May 2019

RECOMMENDATIONS REPORT

CONTAMINANTS OF EMERGING CONCERN WORKGROUP

Prepared for The Association of Clean Water Administrators (ACWA) and
the Association of State Drinking Water Administrators (ASDWA)

Contaminants of Emerging Concern Workgroup Recommendations Report

Executive Summary

The Federal Clean Water Act (CWA) and Federal Safe Drinking Water Act (SDWA), along with state-specific laws and regulations, place state drinking and clean water agencies on the front lines of addressing contaminants in the water cycle. When a contaminant is detected and raises concerns about potential human health or ecological effects, citizens turn to state agencies for answers and actions. In these contexts, states are often placed in the difficult position of formulating responses to concerns and prescribing actions while needed information on toxicity, occurrence, or treatment options is lacking. As experiences with such compounds as per- and polyfluoroalkyl substances (PFAS) have shown, states and their citizens can be left vulnerable to a combination of mixed messages, fear, insufficient actions, and mistrust of best methods to protect public and ecological health.

The Association of Clean Water Administrators (ACWA) and the Association of State Drinking Water Administrators (ASDWA) seek, with this report, to respond to this challenging situation. Some 40,000 estimated chemicals are currently used in commerce and many new chemicals are introduced each year. In the absence of a concerted effort to learn from past experience and make adjustments to the policy and programmatic environment that addresses these contaminants, it is reasonable to anticipate that this pattern will continue into the future. In response, ACWA and ASDWA convened a workgroup of clean water and drinking water resource managers from across the country to discuss recommendations to improve the management of Contaminants of Emerging Concern (CECs). These recommendations are presented for further consideration and action as appropriate by the ACWA and ASDWA Boards.

To organize its exploration of CEC-related challenges and formulate its recommendations for improving CEC-related programs and policies, the Contaminants of Emerging Concern Workgroup articulated a four-phase CEC Lifecycle Framework for this report. This framework reflects an effort to better understand (and document) how current federal, state, and non-governmental programs and policies relate to the detection, characterization, and management of CECs. The four CEC Intervention Phases are:

1. Introductory Screening – relates to federal and certain state programs and policies that seek to ***prevent*** the entry of harmful substances into the water cycle. At present, there are a number of controls and interventions available to the federal government and select states to prohibit or restrict use, deny registration, or prevent distribution of CECs in commerce. For example, USEPA has the authority under the Toxic Substance Control Act to prohibit or restrict use under the New Chemicals Program.[1]

[1] USEPA, Reviewing New Chemicals under the Toxic Substances Control Act (TSCA): https://www.epa.gov/reviewing-new-chemicals-under-toxic-substances-control-act-tsca/actions-under-tsca-section-5

2. Monitoring and Impact Surveillance – relates to federal (e.g., USEPA, USGS), state, interstate, and non-governmental (e.g., academic organizations and watershed associations) programs that ***identify and quantify*** CECs in drinking water, groundwater, surface water, sediment, and fish tissue. Evidence of adverse ecological or human health effects may prompt increased water monitoring of a contaminant or group of contaminants. Additionally, independent toxicity evaluations, or results from newer tools such as bioanalytical screening methods, may also establish a substance as potentially problematic to human or ecological health.

3. Formal Risk Assessment Process Initiated – reflects efforts undertaken by federal (SDWA, CWA, TSCA, or FIFRA) or similar state programs to better (and more formally) ***understand exposure routes and establish aquatic and human health toxicity benchmarks.*** This phase also encompasses ***validation and approval of analytical methods*** for CECs by the USEPA, Department of Defense, ASTM, National Environmental Laboratory Accreditation Program, or individual states, thereby assuring future monitoring will generate data of known, consistent, and documented quality for next steps.

4. Formal Risk Management – addresses the formulation of ***regulatory or voluntary actions to limit CEC exposure*** and thereby attain acceptable human and ecological health risk levels. Actions may include: prohibition or restriction on manufacture, import, use, or disposal (TSCA, FIFRA, RCRA); development of ambient water quality or effluent standards (CWA); or establishment of Maximum Contaminant Levels (SDWA), or state equivalents.

Using this framework as a guide, workgroup members prepared recommendations organized into five Action Areas and identified a set of supplemental actions to facilitate implementation across all phases.

1. **Establish a National Priority Framework and Research Agenda for Priority Setting**
2. **Engage Industry to Develop and Improve Access to Comprehensive Chemical Data**
3. **Increase Coordinated Monitoring Across Water Resource Management Programs**
4. **Expedite Risk Assessment and Response**
5. **Improve Risk Communication**

Utilize Supplemental Actions to Facilitate Implementation Across All Phases. Supplemental actions are intended to provide general improvement to the authorizing environment in which the suite of recommendations from the Action Areas will be implemented. The workgroup proposes two supplemental actions:

1. *Expand resources to increase the rate of evaluating and responding to CECs.* Programs at the state and federal level charged with preventing, identifying, assessing, and monitoring CECs have insufficient funding to keep pace with the demands placed by new and emerging CECs. To address these deficiencies workgroup members recommend: increase funding to the federal programs charged with reviewing substances to reduce backlogs and evaluate substances at a rate that

matches the pace at which new substances are submitted for evaluation; conduct a funding gap analysis to ensure states are provided with adequate resources to address monitoring, developing human health and aquatic life criteria, risk assessments, and standards development for CECs; and identify non-federal sources of funding for states to expand state resourcing options; for example, the funding mechanism used for the Washington State Model Toxics Control Act.[2]

2. *Engage the authorizing environment to strengthen CEC response.* The current procedures and methods used by federal programs limit developing protective limits for CECs in a timely manner. Workgroup members recommend establishing an independent body to oversee federal efforts to assess and derive risk management responses to CECs. Workgroup members recommend pursuing federal recognition and acceptance of state-specific CEC standards; when states have taken independent action to address CECs, federal facilities within their jurisdictions have, at times, questioned the obligation to meet the state set limits.

The recommendations seek to improve the prevention, identification, assessment, and management intervention actions available to water resource managers at each of the four CEC Intervention Phases. These recommendations, presented for further consideration and action as appropriate by the ACWA and ASDWA Boards, reflect the recognition that past challenges with addressing CECs will persist into the future in the absence of focused efforts to alter the current CEC programmatic, procedural, and policy framework. The recommendations presented in this report seek to help states and other water resource management partners—including federal agencies, non-governmental organizations, and chemical manufacturers—more effectively coordinate and utilize the resources we do have (data, models, research and monitoring efforts, etc.), alter programs and procedures to streamline the advancement of CEC understanding and decision-making in a more timely manner, and, in certain instances, reform the current regulatory and policy context to improve prevention of or response to CECs in the water cycle.

[2] https://ecology.wa.gov/Spills-Cleanup/Contamination-cleanup/Rules-directing-our-cleanup-work/Model-Toxics-Control-Act

Introduction

Each year, state water resource managers across the country are responsible for managing a growing list of substances that may be present in their waters and that are suspected to negatively impact the human and ecological health of their communities. In 2018, the Association of Clean Water Administrators (ACWA) and Association of State Drinking Water Administrators (ASDWA) convened a workgroup of clean water and drinking water resource managers from across the country to discuss recommendations to improve the management of these substances. Appendix A includes a complete roster of the Contaminants of Emerging Concern (CEC) Workgroup participants.

Over eight months, the workgroup participated in interviews, webinars, and two in-person meetings to map the current voluntary and regulatory processes for contaminants, as well as to identify barriers to an efficient and effective process to control occurrence of these contaminants in the water cycle. The dialogue also explored the role ACWA and ASDWA can play in helping improve the current processes. The resulting recommendations reflect agreement among workgroup participants for a core set of actions to optimize control of potentially adverse impacts across the entire water cycle.

What Is a Contaminant of Emerging Concern?

While adverse impacts of some "legacy" contaminants have long been known (e.g., lead, mercury, PCBs, DDT) there is both significant public concern and accumulating evidence to support supplemental actions to address newer or lesser-known contaminants. These contaminants are referred to in this document as contaminants of emerging concern (CECs). CECs can be a contaminant that has been newly discovered in the environment (e.g., per- and polyfluoroalkyl substances). A CEC may also be a contaminant that has been known for a long time but is generating increased interest in the scientific community due to new scientific information about its impacts on public health or the environment. These contaminants are often unregulated or are regulated at a level that may no longer be considered adequately protective of human and ecological health.

CECs may be either naturally occurring or man-made:

- **Naturally Occurring CECs** may be inorganic substances in rocks and soil or organic substances produced by algae, bacteria, or other microorganisms. Naturally-occurring CECs may be dispersed through human activities. Examples of naturally-occurring CECs include manganese and cyanotoxins.

- **Man-Made CECs** are non-naturally occurring substances introduced into the environment or drinking water through human activities. Examples of man-made CECs include pharmaceuticals, phthalates, and disinfection by-products such as haloacetic acids or trihalomethanes.

This report also recognizes that there are many chemical compounds, both naturally occurring and man-made, for which the combination of inherent toxicity and use/disposal profile do not pose unacceptable risks to human or ecological health (including aquatic and terrestrial species).

Lifecycle Framework

There are currently over 40,000 chemicals estimated to be used in commerce[3] with more added daily. Of these, many chemical compounds do not pose an unacceptable risk to human or ecological health given their inherent toxicity and current use/disposal profile. However, for contaminants that are identified to be of concern or potential concern, detection and intervention action can (and should) occur along a continuum of four different phases: introductory screening, monitoring and impact surveillance, formal risk assessment, and formal risk management. At each phase of this intervention "lifecycle," there is evidence that can be gathered and intervention actions that may be taken to prevent, limit, or remediate human and environmental exposure of a CEC. These intervention actions range from regulatory actions and controls by federal and state government bodies to information gathering processes, such as research and monitoring, conducted by federal, state, or non-governmental entities. The following framework defines each of these phases and outlines potential intervention actions associated with each.

Phase 1: Introductory Screening

Before a substance can be sold for use in the U.S., an introductory screening phase should provide the first opportunity to determine if the substance will present an unreasonable risk of injury to human or ecological health. If screened appropriately, substances that may pose adverse impacts could be prevented from entering the water cycle, through restriction or prohibition of manufacturing or importation of the CEC for use in commerce.

There are currently a number of controls and interventions available to the federal government to prohibit or restrict use, deny registration, or prevent distribution of the CEC. For example, USEPA has the authority under the Toxic Substance Control Act (TSCA) to prohibit or restrict use under the New Chemicals Program. Under authorities from the Federal Insecticide, Fungicide and Rodenticide Act (FIFRA), USEPA can deny registration and distribution of certain chemicals, or restrict their use.

States also may have authority to restrict chemicals in commerce that pose a risk to human or ecological health. For example, twelve states and the District of Columbia have enacted laws restricting the manufacture, sale, or distribution of products containing bisphenol-A. California's Safe Drinking Water

[3] EPA: EPA Releases First Major Update to Chemicals List in 40 Years: https://www.epa.gov/newsreleases/epa-releases-first-major-update-chemicals-list-40-years

and Toxic Enforcement Act of 1986 (Proposition 65) requires businesses to provide warnings to Californians about significant exposures to chemicals that cause cancer, birth defects, or other reproductive harm. The state publishes an annually-updated list of these chemicals, and the law prohibits manufacturers from knowingly discharging significant amounts of listed chemicals into sources of drinking water. Introductory screening is a key step in preventing the entry of harmful chemicals into the water cycle.

Phase 2: Monitoring and Impact Surveillance

Without prohibition or restrictions before manufacture or import, there is potential for a man-made CEC to enter the water cycle as a result of production, distribution, use, or disposal of goods and services in commerce. Naturally occurring CECs may also enter or be present in the water lifecycle, either through environmental conditions or human activity. Once a CEC is in the water cycle, its occurrence, concentration, and persistence, or adverse health and ecological impacts, may remain unknown for a considerable period of time.

The monitoring and impact surveillance phase is where CECs are identified and quantified in drinking water, groundwater, surface water, sediment, and fish tissue through research and specialized, ongoing programs that monitor water quality, and human and ecological health. These programs may be carried out by federal (e.g., US Environmental Protection Agency (USEPA), US Geological Survey (USGS)), state, interstate, and non-governmental programs (e.g., academic organizations and watershed associations). USEPA, working with the states, conducts National Aquatic Resource Surveys (NARS) of ambient waters (rivers/streams, lakes, coastal waters, and wetlands) which occasionally include monitoring for CECs. USEPA also develops methods to assess wastewater, and states or other organizations may collect specialized data on CECs in wastewater through permit requirements or other mechanisms. USEPA, states, water purveyors, and others assess finished drinking water and water supply resources, through routine regulatory monitoring, special studies, and Unregulated Contaminant Monitoring Rule (UCMR) testing for contaminants of emerging concern that may be candidates for regulation. Drinking water source waters may be evaluated through source water assessments, ambient groundwater and surface monitoring programs, and other activities. When analytical monitoring of water resources includes non-targeted laboratory analyses, there is an increased likelihood of identifying CECs.

Evidence of adverse ecological or human health effects, such as the occurrence of intersex fish resulting from exposure to endocrine disrupting contaminants, or an increased incidence of elevated blood lead levels in children when lead concentrations in drinking water are high, may prompt amplified water monitoring of a contaminant or group of contaminants. Additionally, independent toxicity evaluations, or results from newer tools, such as bioanalytical screening methods, may also establish a substance as potentially problematic to human or ecological health. These efforts may result in the accumulation of evidence to support the initiation of the formal risk assessment process (Phase 3).

Phase 3: Formal Risk Assessment Process Initiated

Once surveillance programs have identified the existence of a CEC in the water cycle, or federal or state agencies have reason to believe the CEC may be a threat to human or ecological health if present in the water cycle, the risk that it poses to human and ecological health needs to be assessed. In this context, the risk assessment process is initiated under programs associated with, for example, federal Safe Drinking Water Act (SDWA), Clean Water Act (CWA), TSCA, and FIFRA, or similar state programs to better understand occurrence and exposure routes, establish aquatic and or human health toxicity benchmarks, and establish guidance or regulatory criteria.

The risks to human health from toxic chemicals in water are calculated by rigorous, nationally-accepted procedures that examine both cancer and non-cancer effects. USEPA and state risk assessments generally follow the four steps in the risk paradigm set forth in 1983 by the National Research Council, which stated that "risk assessments contain some or all of the following four steps:[4]

1. Hazard Identification: The determination of whether a particular chemical is or is not causally linked to particular health effects;

2. Dose-Response Assessment: The determination of the relation between the magnitude of exposure and the probability of occurrence of the health effects in question;

3. Exposure Assessment: The determination of the extent of human exposure before or after application of regulatory controls; and

4. Risk Characterization: The description of the nature and often the magnitude of human risk, including attendant uncertainty."

Human data are used as the basis of risk assessments when available (e.g., arsenic and benzene) but risk assessments for most chemicals are based on animal data. Cancer-based criteria are based on a cancer slope factor (potency factor) and non-cancer effects (e.g., liver or kidney damage, decreased immune response, changes in hormone levels, and behavioral, reproductive and developmental effects) are based on a Reference Dose (RfD). USEPA has provided extensive guidance on human health risk assessment.[5]

Ambient water quality criteria/standards under the CWA are based solely on a scientific rationale, while maximum contaminant level standards for drinking water (MCLs) are based on health effects and include the consideration of other factors such as analytical quantitation and cost of treatment technology. Many

[4] National Research Council. 1983. *Risk Assessment in the Federal Government: Managing the Process*. Washington, DC: The National Academies Press. https://doi.org/10.17226/366

[5] https://www.epa.gov/risk/risk-assessment-guidelines#tab-1

ambient water quality criteria are based on exposure to bioaccumulative chemicals via fish consumption, either separately from or in combination with exposure via water consumption. Risk assessments to derive ambient water quality criteria for human health and aquatic life are based on long-established national risk assessment procedures developed by USEPA.[6] Non-government researchers often conduct studies, using exploratory methods, that are used by state and federal governments to determine where further risk assessment is warranted.

During this phase, and in parallel with risk assessment activity, analytical methods for the CECs need to be validated and approved by agencies such as USEPA, Department of Defense, American Society for Testing and Materials (ASTM), National Environmental Laboratory Accreditation Program (NELAP), or individual states. This ensures that future monitoring will be generating data of known, consistent, and documented quality as the evaluative process moves towards formal risk management.

Phase 4: Formal Risk Management

Once 1) standardized, validated analytical methods and monitoring have identified the concentrations and locations of occurrence, 2) appropriate human health and aquatic toxicity testing have provided reliable information on the toxic effects, and 3) exposure routes are known, then regulatory action or voluntary guidelines to limit the exposure and/or enforceable remediations activities can be undertaken through a formal risk management approach. In situations where the adverse impacts are severe, risk management may take place while the risk assessment process is still under development. To prevent further exposure, intervention actions may include: prohibition or restriction of the contaminant in manufacturing or import (e.g., TSCA, Federal Food, Drug, and Cosmetic Act (FDCA)); development of ambient water quality standards for the protection of human health and aquatic life and effluent limits to meet those standards (CWA); pretreatment steps to avoid and minimize the impact to a municipality (CWA); establishment of MCLs (SDWA); state-derived safe drinking water levels, surface water quality standards, and fish consumption advisories. Where a substance is designated as a hazardous waste, remediation actions may include The Resource Conservation and Recovery Act (RCRA) and Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) requirements and/or the development of a state regulatory cleanup effort that is more stringent than the federal programs.

Recommended Action Areas

The following suite of recommendations have been organized into five action areas and are designed to improve the prevention, identification, assessment, and management intervention actions available to water resource managers at each of the four phases outlined above. These recommendations are articulated for the consideration of the ASDWA/ACWA boards, though due to the scope and nature of the

[6] [6] https://www.epa.gov/wqc/guidelines-deriving-numerical-national-water-quality-criteria-protection-aquatic-organisms-and

recommendations, implementation potentially requires work with a variety of water sector partners, including EPA, industry, and academic institutions.

- **Action Area 1:** Establish a National Priority Framework and Research Agenda for Priority Setting
- **Action Area 2:** Engage Industry to Improve Access to Comprehensive Chemical Data
- **Action Area 3:** Increase Coordinated Monitoring Across Water Resource Management Programs
- **Action Area 4:** Expedite Risk Assessment and Response
- **Action Area 5:** Improve Risk Communication

Action Area 1: Establish a National Priority Framework and Research Agenda for Priority Setting

Action Area 1 Improves Protective Levers in Phases:

Every year, thousands of new chemical substances are created for commercial use in the U.S., and there is a challenge to obtain sufficient knowledge of the risk that their presence in water may pose to human and ecological health. Though the CWA and SDWA were designed to provide federal and state governments with regulatory authority to protect human and ecological health in ambient and public drinking water supplies, these programs are not able to keep pace with the number of new chemicals entering commerce and the needs that arise when concern around possible contamination occurs. The federal and state governments need a more nimble and comprehensive process to address priority concerns on a national basis and provide states with technical support and resources to ensure protection of human and ecological health.

The use of existing authorities and processes under the CWA and SDWA to establish new criteria or standards is onerous, can take decades to implement, and does not meet public expectations for timely identification and prioritization of CECs. For example, under the SDWA, the USEPA identified a CEC (perchlorate) for development of a regulation in 2011, but the agency has yet to publish a proposed rule. In fact, it has been 18 years since USEPA last promulgated a drinking water standard for a new contaminant.[7] However slow these federal process are, many state agencies do not have the infrastructure (i.e., sufficient funds and/or staffing levels), regulatory authority, or technical expertise to derive their own criteria or set their own standards for drinking water, surface water, groundwater, and fish tissue. State resources can be further stressed by the need to develop scientifically-independent and transparent guidelines that have been appropriately vetted publicly when a priority CEC must be addressed. This pressure on state agencies to be out ahead of USEPA can come from interest groups or the public and can significantly impact the implementation of state derived guidelines, at times impeding the process or, alternatively, pressuring action that can stress state resources. While the framework of the federal SDWA contemplated enactment of national drinking water standards to ensure equal and

[7] In December 2000 an MCL was set for Uranium under the Radionuclides Rule. In 2011, under the CCL and UCMR processes, perchlorate was identified for regulation though as of April 2019, no proposed rulemaking has been published.

consistent protection of drinking water across the country, a few states have set stricter standards and/or standards for contaminants that are not federally regulated. As evidenced by current federal and state actions to address PFAS, the failure to provide a responsive process at the federal level is leading to a patchwork of state drinking water guidelines/action levels/standards and may leave many states unable to effectively regulate CECs. To better characterize the toxicity of the vast suite of untested and undertested substances, the following ideas to coordinate efforts and streamline response to CEC occurrence in the water cycle should be explored for implementation at a national level.

- **Recommendation 1.1: Engage and amplify state voices to establish a national framework and agenda.** States remain at the front lines of identification, characterization, and prioritization of CECs within their communities, and existing collaboration vehicles, such as Federal-State Toxicology and Risk Analysis Committee (FSTRAC) and Water Quality Standards Managers Association (WQSMA), should be supported and leveraged to gather input from state water resource managers. To accomplish this improved collaboration, the frequency of FSTRAC webinars should be increased and annual in-person meetings should be reinstated.

- **Recommendation 1.2: Develop an evaluation framework to organize the characterization of CECs.** To address the gap in monitoring and characterization of the magnitude and extent of CECs in ambient and drinking waters, develop a screening framework outlining necessary information for CECs to facilitate appropriate screening and management. Potential categories may include: uses, sources, fate and transport, persistence, breakdown/degradants, occurrence, human health toxicity, aquatic life toxicity, treatability, analytical methods, and bioaccumulation.

- **Recommendation 1.3: Using the framework, develop a national list of CECs to more nimbly and comprehensively respond to emerging CECs.** It is difficult for the federal government to respond rapidly to emerging CECs, leaving states to independently identify and prioritize them. USEPA should work cooperatively with states to generate a list of priority CECs by working with the members of ACWA, ASDWA, FSTRAC and WQSMA. Other resources that should be referenced include USEPA Toxic Release Inventory (TRI) data, USEPA and state NARS data, National Atmospheric Deposition Program air deposition data, air emission data, and other state monitoring data.

- **Recommendation 1.4: Develop a holistic research agenda to advance rapid and predictive screening methods/tests.** There is a need on a broad national scale to assess the capacity to more quickly evaluate the toxicity of chemical substances introduced into commerce, including the further development of predictive analytics and grouped evaluation methods. An agenda should be articulated in the near future to identify priority topics for research in support of advancing analytical methods in various types of matrices and health effects screening.

- **Recommendation 1.5: Identify gaps or barriers in current CWA/SDWA authorities to rapidly respond to CECs.** There is a need to identify and address existing barriers to this process to better respond CECs. Amendments are needed to realize longer-term improvements to the process and protect public health.

- **Recommendation 1.6: Develop a visual representation of the contaminant lifecycle phases and associated intervention actions.** Given the complexity of the CEC lifecycle, a visualization of the four

phases along with the associated federal, state, and non-governmental activities in each phase would help provide a shared understanding of the full suite of mechanisms available.

Action Area 2: Engage Industry to Develop and Improve Access to Comprehensive Chemical Data

Companies that develop and sell chemicals are required to provide toxicity data to the USEPA under TSCA. A number of barriers exist that prevent effectively accessing and using the data to identify, communicate, assess, and respond in the event of a CEC occurrence in the water cycle. When companies do provide toxicity data, the USEPA lacks the resources to fully review and use the information. Second, non-governmental researchers are unable to access the data due to confidential business information (CBI) provisions that protect companies from disclosure to non-governmental entities. This lack of access to or availability of toxicity information hinders non-governmental researchers, which conduct the majority of research that federal and state governments rely upon, from efficiently completing research and health studies. Finally, as risk assessors generally only provide stringent health protection guidelines for exposure to chemicals when there is substantial data to support such findings, this lack of access to or availability of toxicity information often means that little is done to limit the exposure to these chemicals or track where they are used as information is evolving. To effectively engage industry partners to improve the availability of and access to toxicity data for new or existing chemicals in widespread use, the following ideas should be explored.

- **Recommendation 2.1: Elevate state water resource manager understanding of current chemical substance regulation and resources.** In 2016, provisions in the Frank R. Lautenberg Chemical Safety for the 21st Century Act amended CBI access guidelines under TSCA. More research, such as a pilot test to request CBI information from a state or a non-governmental researcher under government contract, should be conducted to determine practicability of access. Additionally, trainings and materials should be developed by ACWA and ASDWA to map and communicate new TSCA requirements to water resource managers. FSTRAC may provide an existing vehicle for reaching states and could be expanded to include information sharing related to TSCA initiatives and development.

- **Recommendation 2.2: Initiate collaborative dialogue among manufacturers and water resource managers.** Enhanced communication and collaboration among manufacturers and water resource managers will likely improve the coordination needed to prevent or respond in the event of a CEC occurrence in the water cycle. Actors to engage in this dialogue include: federal toxicologists (e.g., USEPA, Agency for Toxic Substances and Disease Registry (ATSDR), Food and Drug Administration (FDA)), state officials (drinking water administrators, clean water administrators, toxicologists and risk assessors, standards developers), non-governmental researchers, manufacturers and associated representatives (e.g., American Chemical Council, FluoroCouncil), environmental contamination and product litigants, and non-governmental associations (e.g., Interstate Technology and Regulatory Council). Topics for discussion may include: effective methods for providing non-governmental

researchers with access to CBI, estimating risk when data are unavailable, improving access to lab standards and treatment technologies, augmenting methods for analytical identification and quantification, and providing guidance and insight when analytical methods are unavailable.

- **Recommendation 2.3: Explore targeted regulatory and legislative changes to increase manufacturer responsibility and the availability of manufacturer-produced toxicity information.** New chemical regulation should be amended to require a suite of information at time of introduction, available to both state and non-governmental researchers, to better equip water resource managers to access and respond should a substance enter the water cycle. This suite of information may include a complete life-cycle risk analysis, including for byproducts and degradants, bioaccumulation and persistence in the environment, potential human and ecological health impacts, lab standards, and analytical methods and requirements for ongoing review and update of the information (e.g., minimum every three years). In addition to providing comprehensive information on new substances, manufacturer responsibility for a substance should be increased. Changes may include: requiring corporate officers and product managers to provide annual certification under TSCA about any new information regarding the toxicity or other potential dangers to human and ecological health associated with chemicals they produce; expanding the TRI Program to include more substances; and requiring manufacturer surveillance monitoring for new chemicals that are toxic and/or have a high likelihood of reaching the water environment.

Action Area 3: Increase Coordinated Monitoring Across Water Resource Management Programs

Action Area 3 Improves Protective Levers in Phases:

Water resource managers at state clean water and drinking water programs often lack awareness or access to the information generated by other states, regional organizations, federal agencies, and academia on the occurrence of key emerging CECs that may have been found at levels of potential human health or ecological concern. Programmatic silos may prevent the effective sharing of information across clean water and drinking water programs, sometimes even in the same state. This lack of information sharing results in some states or programs remaining unaware that they should be investigating these priority CECs. This can result in states utilizing scarce resources to reinvent approaches or data that other organizations have already developed to address CECs, and/or investing resources unnecessarily to evaluate CECs that are unlikely to be priorities in their waters. It is crucial to ensure that occurrence and risk-based information is shared to prioritize CECs and to understand which CECs need to be monitored and addressed and which CECs do not.

Action Area 1 includes the recommendation to prepare a state-generated list of priority CECs and a characterization profile to target resources and identify needed information for priority CECs. The following recommendations seek to build on that coordinated action and improve the methods for sharing of information across federal, state, and non-governmental programs, and the following ideas should be

explored for both individual CECs, and where possible, groups of similar CECs (e.g., perfluorinated compounds).

- **Recommendation 3.1: Connect or expand existing information platforms with a more comprehensive dataset to facilitate the evaluation of CECs.** At present, CEC data remains fragmented and inaccessible. The Water Quality Portal (WQP)[8], which is primarily for ambient water data, provides an existing platform that should be enhanced and linked with other water databases to provide a more comprehensive and accessible dataset. The WQP could be linked to other data, such as groundwater, sediment, fish tissue, etc. For example, whole effluent toxicity (WET) violations of National Pollutant Discharge Elimination System (NPDES) permits in the WQP could be used to inform ambient water assessments, and exceedances could trigger additional monitoring of ambient waters. It is recommended that the USEPA consider linking the Safe Drinking Water Information System (SDWIS) and the Integrated Compliance Information System (ICIS) to the WQP to facilitate the evaluation of CECs that occur in matrices such as discharge sources, ambient waters, groundwater, drinking source waters, finished drinking water, sediment, and fish tissue. Additionally, once developed, states and non-governmental organizations should be invited and encouraged to add occurrence and source water data to the WQP.

- **Recommendation 3.2: Identify best practices for targeting source review, occurrence characterization, available analytical methods, and monitoring through information sharing.** Leverage existing national, regional, and state surveys for occurrence characterization of CECs. Workshops should be held by national associations and include USEPA, USGS, and other organizations (e.g., water utilities) to identify existing processes for monitoring and screening CECs. The National Water Monitoring Council, FSTRAC, and WQSMA provide an opportunities to leverage existing venues to share examples of coordinated monitoring approaches such as the Great Lakes Initiative.

- **Recommendation 3.3: Identify a threshold or framework considering state, regional, or national CEC occurrence, distribution, and toxicity, that could be applied to prioritize CECs, and/or elevate a CEC or group of CECs through the phases from Monitoring and Impact Surveillance to initiating a Formal Risk Assessment process, and then to Formal Risk Management.[9]** State resource managers are often responsible on a program-by-program basis for determining where to devote resources to monitor and address CECs. USEPA, in consultation with the states, should develop a framework that can be applied at the national level to articulate specific thresholds that, once reached, mobilize programs at the state, regional, or national level to move a CEC or group of CECs from Monitoring and Impact Surveillance to a Formal Risk Assessment process. The framework could also indicate when to transition from Formal Risk Assessment to Formal Risk Management for those CECs.

[8] The Water Quality Portal (WQP) is a cooperative service sponsored by the United States Geological Survey (USGS), the Environmental Protection Agency (USEPA), and the National Water Quality Monitoring Council (NWQMC). It serves data collected by over 400 state, federal, tribal, and local agencies.

Action Area 4: Expedite Risk Assessment and Response

Action Area 4 Improves Protective Levers in Phases:

Once a CEC has been confirmed as a priority based on monitoring data and human or ecological health concerns, there is a need for the rapid development of additional test methods for various media to support risk assessment and mitigation activities. These activities include an evaluation of toxicity and exposure routes, the derivation of protective limits for drinking and surface water to protect receptors, the provision of technical assistance to states, and development of treatment technologies and residuals handling. However, often there is little publicly-available information on the toxicity of CECs or validated and approved analytical methods to assess contamination in a variety of environmental media. This impedes surveillance, risk assessment, effective responses, and communication. Established processes to develop this detailed information are slower than the development, use, and detection of new CECs and the advance of public concern. There is a significant need for an improved and more efficient means for gaining knowledge so that timely, multi-faceted, and effective response actions can be developed and implemented. Action Areas 1 through 3 seek to provide recommendations to reduce response time and secure valuable toxicity information from manufacturers. Action Area 4 seeks to improve and expedite the risk assessment and response process through the recommendations below. These should be explored for both individual, and groups of substances, where possible:

- **Recommendation 4.1: Use early UCMR data or available water quality survey results to more rapidly identify future regulatory considerations.** First year Unregulated Contaminant Monitoring Rule (UCMR) data results have been found to be fairly consistent with overall results from the three-year monitoring period and should be used to speed up the process for the development of guidance for interim actions and analysis of cost of treatment and remediation for early consideration. The monitoring done under the first year of the UCMR needs to be geographically representative across the country to support this early use of the data. Additionally, if the USEPA, USGS, states or others have data regarding ambient water quality or other environmental impacts for the contaminants, especially bioaccumulation, then this could also help to more rapidly assess the necessity for regulatory controls. All this information needs to be assembled and made available to state drinking water and clean water managers.

- **Recommendation 4.2: Enhance states' ability to respond to CECs through coordination in the development of toxicity values.** Developing toxicity values and health advisories is primarily a federal responsibility but is also a state responsibility in some cases. These efforts need to be led by well-resourced groups within the appropriate agencies. A state cooperative model should be created to enhance coordination as federal agencies develop toxicity values and other response actions. This model should be a formal group, such as the Great Lakes-Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (GLUMRB) Water Supply Committee, which develops the 10 States Standards recommendations. In addition to the development of a formal group for coordination other relevant organizations such as the Society of Environmental Toxicology and

Chemistry (SETAC), the American Chemical Society, FSTRAC and Great Lakes states (GLI Clearinghouse) and the Society of Toxicology should be engaged in these efforts.

- **Recommendation 4.3: Engage states in the development of Health Advisory Levels (HALs) and guidance for water systems to improve state and water utility response preparedness.** In the past,[10] the publication of HALs has been siloed at the federal level with an inconsistent level of engagement with states. This process fails to capitalize on insights from risk assessors and state resource managers already implementing response processes within their communities. This lack of coordinated action erodes trust in the ability of the state and water systems to adequately safeguard human and ecological health. Developing HALSs and guidance for water systems should involve states both from the toxicology and risk assessment side, and the management and communication side. Past processes, such as state engagement in the development of Cyanotoxins response[11] should be reviewed for best practices for implementation moving forward. Therefore, when HALs are being developed a workgroup involving states should be formed.

- **Recommendation 4.4: Provide technical assistance to states to facilitate the development of water quality standards.** USEPA with assistance from ACWA should routinely survey states to determine which priority CECs require ambient water quality criteria and what is needed to assist states in the development of surface water quality standards. The GLI Clearinghouse could be used as a model for states to share water quality criteria derived using USEPA methodologies. Based on this input, USEPA should provide technical assistance to states to facilitate development of state water quality standards. This could be as Integrated Risk Information System (IRIS) risk assessments, recommended ambient water quality criteria, more brief toxicity assessments, etc.

Action Area 5: Improve Risk Communication

Action Area 5 Improves Protective Levers in Phases:

The risks of a CEC to public health and the environment are not often known at the time a CEC is approved for use in commerce. Once agencies or the general public become aware of exposure risk and/or occurrence within a community, there is a time-sensitive need to provide information to the public. Though this risk communication is a challenging aspect of all public and ecological health programs, communicating the risk of unregulated CECs is much more challenging than for regulated CECs. For regulated CECs, if a standard is not exceeded, agencies are able to communicate that the water is considered "safe" for consumption, recreation, and/or protection of aquatic life. For unregulated CECs, there are a few scenarios that further complicate communications. First, agencies and the general public may become aware of potential exposure to a CEC that is in the early stages of characterization and about which little is known in regard

[10] For example, the USEPA publication of PFOA and PFOS HALs in 2016 caught many states, water systems, and communities by surprise and precluded coordinated action and prepared communications.

[11] The cyanotoxins response is considered by states as a strong model of state-USEPA collaboration as well as providing helpful guidance to assist state response.

to toxicity, exposure pathways, and health or environmental impacts, leaving agencies limited in their capacity to communicate information to the public. The lack of reliable, federally-approved testing methodologies further slows the development and flow of information. Second, when toxicity information or health based levels exist, they can vary from state to state or between state and federal advisory levels. Though different numbers exist to address different endpoints or exposure pathways or may be tiered or a time-based value (e.g., short-term, long-term, chronic), the seeming variability between agencies may erode public understanding or trust. All of these nuances can make it difficult for an agency to communicate to the public what is considered "safe" and what the risk from exposure to the CEC truly is. To better communicate the risk posed by CECs in the water cycle, the following ideas should be explored for both individual substances, and, where possible, groups of substances.

- **Recommendation 5.1: Leverage existing best risk communications practices and develop a communications playbook to better inform the public of the concept of risk, avoid known risk communication errors, and identify the type of information needed across defined scenarios.** Though the risk communication needs for each CEC will vary slightly, there is a defined set of scenarios under which agencies will likely need to provide risk communication information. Potential scenarios include: 1) there is a signal that a substance will be of interest (e.g., exposure occurrence, reporting requirement, national media coverage) but limited data exist to characterize the substance or the potential risk; 2) a number, such as an HAL, is available but little to no guidance is available relative to appropriate risk management responses; and 3) multiple regulatory or guidance values from various state or federal agencies exist. Each scenario presents a set of easily-anticipated communications needs as well as unique areas of information that may be needed. These scenarios should be developed to provide an effective risk communications playbook. To begin this process, states, through ACWA and ASDWA, should develop a list of FAQs from past experiences to identify the "ingredients" needed for future CEC risk communications. The process used for cyanotoxins also may provide a set of lessons learned on the type of information needed to be made available.

- **Recommendation 5.2: Increase coordination and support for development of health and ecological impact numbers across federal and state agencies.** To reduce confusion surrounding different health and ecological impact numbers (e.g., protective limits such as water quality criteria, maximum contaminant levels), federal agencies (e.g., USEPA, Centers for Disease Control and Prevention (CDC), Agency for Toxic Substances and Disease Registry (ASTDR)) should more proactively collaborate to understand and support health-based values from other agencies. At the state level, collaborative efforts may include cross-training and collaboration across drinking water and clean water staff and information on how best to communicate to the public. To identify effective collaboration practices, a review of the Interstate Technology & Regulatory Council's effort to conduct PFAS trainings and their development of a PFAS risk communications template, and a review of other federal and state risk communication guidance documents should be conducted. The work done in the reuse community (e.g., the Water Research Foundation, WateReuse) may provide additional best practices for communicating relative risk, identifying trusted messengers, and developing effective guidance. Finally, the development of an ACWA/ASDWA risk communications workgroup or similarly-functioning forum may provide a venue to further develop these tactics.

Supplemental Actions to Facilitate Implementation Across All Phases

The supplemental actions below are intended to provide an overarching mechanism to help facilitate implementation of the suite of recommendations contained within each of the Action Areas. These supplemental actions are not comprehensive but provide an example, and initial framework, for the type of support the various water sector partners will need to implement the suite of Action Area recommendations.

Supplemental Action Area 1: Expand resources to increase the rate for evaluating and responding to CECs

Programs at the state and federal level charged with preventing, identifying, assessing, and monitoring CECs in our waters are vastly underfunded to ensure the protection of human and ecological health. The following recommendations provide a set of actions targeted at addressing the funding gap.

- **Supplemental Recommendation 1.1: Increase funds to federal programs charged with reviewing substances.** To effectively screen for problematic CECs before they enter the water cycle, federal oversight programs such as TSCA, FIFRA, and FDCA should be funded at higher levels to reduce review backlogs and to have the capacity to evaluate substances at a rate that matches the pace at which new substances are submitted for evaluation. To help ensure adequate resources, additional funding resources and options should be identified to ensure that federal staffing is adequate to conduct timely reviews.

- **Supplemental Recommendation 1.2: Conduct a funding gap analysis to ensure states are provided with adequate resources to address CECs.** While federal agencies should have the lead on addressing CECs nationally, state water resource programs are at the front line for addressing local CEC issues. State programs require sufficient funding to ensure they have adequate resources to conduct required activities such as monitoring, developing human health and aquatic life criteria, risk assessments, and developing water quality standards. A review should be conducted to determine the level of funding needed by state programs to adequately address CEC issues.

- **Supplemental Recommendation 1.3: Identify potential non-federal sources of funding to states to expand state resourcing options.** A study should be conducted to identify resource options for states. This study should include an inventory of potential sources and a review of various state funding or manufacturer fee models (e.g., Washington State Model Toxics Control Act).[12]

[12] The MTCA is a tax on hazardous substances (such as petroleum products, pesticides, and other chemicals) that generates funds to pay for cleanups. Under MTCA, the state may recover penalties or require polluters to pay for cleanups and state oversight.

Supplemental Action Area 2: Engage the authorizing environment to strengthen CEC response

As previously discussed, the process for establishing guidelines, advisory levels, and/or regulatory standards remains slow and ineffective. The following recommendations provide targeted actions to lessen political barriers that exist to addressing CECs .

- **Supplemental Recommendation 2.1: Improve the expediency and independence of establishing protective limits for CECs.** The federal programs have struggled to develop protective limits for CECs in a timely manner. These programs should be modified to remove barriers that impede the pace of the process and their ability to establish limits based on sound science. Consideration of the use of an independent body holds the potential to better insulate the protective limit establishing process from undue influence of interest groups.

- **Supplemental Recommendation 2.2: Pursue federal recognition and acceptance of state-specific CEC standards.** In the absence of national standards, many states have derived their own specific CEC standards for ambient waters and drinking water. Federal agency facilities responsible for the contamination of waters should not be shielded from complying with those state-specific standards. Responsible federal agencies should be required to remediate contaminated source waters to meet those limits and, as necessary, provide funding for water supply treatment systems to allow them to achieve the applicable state drinking water regulatory standard.

Appendix A: Contaminants of Emerging Concern Workgroup Roster

Name	Organization
Brandon Kernen	New Hampshire Department of Environmental Services
Claire Waggoner	California State Water Resources Control Board
Connie Brower	North Carolina Department of Environmental Quality
Eileen Hack	Indiana Department of Environmental Management
Jennifer Wigal	Oregon Department of Environmental Quality
Leslie McGeorge	New Jersey Department of Environmental Protection
Lisa Daniels	Pennsylvania Department of Environmental Protection
Rebecca Sadosky	North Carolina Drinking Water Protection
Roger Sokol	New York Division of NYS Department of Health
Ron Falco	Colorado Department of Health and Environment
Scott Stoner	New York State Department of Environmental Conservation
Todd Johnson	Minnesota Department of Health

Appendix B: List of Action Areas and Recommended Actions

Action Area 1: Establish a National Priority Framework and Research Agenda for Priority Setting

Recommended Actions	Timeframe	Organization to Lead Effort
1: Engage and amplify state voices to establish a national framework and agenda	Near Term	National Associations
2: Develop an evaluation framework to organize the characterization of CECs	Near Term	ACWA, ASDWA, USEPA
3: Using the framework, develop a national list of CECs to more nimbly and comprehensively respond to emerging CECs	Mid Term	ACWA, ASDWA, USEPA
4: Develop a holistic research agenda to advance rapid and predictive screening methods/tests	Mid Term	National Associations
5: Identify gaps or barriers in current CWA/SDWA authorities to rapidly respond to CECs	Mid Term	ACWA, ASDWA, USEPA
6: Develop a visual representation of the Contaminant Lifecycle Phases and Associated Intervention Actions	Short Term	ACWA, ASDWA

Action Area 2: Engage Industry to Develop and Improve Access to Comprehensive Chemical Data

Recommended Action	Timeframe	Organization to Lead Effort
1: Elevate state water resource manager understanding of current chemical substance regulation and resources	Near Term	ACWA, ASDWA, USEPA
2: Initiate collaborative dialogue among manufacturers and water resource managers	Mid Term	ACWA, ASDWA, USEPA
3: Explore targeted regulatory and legislative changes to increase manufacturer responsibility and the availability of manufacturer-produced toxicity information	Near Term	National Associations

Action Area 3: Increase Coordinated Monitoring Across Water Resource Management Programs

Recommended Action	Timeframe	Organization to Lead Effort
1: Connect or expand existing information platforms with a more comprehensive dataset to facilitate the evaluation of CECs	Mid to Long Term	USEPA

2: Identify best practices for targeting source review, occurrence characterization, available analytical methods, and monitoring through information sharing	Near Term	National Associations
3: Identify a threshold or framework considering state, regional, or national CEC occurrence, distribution, and toxicity, that could be applied to prioritize CECs, and/or elevate a CEC or group of CECs through the phases from Monitoring and Impact Surveillance to initiating a Formal Risk Assessment process, and then to Formal Risk Management	Mid Term	ACWA, ASDWA, USEPA

Action Area 4: Expedite Risk Assessment and Response

Recommended Action	Timeframe	Organization to Lead Effort
1: Use early UCMR data or available water quality results to more rapidly identify future regulatory considerations	Near Term	USEPA
2: Enhance states' ability to respond to CECs through coordination in the development of toxicity values	Near Term	ACWA, ASDWA, USEPA
3: Engage states in the development of Health Advisory Levels (HALs) and guidance for water systems to improve state and water utility response preparedness	Near Term	USEPA
4: Provide technical assistance to states to facilitate the development of water quality standards	Near Term	USEPA

Action Area 5: Improve Risk Communication

Recommended Action	Timeframe	Organization to Lead Effort
1: Leverage existing best risk communications practices and develop a communications playbook to avoid known risk communication errors and identify the type of information needed across defined exposure pathways	Near Term	ACWA, ASDWA, USEPA
2: Increase coordination and support for development of health and ecological impact numbers across federal and state agencies	Mid Term	ACWA, ASDWA, USEPA

Supplemental Actions to Facilitate Implementation Across All Phases

Supplemental Action Area 1: Expand resources to increase the rate for evaluating and responding to CECs

Recommended Action	Timeframe	Organization to Lead Effort
1: Increase funds to federal programs charged with reviewing substances	Mid Term	ACWA, ASDWA
2: Conduct a funding gap analysis to ensure states are provided with adequate resources to address CECs	Near Term	ACWA, ASDWA
3: Identify potential non-federal sources of funding to states to expand state resourcing options	Near Term	ACWA, ASDWA

Supplemental Action Area 2: Engage the authorizing environment to strengthen CEC response

Recommended Action	Timeframe	Organization to Lead Effort
1: Improve the expediency and independence of establishing protective limits for CECs.	Mid to Long Term	ACWA, ASDWA, USEPA
2: Pursue federal recognition and acceptance of state-specific CEC standards	Near Term	ACWA, ASDWA