Cyanotoxins in Drinking Water: **Filling the Data Gaps**

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The United States Environmental Protection Agency (EPA) and the Safe Drinking Water Act (SDWA) play vital roles in protecting public health from contaminants that may occur in drinking water. The SDWA was passed by Congress in 1974 and amended in 1986 and 1996. The Act authorizes EPA to establish national primary drinking water regulations (NPDWRs) to protect public health. Currently, there are no NPDWRs for cyanotoxins (USEPA 2014a). In order for EPA to decide to develop a NPDWR for cyanotoxins, the agency would consider whether cyanotoxins are likely to cause an adverse effect on the health of persons, are known or likely to occur in public water systems at a frequency and level of public health concern, and in the sole judgment of the EPA Administrator, a regulation presents a meaningful opportunity to reduce risk to persons served by public water systems, per SDWA Section 1412(b)(1)(A). Health effects information and drinking water monitoring data are key building blocks upon which a decision to develop or not develop a regulation for cyanotoxins would be dependent. This article points out areas where additional data could facilitate a decision as to whether to develop a cyanotoxin regulation.

Figure 1 depicts the drinking water program's risk management processes and indicates steps throughout the processes where public input is requested. These processes guide EPA to take the necessary regulatory steps to address possible public health risks from unregulated contaminants, such as cyanotoxins, should it be necessary.

Contaminant Candidate List

Cyanotoxins have the potential to occur in sources of drinking water and are associated with adverse human health risks (USEPA 2014a; WHO 1999). Cyanotoxins, including anatoxin-a, microcystin-LR, and cylindrospermopsin are on the most recent draft fourth Contaminant Candidate List (CCL

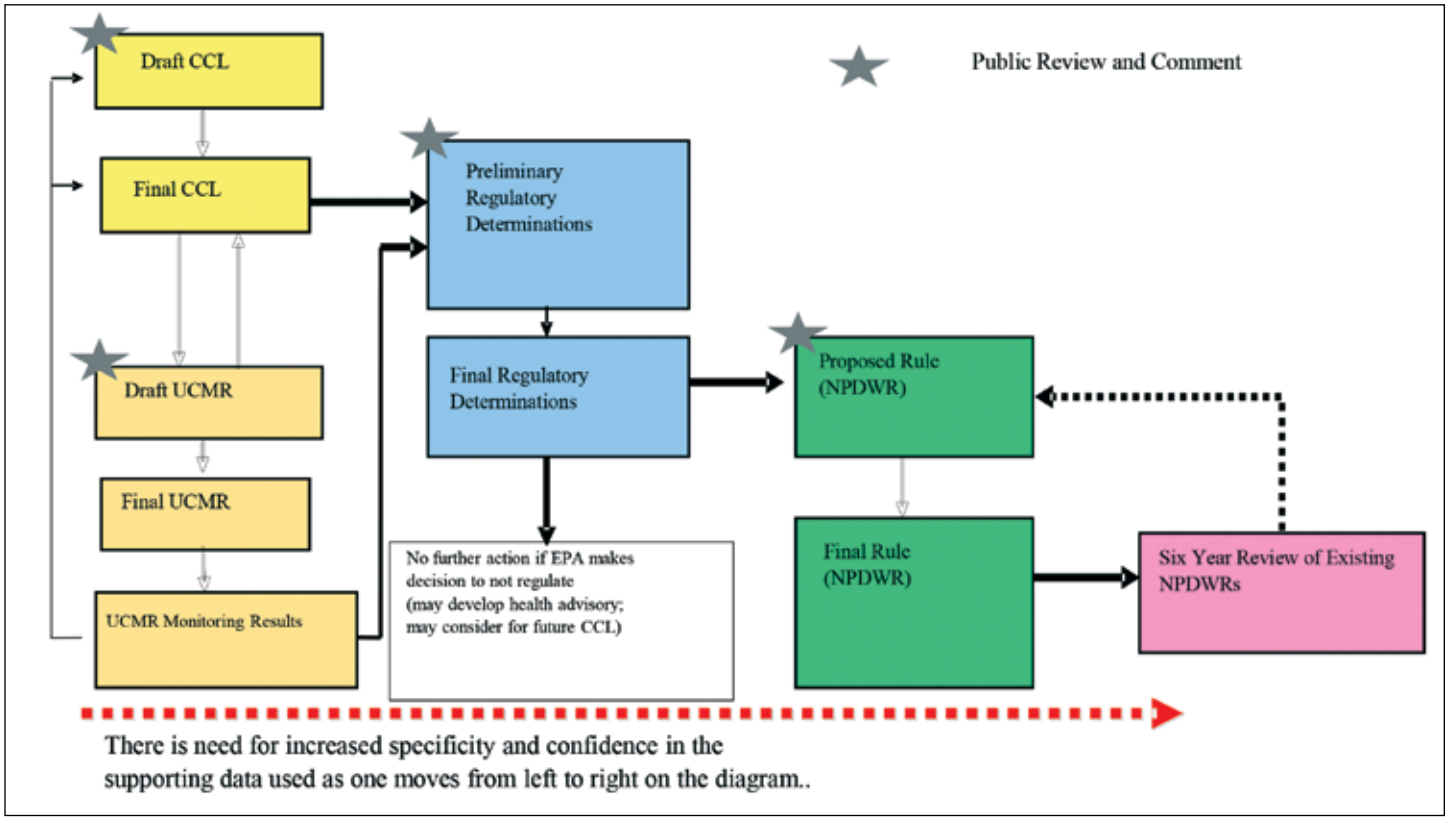

Figure 1. Drinking Water Program Risk Management Processes (adapted from USEPA, 2014b) .

4) (USEPA 2015a) and have been included on previous CCLs that were published in 1998, 2005, and 2009. EPA is required by SDWA to publish a CCL every five years. A CCL is a list of unregulated contaminants that are known or anticipated to occur in public water systems and may require regulation (USEPA 2015a). In establishing a CCL, EPA uses a screening and selection process to identify unregulated contaminants with the greatest potential to occur in public water systems and which may require regulation due to potential public health concerns.

Regulatory Determination Process

EPA evaluates contaminants on the CCL to determine whether the agency should initiate a rulemaking for a specific contaminant or group of contaminants in a process called "Regulatory Determination." When sufficient information and data are available, a decision to initiate regulatory development (positive) or not to regulate (negative) is made. If a positive determination for a contaminant is made, EPA prepares a proposed NPDWR (proposed rule) for public review and comment. A final rule is subsequently prepared considering new information and public comments received on the proposed rule. The lack of sufficient information upon which to make Regulatory Determinations, often results in EPA not making Regulatory Determinations on specific contaminants. EPA uses the CCL process to prioritize research and data collection efforts to acquire information that will facilitate Regulatory Determinations (USEPA 2013). For additional information on the CCL and Regulatory Determination processes, please see www2.epa.gov/ccl.

Routes to Obtain Additional Contaminant Information

EPA uses the best available health effects and occurrence data when determining whether to regulate a contaminant. At this time, there is limited drinking water occurrence (frequency, location, and concentration) data for cyanotoxins. Inclusion of cyanotoxins on the CCL communicates to government agencies, the academic community, and other interested stakeholders the need for more health effects and monitoring information. EPA's Unregulated Contaminant Monitoring Regulation (UCMR) program considers the CCL when determining which contaminants to include in its drinking water monitoring program. While not all CCL contaminants are included in the UCMR program, the CCL helps inform the priorities of the UCMR program. The UCMR program collects nationwide monitoring data from public drinking water systems for no more than 30 unregulated contaminants every five years. If the EPA determines that additional cyanotoxin occurrence data would help inform future agency decision making, the agency would consider including cyanotoxins in the next UCMR monitoring program. Cyanotoxins were not monitored in previous UCMRs. They were removed from the selection process due to the need for analytical method improvements (USEPA 2012). EPA recently released new methods for cyanotoxins, including microcystins and nodularin (Method 544) and cylindrospermopsin and anatoxin-a (Method 545) (USEPA 2015b, c). For more information on the UCMR selection process, please see http://water.epa.gov/lawsregs/rulesregs/sdwa/ucmr/.

Health Advisories

For unregulated contaminants, such as cyanotoxins, EPA may have enough information to publish drinking water health advisories (HAs). EPA develops HAs to provide information on contaminants that are known or anticipated to occur in drinking water and that can cause human health effects. HAs provide non-enforceable contaminant concentrations at which adverse human health effects are not anticipated to occur over a specified duration (e.g., one-day, ten-day, lifetime). They provide technical guidance to drinking water regulators and contain information on health effects, toxicokinetics, occurrence and exposure, analytical methods, and treatment technologies associated with specific drinking water contaminants (USEPA 2014c). EPA anticipates releasing HAs for microcystin and cylindrospermopsin in summer 2015. Information in the HAs is a step forward in summarizing health and exposure effects related to cyanotoxins.

Final Thoughts

EPA and partner organizations are filling data gaps related to human health risks of cyanotoxins in drinking water. The publication of health advisories will fill some of these gaps while the acquisition of occurrence data, such as through the UCMR program, would provide information that will be key to determining if addressing cyanotoxin risk through a NPDWR is appropriate.

In summary, EPA provides states and utilities with information in the short-term, while following an established process to develop science-based NPDWRs, when needed.

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the threshold has already been reached. At the conclusion of these studies, my goal is to be able to make recommendations for the management of *D. geminata* mats in the Kootenai River.

Conclusion

D. geminata is an unsightly nuisance that many wish would just wash away. However, this diatom may be an indicator of a much larger environmental issue. Understanding the driving mechanism behind the dramatic shift of the microscopic native diatom to the ugly macroscopic nuisance is essential to identify viable management strategies and understand ecosystem health. While the Kootenai River has an extensive water quality dataset, for most river systems with significant *D. geminata* nuisance mats, long-term water quality data are patchy or non-existent, making it difficult to detect consistent and widespread regional trends. To further understand this complex issue, efforts to compile mat (nuisance or otherwise) locations, cell locations, and related water quality data are imperative. Understanding global environmental health trends is an enormous undertaking but by working to understand this perplexing diatom, I aim to gain valuable insights.

If you are interested in providing algae scrapings for *D. geminata* detections and the Didymo Database, please contact Mary Coyle at rocksnotresearch@gmail.com.

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