Recommendation for the Regulation of Cyanotoxins in Drinking Water

Basis and Background

New Jersey Drinking Water Quality Institute

August 4, 2025

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State of New Jersey
DEPARTMENT OF ENVIRONMENTAL PROTECTION
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Governor

TAHESHA L. WAY
Lt. Governor

SHAWN M. LaTOURETTE
Commissioner

August 4, 2025

Shawn M. LaTourette, Commissioner
New Jersey Department of Environmental Protection
P.O. Box 402
Trenton, NJ 08625-0402

Dear Commissioner LaTourette,

The members of the New Jersey Drinking Water Quality Institute (Institute) are pleased to submit their recommendation for the regulation of cyanotoxins in drinking water. Throughout these materials, we use the term "cyanotoxins" to refer specifically to the following four types of toxins, unless otherwise noted: microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin.

Three subcommittees within the Institute were established to address the essential considerations for development of drinking water standards as outlined in the New Jersey Safe Drinking Water Act (N.J.S.A. 58:12A-20). The Health Effects Subcommittee is responsible for recommending health-based levels for contaminants of concern, the Testing Subcommittee is responsible for evaluating and recommending appropriate analytical methods and developing Practical Quantitation Levels (PQLs; the levels to which a contaminant can be reliably measured by drinking water laboratories), and the Treatment Subcommittee is responsible for evaluating best available treatment technologies for removal of the contaminants of concern from drinking water.

The three subcommittees thoroughly reviewed the available scientific information relevant to the health effects, analytical methods, and treatment options associated with cyanotoxins in drinking water. The Health Effects Subcommittee reviewed the basis of the Reference Doses and drinking water guidance values developed by the Division of Science and Research (DSR) of the New Jersey Department of Environmental Protection (Department) and summarized their findings in a memorandum sent to the Institute on October 27, 2022. The Testing and Treatment Subcommittees developed detailed technical reports to support the recommendations described below. The Testing and Treatment Subcommittee recommendations were presented at a public meeting of the Institute on February 22, 2023 and July 2, 2024, respectively, and the draft subcommittee reports were posted for a 60-day public comment period which started in January 2025. The Treatment Subcommittee presented responses to the comments submitted during the public comment period, and the changes to the draft Treatment Subcommittee report in response to the comment, at the

May 29, 2025, Institute meeting. No comments were submitted regarding the other subcommittee's work.

The Health Effects Subcommittee concluded that the Department's drinking water guidance values are protective for short-term exposure and supports the use of the Department's drinking water guidance for the four cyanotoxins. The Testing Subcommittee determined a PQL of 0.3 µg/L for the cyanotoxin group microcystins, which is higher than the than the Department's drinking water guidance value of 0.07 µg/L for microcystin in children six years or less of age. The Testing Subcommittee further stated that additional research was needed for the development of a PQL for cylindrospermopsin, anatoxin-A, and saxitoxin. The Treatment Subcommittee concluded that cyanotoxins can be reliably and feasibly managed and/or removed by drinking water systems. Furthermore, the Treatment Subcommittee recommended that a treatment technique approach be considered in regulating cyanotoxins and advises that drinking water systems manage cyanotoxins by carefully considering a multi-barrier approach that consists of establishing a robust watershed management plan and optimizing treatment plant technologies.

The conclusions reached by the three subcommittees, which are detailed in the attached documents, were approved by a unanimous vote (11-0, 2 absences, 1 vacancy) at an Institute meeting on May 29, 2025. As the analytical methods for cyanotoxins are currently a limiting factor, the Institute recommends a drinking water standard for the cyanotoxin microcystin based on the PQL of 0.3 µg/L and recommends the Department regulate cyanotoxins in drinking water utilizing a treatment technique-based approach.

Please feel free to contact me if you have any questions or need additional information related to these recommendations.

Respectfully,

Phoebe Stapleton

Phoebe Stapleton, Ph.D.
Chair, Drinking Water Quality Institute

Table of Contents

Executive Summary

The New Jersey Drinking Water Quality Institute (Institute), established by the 1984 amendments to the New Jersey Safe Drinking Water Act (SDWA) at N.J.S.A. 58:12A- 20, is charged with developing drinking water standards for hazardous contaminants in drinking water and for recommending those standards to the New Jersey Department of Environmental Protection (Department).

Three subcommittees are established within the Institute to address the essential considerations for development of drinking water standards as outlined in the New Jersey SDWA. The Health Effects Subcommittee is responsible for recommending health-based levels for contaminants of concern. The Testing Subcommittee is responsible for evaluating and recommending appropriate analytical methods and developing Practical Quantitation Levels (PQLs; the levels to which a contaminant can be reliably measured by drinking water laboratories). The Treatment Subcommittee is responsible for evaluating the best available treatment technologies for the removal of contaminants of concern from drinking water.

The three Institute subcommittees have reviewed the available scientific information relevant to the health effects, analytical methods, and treatment options associated with four cyanotoxins: microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin. Throughout these materials, we use the term "cyanotoxins" to refer specifically to these four types of toxins unless otherwise noted. Detailed documents presenting the technical basis for each of the Subcommittees' recommendations are attached in Appendices A, B, and C.

The Health Effects Subcommittee concluded that the Department's drinking water guidance values are protective for short-term exposure and supports the use of the Department's drinking water guidance for the four cyanotoxins. The Testing Subcommittee determined a PQL of 0.3 µg/L for the cyanotoxin group microcystins and stated that additional research was needed for the development of a PQL for cylindrospermopsin, anatoxin-A, and saxitoxin. The Treatment Subcommittee concluded that cyanotoxins can be reliably and feasibly managed and/or removed by drinking water systems. Furthermore, the Treatment Subcommittee recommended that a treatment technique approach be considered in regulating cyanotoxins and advises that drinking water systems manage cyanotoxins by carefully considering a multi-barrier approach that consists of establishing a robust watershed management plan and optimizing treatment plant technologies.

Because the analytical methods for cyanotoxins are currently a limiting factor, the Institute recommends a drinking water standard for the cyanotoxin microcystin based on the PQL of 0.3 µg/L and recommends the Department regulate cyanotoxins in drinking water utilizing a treatment technique-based approach.

Introduction

Background

The New Jersey Safe Drinking Water Act at N.J.S.A. 58: 12A-20, established the New Jersey Drinking Water Quality Institute (Institute), consisting of six ex officio and nine appointed members, to make recommendations to the New Jersey Department of Environmental Protection (Department) regarding drinking water quality. The members represent the public, the academic community, the water purveyors, the Department, the New Jersey Department of Health, and the New Jersey Water Supply Advisory Council.

The Institute is responsible for providing recommendations to the Commissioner of the Department on the implementation of the Department's drinking water quality program. Three subcommittees are established to address the important considerations in the development of drinking water standards. The Health Effects Subcommittee recommends health-based levels that are target drinking water levels based solely on health effects. The Testing Subcommittee reviews existing analytical methods to identify those methods with practical quantitation levels (PQLs). The Treatment Subcommittee evaluates the best available treatment technologies for removal of contaminants from drinking water.

In December 2021, the Institute began to evaluate the four cyanotoxins: microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin. The Institute has accepted the recommendations from each of its three subcommittees that are presented in this document and can be found in full in the appendices. These subcommittee recommendations form the basis for the Institute recommendation that the Department develop a regulation for cyanotoxins.

Drinking Water Quality Institute Membership

Chair
Phoebe Stapleton, Ph.D., Rutgers University

Health Effects Subcommittee
Chair: Jessie Gleason, M.S.P.H., NJ Department of Health
Josephine Bonventre, Ph.D., NJ Department of Environmental Protection
Perry Cohn, Ph.D., retired, NJ Department of Health
Judith Klotz, M.S., Dr.P.H., Rutgers University, Drexel University

Testing Subcommittee
Chair: Tina Fan, Ph.D., NJ Department of Health
Leslie Brunell, Ph.D., P.E., Stevens Institute of Technology
Michael Furrey
Michele Potter, NJ Department of Environmental Protection

Treatment Subcommittee
Chair: Oleg Kostin, New Jersey American Water
Richard Calbi, P.E., P.P., Ridgewood Water
Patricia Ingelido, NJ Department of Environmental Protection
Andrea McElroy, Veolia New Jersey – Haworth Water Quality Laboratory
Norman Nelson, P.E.

Health Effects Considerations and Recommendations

The Health Effects Subcommittee evaluated the basis of the Reference Doses and drinking water guidance values developed by the Department's Division of Science and Research (DSR) for four cyanotoxins: microcystins, cylindrospermopsin, anatoxin-a, and saxitoxin. In October 2022, the DWQI Health Effects Subcommittee released a memorandum summarizing its review.

In September 2017, DSR released guidance values for microcystins, cylindrospermopsin, and anatoxin-a (NJDEP, 2017). In May 2021, DSR recommended guidance values for saxitoxin (NJDEP, 2021). These guidance values were developed to be protective of short-term (10-day) exposure. These guidance values are shown in the table below.

Cyanotoxin	NJDEP Guidance Values (µg/L)	
	< 6 years of age	≥ 6 years of age
Cylindrospermopsin	0.2	1.0
Microcystins	0.07	0.3
Anatoxin-a	0.7	3.3
Saxitoxin	0.025	0.11

In its review, the Health Effects Subcommittee evaluated the risk assessment process used to develop the Reference Doses by the Department's Division of Science and Research (DSR), which are applicable to short-term exposure. The Subcommittee concurred that the Reference Doses developed by DSR are based on reviews of recent health effects literature and sound science. The Subcommittee also noted that the derivation of these Reference Doses underwent external peer review by experts in human health risk assessment and/or health effects of cyanotoxins and that DSR incorporated the peer reviewers' comments.

The Health Effects Subcommittee also agreed with DSR that the drinking water ingestion assumptions for ages 0 to 6 years, and 6 years of age to adulthood, used in the United States Environmental Protection Agency (EPA) drinking water Health Advisories for two cyanotoxins are appropriate for use in the Department's drinking water guidance for cyanotoxins. The Subcommittee further concurred with DSR that the Department's drinking water guidance values based on these Reference Doses and exposure assumptions are protective for short-term exposure.

Analytical Considerations and Recommendations

The Testing Subcommittee evaluated existing certified analytical methods for detecting the cyanotoxin microcystin, including EPA Method 546 (*Determination of Total Microcystins and Nodularins in Drinking Water and Ambient Water by Adda Enzyme-Linked Immunosorbent Assay*), and whether these methods could support DSR's guidance value of 0.07 µg/L for microcystins in children six years or less of age (Zaffiro et al 2016).

In addition, the Testing Subcommittee reviewed a two-part scientific evaluation conducted by the Department into the testing of microcystin with an enzyme linked immunosorbent assay (ELISA) using the ADDA-OH kit. This performance data was used to validate a modification to EPA Method 546, the Streptavidin Enhanced Sensitivity (SAES) assay. A round robin analysis was conducted with partner laboratories which were conducting cyanotoxin monitoring in drinking water systems using the data obtained during the validation study. Based on the results generated from the round robin study, and from the minimum reporting levels (MRLs) obtained from the performance data obtained from labs certified for EPA Method 546, and due to limitations with current detection capability of microcystins in finished drinking water, a PQL of 0.3 µg/L is recommended for microcystins.

It was further recommended that any result ≥ 0.3 µg/L for total microcystins in finished drinking water be followed up with confirmation by EPA Method 544 (*Determination of Microcystins and Nodularin in Drinking Water by SPE and LC-MS/MS Detection*) (Shoemaker et al 2015).

The three additional cyanotoxins, cylindrospermopsin, anatoxin-a, and saxitoxin were not evaluated as part of the Testing Subcommittee's review or the Department's round robin study. Cylindrospermopsin and anatoxin-a have an EPA-approved methodology, EPA Method 545 (*Determination of Cylindrospermopsin and Anatoxin-a in Drinking Water by Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC/ESI-MS/MS*) (EPA 2015), as well as an existing ELISA analytical methodology (EPA 2016). Saxitoxin does not have an EPA-approved methodology but does have an existing ELISA analytic methodology with extensive usage in the food industry for shellfish testing. The DSR recommended drinking water guidance values for cylindrospermopsin, anatoxin-a, and saxitoxin in finished drinking water are within the range of quantification for the ELISA methodology for these toxins; however, additional research is needed for the development of a PQL for these cyanotoxins, due to the limited number of laboratories performing these methods.

Treatment Considerations and Recommendations

The Treatment Subcommittee reviewed the current literature and conducted outreach to drinking water systems across the United States to review treatment options for the removal of cyanotoxins, their efficiency, reliability, and viability for large-scale water treatment. In addition, the Treatment Subcommittee reviewed other cyanotoxin mitigation strategies implemented by other states.

Cyanotoxins can be produced by cyanobacteria in surface water bodies, such as lakes, reservoirs, and rivers, that are utilized as drinking water sources by water systems. As a result, the Treatment

Subcommittee considered algal bloom prevention and mitigation strategies for cyanotoxin management in sources waters. Treatment methods for removing cyanotoxins that have entered the drinking water treatment plant were also evaluated. Effective strategies varied based on whether intracellular and/or extracellular cyanotoxins were the main concern.

The Treatment Subcommittee concluded that cyanotoxins can be reliably and feasibly managed and/or removed by drinking water systems. The Treatment Subcommittee advises that water systems manage cyanotoxins by carefully considering a multi-barrier approach that is uniquely designed and optimized to fit the characteristics of the system. Drinking water systems should have a Cyanotoxin Management Plan (CMP) that addresses prevention management, source water monitoring, and treatment optimization and considers both normal operating conditions and unusual or extreme conditions, such as drought and weather events. The Treatment Subcommittee recommends that a treatment technique approach be considered by the Department to regulate cyanotoxins at drinking water systems. Furthermore, the Treatment Subcommittee recommends that the Department explore the impact of cyanotoxins to private wells and whether changes to the Private Well Testing Act (PWTA) could help address these impacts.

Recommendation

The Health Effects Subcommittee supported the use of the drinking water guidance developed by DSR for the four cyanotoxins. The Testing Subcommittee recommended a PQL of 0.3 µg/L for the cyanotoxin microcystins, which is higher than the than the Department's drinking water guidance value of 0.07 µg/L for microcystin in children six years or less of age. The Treatment Subcommittee concluded that cyanotoxins can be reliably and feasibly managed and/or removed by drinking water systems. The Institute has accepted the recommendations of each of the three subcommittees. Accordingly, the Institute recommends a drinking water standard for the cyanotoxin microcystin based on the PQL of 0.3 µg/L and recommends the Department regulate cyanotoxins in drinking water utilizing a treatment technique-based approach.

References

EPA. 2015. Method 545: Determination of Cylindrospermopsin and Anatoxin-a in Drinking Water by Liquid Chromatography Electrospray Ionization Tandem Mass Spectrometry (LC/ESIMS/MS), EPA 815-R-15-009. https://www.epa.gov/sites/default/files/201710/documents/epa_815-r-15-009_method_545.pdf.

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NJDEP. 2021. Recommendations for NJDEP Drinking Water Guidance for Saxitoxin. Division of Science and Research.

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