall that Des Moines Waterworks sued upstream drainage districts for impaired water quality to cover the cost of a multimillion dollar water treatment plant to remove nitrates that is now almost at capacity. Or, consider three Oklahoma cities and their daunting task to clean up their mutual drinking water supply reservoir, Lake Thunderbird, (the water supply for Moore, Oklahoma City and Norman, OK). Their 6,000 acre reservoir needs a 35% load reduction of Nitrogen, Phosphorus, and TSS (Total Suspended Solids) to meet Water Quality targets. Their current compliance plan for restoration will cost *each city* $4-8 million dollars to implement BMP reducing sediments and nutrients**.**

*Presenter Forrest John on behalf of the EPA reported these significant rates of polluted drinking water due to toxic algal blooms in his session, **EPA Region 6 Perspective on Nutrient Criteria Development, Environmental Protection Agency Region 6** at the summer AWRC conference.

On the national scope the EPA is receiving more and more reports of algal blooms in recent years. He attributed this to the fact that Nitrates doubled in last seven years in drinking water, that 2.5 million acres of drinking water are now polluted.

The Alliance proposes that ADEQ, ANRC, and the ADH collaborate to rigorously monitor and assess pathogens, E-coli, and algae types, characteristics, and growth patterns according to the most recent World Health Organization (WHO) 2012 and EPA 2015 recommendations, to proactively implement recommended thresholds, and to update these as newer guidelines emerge, for recreational waters and drinking water. Attached are current plans and recommendations. Note that rivers and nutrients are referenced.

Also note an odd interpretation of WHO recommendations for guidelines for recreational waters that has been implemented for adoption by three states for their drinking water guidelines. The Alliance requests that ADEQ and ANRC and ADH acknowledge this, since drinking water and recreational water guidelines are not usually interchanged in regulations or guidelines. In the interest of public health, our state government agencies should include language for the most stringent guidelines rather than accept the faulty reasoning exhibited by the following three states referenced below. If anything, the drinking water standards should be applied to recreational waters instead, since swimmers, skidoo operators, water skiers, kayakers, canoeists, and especially children, tend to imbibe mouthfuls of water during recreational use of state waterways.

See:
Algal Toxin Risk assessment and Management Strategic Plan for Drinking Water 2015
https://www.epa.gov/sites/production/files/2015-11/documents/algal-risk-assessment-strategic-plan-2015.pdf
and
https://www.epa.gov/sites/production/files/2015-06/documents/microcystins-report-2015.pdf

Cyanotoxin	Drinking Water Health Advisory (10-day)		
	Bottle-fed infants and pre-school children	School-age children and adults	
	Microcystins	0.3 µg/L	1.6 µg/L
Cylindrospermopsin	0.7 µg/L	3 µg/L	

Several U.S. states have implemented standards or guidelines that apply to cyanotoxins and cyanobacteria in drinking water using risk assessment methods and *the guidelines provided by the WHO for recreational waters.* Guidance values for drinking water have been adopted by three states in the U.S.:

State	Drinking Water Guidance/Action Level
Minnesota	Microcystin-LR: 0.1 µg/L
Ohio	Do Not Drink – children under 6 and sensitive populations (pregnant women, nursing mothers,

State	Drinking Water Guidance/Action Level
	those receiving dialysis treatment, the elderly and immune-compromised individuals) Microcystin: 0.3 µg/L Anatoxin-a: 20 µg/L Cylindrospermopsin: 0.7 µg/L Saxitoxin: 0.2 µg/L Do Not Drink – children 6 and older and adults Microcystin: 1.6 µg/L Anatoxin-a: 20 µg/L Cylindrospermopsin: 3.0 µg/L Saxitoxin: 0.2 µg/L Do Not Use (based on the Recreational No Contact Advisory thresholds) Microcystin: 20 µg/L Anatoxin-a: 300 µg/L Cylindrospermopsin: 20 µg/L Saxitoxin: 3 µg/L
Oregon	Microcystin-LR: 1 µg/L Anatoxin-a: 3 µg/L Cylindrospermopsin: 1 µg/L Saxitoxin: 3 µg/L
Vermont	Microcystin-LR: equal to or greater than 0.16 µg/L Anatoxin-a: equal to or greater than 0.5 µg/L Cylindrospermopsin: equal to or greater than 0.5 µg/L

Where and when HABs will occur remains an information gap that prevents us from fully understanding the human exposure risks from cyanotoxins in drinking water provided by PWSs. There is a knowledge gap regarding the occurrence and formation of blooms in surface waters, *including rivers*. Occurrence information in all surface waters could be collected using planned and event response monitoring for HABs, cyanotoxins and HAB predictors, such as nutrients. Understanding the factors leading to HAB and cyanotoxin formation can help provide insight into occurrences of HABs and cyanotoxins, provide information for recommendations for monitoring frequency, and better inform HAB prevention strategies. For example, *although research has shown nutrients, specifically phosphorous and nitrogen, play key roles leading to HAB formation (WHO, 1999; Jacoby et al., 2000)* additional information is needed to fill information gaps on understanding *the relationships among nutrient levels, bloom formation, toxin release and other factors such as temperature and precipitation*. This information could be used to determine threshold values for various indicators….

The relationship among factors that promote algal bloom and subsequent toxin production are not well understood. *Those factors include both environmental conditions such as water clarity, meteorological conditions, alteration of water flow, vertical mixing, temperature and water quality conditions such as pH changes, nutrient loading (principally in various forms of nitrogen and phosphorus) and trace metals….* More information is also needed to better understand how climate change will affect the geospatial and temporal distribution of HABs. For example, studies have shown that *increases in temperature, altered rainfall patterns, and anthropogenic nutrient loading may lead to an increase in bloom frequency, intensity, duration and geographic distribution (O'Neil et al., 2012; Paerl and Huisman, 2009; Paerl et al., 2011)*. Another information gap is understanding how the interactions of multiple future climatic changes will impact HAB and cyanotoxins in fresh water systems. Given the potential increase in cyanobacterial blooms due to both the direct and indirect effects of climate change, *understanding the effects at a regional scale can help water systems prepare for potential blooms that could occur due to changes in regional climate*. *(*Algal Toxin Risk assessment and Management Strategic Plan for Drinking Water 2015)

Besides algae concerns and the necessity of including specific precautionary thresholds for them, Regulation 2 must include the latest 2012 EPA recommendations for pathogen thresholds recognizing the increase in CAFO waste outputs through leakage and land applications, especially in karst terrains.

What are the recommendations? The 2012 RWQC offer two sets of numeric concentration thresholds, either of which would protect the designated use of primary contact recreation and, therefore, would protect the public from exposure to harmful levels of pathogens. Illness rates upon which these recommendations are based use the National Epidemiological and Environmental Assessment of Recreational Water (NEEAR) definition of gastrointestinal illness, which is not limited to illnesses which exhibit a fever. *The RWQC consist of three components: magnitude, duration and frequency*. The magnitude of the bacterial indicators are described by both a geometric mean (GM) and a statistical threshold value (STV) for the bacteria samples. The STV approximates the 90th percentile of the water quality distribution and is intended to be a value that should not be exceeded by more than 10 percent of the samples taken. The table summarizes the magnitude component of the recommendations. *All three components are explained in more detail in the sections below*. Water quality criteria recommendations are intended as guidance in establishing new or revised water quality standards. They are not regulations themselves.
https://www.epa.gov/sites/production/files/2015-10/documents/rec-factsheet-2012.pdf

The Alliance proposes that ADEQ, ANRC, and the ADH collaborate to rigorously monitor and assess pathogens, E-coli, and algae types, characteristics, and growth patterns according to WHO and 2012/15 EPA recommendations, to proactively implement recommended thresholds in regulation 2, and to update these as newer guidelines emerge for recreational waters and drinking water. Such a collaborative arrangement has been described for one watershed in the Governor's new "**Buffalo River Watershed Management Plan":**

Watershed-Based Management Plan for the Buffalo River Watershed, AR

Task 2, Characterize watershed **Costs $11,992**

Objective: Review existing studies of the Buffalo River watershed to characterize pollutants, sources, and loads

Subtask 2.1 Gather existing data and information from previous studies and modeling

Subtask 2.2 Identify data gaps

Subtask 2.3 Characterize pollutant trends, sources, and causes

Subtask 2.4 Estimate pollutant loads

The Alliance requests that Regulation 2 include this plan's Task # 2, making sure to gather and include additional existing watershed water quality data from the National Park Service and the Karst Hydrogeology of the Buffalo National River (KHBNR) team as well, in order to create a well-rounded and more complete assessment for estimations and conclusions.

In addition to the comments above, we incorporate by reference, in full, the comments submitted by Ozark River Stewards.

Thank you for the opportunity to submit these comments.

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