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Guidance for Developing a State Contaminants of Emerging Concern Program

FINAL

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Contaminants of Emerging Concern Steering Committee

ASTSWMO
1015 18th Street, NW, Suite 803
Washington, DC 20036
https://astswmo.org/

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ASTSWMO is an organization supporting the environmental agencies of the States and Territories. ASTSWMO's mission is to enhance and promote effective State and Territorial programs and to affect relevant national policies for waste and materials management, environmentally sustainable practices, and environmental restoration. The purpose of the CEC Steering, formed by the Board of Directors in October 2019, is to provide a forum for ASTSWMO representatives to discuss federal, State and Territorial (State) regulatory, policy, and technical developments, and to recommend research projects and training activities for ASTSWMO teams and members to execute regarding CECs.

ASTSWMO thanks the following members for their participation in developing this guidance document:

Tracie White, CO – Chair
Kasey Kathan, VT – Vice-Chair
Millie Garcia-Serrano, MA
Matthew Jones, NH
Sonja Favors, AL
Teresa Booeshaghi, FL
Ray Holberger, SC
Sandra Snyder, SC
Justin Meredith, TN
Tom Higgins, MN
Amy Brittain, OK
Jillian Hunt, MO
Ann Kron, MT

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I. INTRODUCTION

The Association of State and Territorial Solid Waste Management Officials (ASTSWMO) is an organization representing the waste management and cleanup programs of the 50 States, five Territories and the District of Columbia (States or members). ASTSWMO's Contaminants of Emerging Concern (CEC) Steering Committee serves to provide a forum for ASTSWMO members to discuss regulatory, policy, and technical developments related to CECs. Many of ASTSWMO's members are in the process of developing or considering the development of a State CEC program. On July 1, 2021, the CEC Steering Committee provided an introductory presentation, with an outline of activities that a State should consider when developing a CEC program. This guidance follows that presentation, to provide further comment on the topic areas and examples from the development of successful CEC programs nationwide and provides a series of best practices and recommendations that States may want to consider when developing a CEC program. This guidance could be implemented on a wide variety of scales, depending on State-specific needs and available resources.

After identifying a CEC[1], regulatory agencies and the regulated community need to address potential exposure pathways in a timely and effective manner, considering the expectations and concerns of affected stakeholders. Development of a CEC program at the State level can provide for more proactive and rapid regulation and standard setting, therefore avoiding reactionary efforts upon contamination discovery. A formal CEC program preemptively allows areas of opportunity and risk to be identified earlier in the contamination discovery and evaluation process and provides leadership with a resource to lean on during periods of rapidly-developing scientific changes. A CEC program will encourage a State to be initiative-taking in assessing, managing, and addressing CECs. The following three steps are critical in establishing a successful State CEC program:

1. Engage leadership
2. Define scope
3. Compile and assess available information

Each of these components is discussed in greater detail below.

II. LEADERSHIP ENGAGEMENT

Active State executive leadership is a primary key to establishing, developing, and maintaining a successful State CEC program. Involving executive leadership early in the development of a CEC program ensures that directors and other executive leaders are invested in the process from inception. A key person, with a leadership role, will serve as a champion for resources; be essential to the success of any internal and external communications; and be able to act on decisions that are made. The presence of a standing CEC program should inform broader

[1] ASTSWMO defines CEC as any physical, chemical, biological, or radiological substance or matter in any environmental media that may pose a risk to human and/or ecological health, is under regulated, and the presence, frequency of occurrence or source of which is not well understood, routinely monitored, and/or may lack analytical methods.

decision-making and be a consideration in long-term planning and optimization of a State-level response.

Active State executive leadership also must be present to effectively set the tone for tasks that aim to impart direction, support, and accountability. Several models have worked successfully for States with active CEC programs, including the formation of a cross-programmatic CEC workgroup led by the environmental agency head (e.g., commissioner or director). Under this model, the commissioner or director is responsible for directing and supporting the workgroup's efforts, including meeting routinely and ensuring consistency with the CEC program scope and problem statement developed by the workgroup members and approved by the State's leadership.[2]

Build Core CEC Workgroup

A successful State CEC program will require input from multiple State programs. Therefore, it is important to consider and define not just the core group who will be involved in the long-term steering of the program, but also the broader group of strengths and expertise that need to be involved early in the process. For example, while the focus on CECs often tends to be on drinking water, it may prove helpful to include representation from underground storage tanks, wastewater, Superfund, biosolids, air compliance, hazardous waste, or other programs. While there might not be an immediate correlation within these programs, their input and participation will assist the State in taking a holistic approach, providing insight from a wide variety of perspectives. Additionally, inclusion of agencies and groups that are outside of the State environmental programs, such as the Department of Transportation, Department of Health and Human Services, local planning commissions, and environmental protection non-profits will help to ensure that all potential aspects of CECs are being considered. Inclusion of these other programs and groups will help to provide additional insight from different angles that will benefit the products, services, and strategies developed by the CEC program.

Developing a standing set of meetings that are inclusive of these diverse programs will improve information flow, distribution, and sharing. The goal of the CEC workgroup is not to address individual programmatic issues, but to maintain cohesive communication and ensure continuity in the development and implementation of a CEC strategy.

Part of the workgroup's mission also should include the continued identification of partners for collaborative engagement. In addition to the departments and agencies listed above, this may also include federal environmental counterparts, associations, legislators, academia, and environmental advocacy groups.

Staffing and Budgeting for a CEC Program

As regulators contend with staffing and budget limitations, it is important to emphasize the importance of this work by effectively connecting achievements with improved health and

[2] https://www.mass.gov/info-details/emerging-contaminants

environmental indicators. A State CEC program can be made scalable, based on resource availability, but flexible enough to perform projects when feasible. CEC programs should consider generating a list of projects, with detailed cost estimates, that could be undertaken once funding is made available.

State-specific authority may also present distinct issues. Several States enjoy broad authority, enabling enforcement to address CEC releases to the environment. However, some States struggle with the ability to regulate CECs until federal regulations/definitions are modified to include specific CECs.

III. DEFINING SCOPE: DEVELOPING A PROBLEM STATEMENT AND DEFINITION OF CONTAMINANTS OF EMERGING CONCERN

Given that a diverse workgroup has just been established, one of the first tasks is ensuring a joint understanding regarding the scope of the CEC program, to include what will, and will not, be addressed. This will vary, based on each individual State's starting point and exposure/risk thresholds.

When defining the CEC problem statement, it may be helpful for each of the involved programs and agencies to discuss how CECs come into their programmatic scope and how they are subsequently addressed. The emergence of a CEC as a programmatic issue may come from a variety of pathways, from monitoring and impact assessment surveys, changes in analytical methodologies, or through collaboration with other programs. Each of these pathways is going to come with its own background and impact on the programs' understanding of what CECs are and how they need to be addressed. This initial conversation should result in a working definition for "Contaminants of Emerging Concern" and a definition of the group's problem statement.

There are several existing definitions for "Contaminants of Emerging Concern" that certainly can be brought into the discussion. For example, ASTSWMO defines CECs broadly, such that the term covers a wide range of substances/conditions. A broad definition also provides States with flexibility while developing a CEC program or expanding upon an existing CEC program. Despite the term's many definitions, one common factor is that while CECs may be present in the environment, they often are undetected. This may be because the CECs are not analyzed for in routine monitoring programs, or they may be present below an analytical method's detection limits and therefore remain "unseen."

As part of the workgroup's initial discussions and scoping exercises, it may be important to consider the various pathways by which workgroup members can proactively identify CECs in the environment during their program's routine work. Examples to consider include:

- **Adopting Improved Analytical Methods with More Sensitive Detection Limits** – Method Detection Limits (MDLs) tend to change and improve over time, given technological advances. Chemicals that may not have been detected in the past could be detected now (or soon) by using methods with lower MDLs. It is important for regulatory programs to stay current on updates to methods commonly used to detect contaminants.

- **Considering Chemicals Added to EPA's Unregulated Contaminant Monitoring Rule (UCMR) List** – EPA's drinking water program periodically requires water suppliers to sample for a list of unregulated contaminants. These lists, and the results of the water supply sampling, can provide a window to chemicals that may be present in the surrounding environment. As described by the EPA, UCMR monitoring is a drinking water program effort that develops contaminant occurrence data that is used to initiate regulatory determinations. The fifth UCMR (UCMR 5), published on December 27, 2021, requires sample collection for 30 chemicals between 2023 and 2025, giving rise to a potentially new universe of CECs in the coming years.

- **Prevalence and Occurrence of Chemicals Detected in Land Source Areas or Groundwater Plumes** – By understanding what chemicals are most-frequently detected in source areas and plumes at known sites, regulators can begin to draw conclusions regarding the universe of CECs that might be present at uncharacterized sites. Taking full advantage of available data from past and current monitoring programs implemented by the State or federal government will inform site-specific chemicals of concern (CoC) lists. Tentatively Identified Compounds (TICs), often reported in data packages, also offer a window to potential CECs.

- **Reviewing Available Non-Regulatory/Research Data** – The review of data generated by academic research sampling and analysis programs, such as the National Institute of Environmental Health Sciences Superfund Research Program, provides technical information potentially applicable to sites managed by regulators. These data may also help toxicologists or risk assessors predict bioavailability and uptake of CECs by humans, fauna, and flora.

- **Researching a CEC's Toxicity and Risk Potential** – Once data packages are reviewed, and chemicals with the highest occurrence and prevalence (high frequency of detection) are identified, regulators can research whether toxicity data (i.e., reference doses, reference concentrations, oral slope factors, inhalation unit risks, etc.) exists to evaluate exposure potential and health/environmental risk. EPA's Integrated Risk Information System (IRIS) is a primary source of information regarding a chemical's toxicity.

IV. COMPILE AND ASSESS AVAILABLE INFORMATION

States forming a CEC program should next consider developing a database of analytical data and observations regarding detections, trends, and occurrence/prevalence of chemicals. Special attention should be given to quality assurance/quality control data generated by analytical laboratories (including the list of TICs), as well as detection limits. This added review can help uncover chemicals that may not have been identified during past sampling events.

Regulators may also consider performing environmental sampling for contaminants listed on EPA's UCMR for public water systems, particularly if there is a connection between known past

releases and a chemical on the UCMR list. Though EPA's UCMR is specific to their drinking water program, UCMR lists of "unregulated" contaminants (e.g., CECs) can be helpful resources for environmental regulators, when looking for CECs affecting groundwater, soil, sediment, and other environmental media.

The goal of a CEC program is to determine if unrecognized or non-routine contaminants are present in the environment, either at a specific site or Statewide, at a frequency of occurrence, concentration, exposure potential, or toxicity that would warrant State regulatory action. Through the in-depth evaluation of a chemical's occurrence/prevalence, and review of available health assessment/toxicological data, regulators can decide if resources should be directed at robust monitoring, and based on the information gathered, if health-based guidelines or standards should be developed to protect human health and the environment.

Considerations for Identifying and Assessing CECs

Given that scientific research and toxicological information about CECs may be rapidly changing, regulators need to continually ask the question, "How Concerned Should We Be About a CEC?". By revisiting this question periodically for multiple CECs, a State's focus may shift. A regulator's level of concern about a CEC will be determined by its physical, chemical, and toxicological characteristics, and may consider such things as:

- Are the releases typically of small or large quantities?
- Is the chemical considered highly toxic or relatively non-toxic?
- Is it easily biodegraded or persistent?
- Is the CEC insoluble or soluble in water?
- Is it volatile or non-volatile?
- Is the chemical relatively mobile or does it bind to a medium?

In general, small and rare releases of relatively non-toxic, immobile, and biodegradable material are of less concern when compared to large and more-common releases of persistent and toxic chemicals that can easily migrate in the environment. Likewise, consider that CECs may be:

1. Unknowingly present at a site undergoing active assessment or remediation; or
2. Unknowingly released to the environment during routine and/or permitted operations that use CECs as part of a process or industrial use.

An example of the first scenario could be the presence of explosives constituents (e.g., TNT, HMX, RDX) in groundwater at a military munitions range undergoing site assessment. A review of EPA's UCMR lists reveals that explosives were included in the second cycle of the revised UCMR (UCMR 2, 2005). Additionally, EPA's Emerging Contaminants and Federal Facilities Contaminants of Concern webpage provides information regarding CECs present at these unique types of sites. By reviewing available resources specific to this type of site, regulators may start developing a dataset for explosives constituents (i.e., CECs) in soil and groundwater to determine if a

widespread presence of explosives-related constituents exists across military and training sites. This would further compel the creation of a CEC watch list for future screening.

An example of the second scenario involves routine industrial activities that use blasting agents and explosives as part of their process, which could result in widespread CEC contamination. This was the case for perchlorate. Regulatory concern about perchlorate has been noted as far back as 2006, after perchlorate (a lesser-known contaminant at the time, listed on EPA's UCMR 1) was detected in public water supply wells located near blasting operations. As a State-specific example, perchlorate initially was incorporated into the Commonwealth of Massachusetts' CEC watch list for more active monitoring. Upon detection of perchlorate in drinking water supplies, the State responded by using Geographic Information System (GIS) mapping to co-locate known blasting operations and public water supplies. The State followed-up with more robust perchlorate sampling in public water supplies, private wells, and at Superfund/State-lead cleanup sites with past historical use of propellants. Several additional States relied on the occurrence data obtained through this Statewide effort to contemplate promulgation of perchlorate standards. Subsequently, some States proceeded with promulgating a standard for this CEC. In July 2020, however, EPA determined that perchlorate did not meet the criteria for federal-level regulation, so no national regulation for perchlorate was issued.

Approach to Prioritizing CECs: From Watch List to Action List

Ideally, under the direction of executive leadership, a CEC workgroup should be able to prioritize CECs to compel State action. This process involves evaluating a State-specific CEC watch list and determining which CECs should advance to an action list.

Regulators can initiate workgroup discussion by discussing their existing State-specific CEC watch list to determine if any of the watch list CECs may be good candidates for further evaluation. Regulators can ask questions like, "What unregulated chemicals commonly appear in environmental data packages?" or "What is the single most important pathway for that CEC that, if removed, could bring remarkable and quantifiable minimization of exposure and subsequent risk?" Responses to these and similar questions may trigger policy deliberations and decision-making to move forward with regulatory action.

By way of example, in 2002, Massachusetts formed a CEC workgroup, due to its experience with the unexpected discovery of perchlorate contamination in groundwater across the State. Given that this contamination triggered involvement from multiple departments and programs and given the lack of federal perchlorate drinking water or cleanup standards, the State's CEC workgroup recommended adding perchlorate to their CEC watch list and later (after applying screening criteria) the process served to advance perchlorate to the State's CEC action list.

Once a State develops their own CEC watch list, this list can be screened to help identify CECs for State action. Figure 1 illustrates a sample CEC Screening Process that can be used by CEC workgroups to advance a CEC from a watch list to an action list and position it for discussion with the workgroup's team leader to direct follow-up actions.

Figure 1: Sample CEC Screening Process

CEC Screening Process	
Priority List	• Database Scans • Expert/Ground-level Knowledge • High Urgency and High Visibility Issue
Screening Process: Step 1	• Impact/Risk "Importance" • Work Being Done By Others (EPA, States) • Existing State or federal Standards or Guidelines • Jurisdictional Issues
Create Watch List	
Screening Process: Step 2	• Certainty in Available Science • Possibility of Tangible Outcomes • Cross-Media Contaminant
Outcomes	• Prioritize Emerging Contaminants • Nominations for Short-Term Action with Recommended Long-Term Strategy to Address CEC

The prioritization and placement of a CEC on an action list may compel subsequent actions, including standards promulgation or legislative "call for hearings." Many States have invoked legislative hearings by forming a task force devoted to developing a better understanding of the challenges that specific CECs pose in the environment. These task forces have largely focused on issues such as the following:

1. Gathering and reviewing information to create a response plan and strategy for CECs Statewide;
2. Identifying data gaps and efforts to populate these gaps (e.g., what are CECs and where are they present?);
3. Creating opportunities for public education regarding CEC contamination;
4. Identifying the sources of CEC contamination and exposure pathways;
5. Examining the burden and benefits of CEC treatment options;
6. Addressing how federal and State agencies can use their existing authority to compel action by potentially responsible parties;
7. Determining the inventory of CEC sources and developing CEC-free alternatives;
8. Gathering and examining CEC data in freshwater and marine fish and shellfish;
9. Examining the cost of CEC mitigation at known areas of contamination; and
10. Examining exposure to State residents through CEC-contaminated consumer products.

The Final Report from the Massachusetts PFAS Interagency Task Force is an example for States to access, as they consider developing or expanding upon their approach to CEC identification and management.

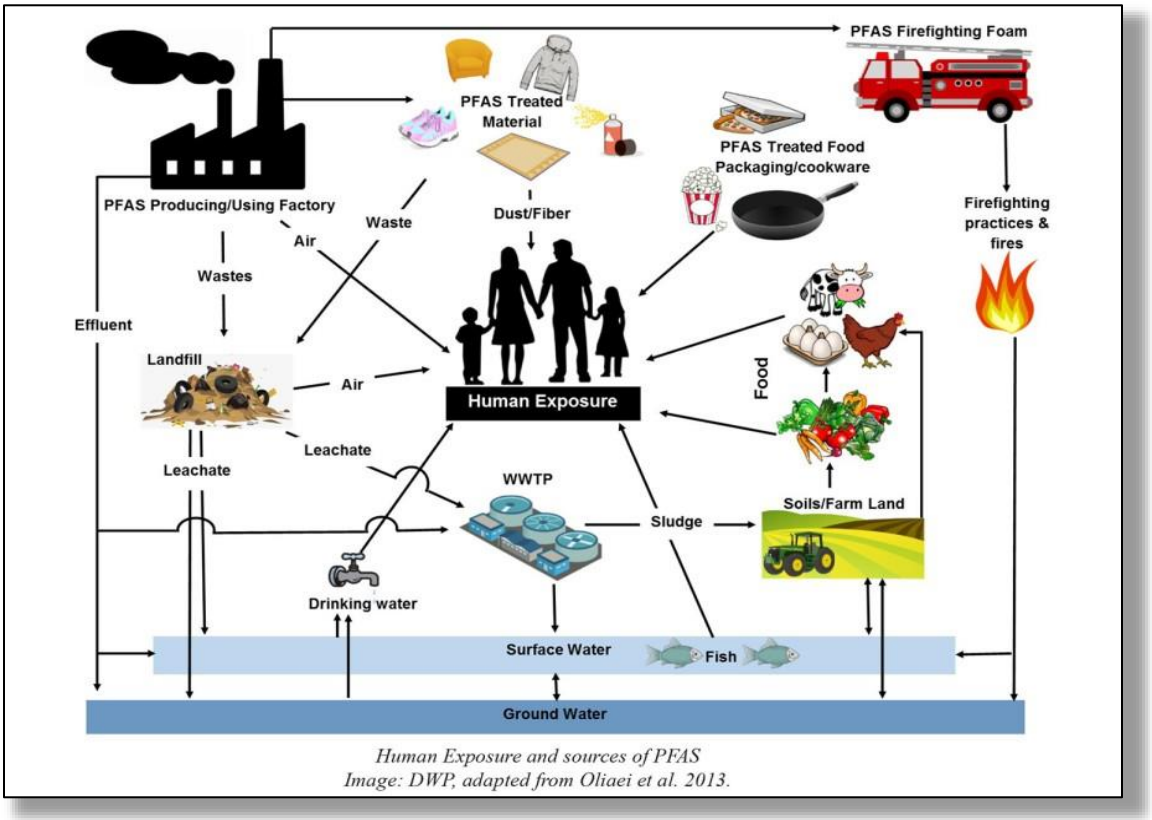
It is important to recognize that States consider different factors and experience different challenges when moving through the process to develop and promulgate State-specific enforceable standards for CECs – whether they are drinking water standards, air standards, or

standards for the cleanup of contaminated soil, groundwater, or sediment. For example, an array of widely varying State-promulgated standards and regulations currently exist for 1,4-dioxane.

CEC Conceptual Exposure Model Development – A PFAS Example

Upon identification of a specific CEC, regulators can begin to develop a conceptual exposure model to illustrate the various feasible pathways for human and ecological exposure. As an example, Figure 2 captures a conceptual exposure model for PFAS, where sources of PFAS in the environment and modes of human exposure are visually illustrated.[3] This illustration can facilitate subsequent discussion between regulators regarding applicable risk assessment equations, exposure factors, and toxicity values, to further understand potential risks posed by CECs at a specific site or Statewide.

Figure 2: Conceptual Exposure Model – PFAS Example



Human Exposure and sources of PFAS
Image: DWP, adapted from Oliaei et al. 2013.

Predicated on what regulators know about a CEC's chemical characteristics, fate and transport in the environment, and toxicological nature, certain CECs may pose more risk through a specific exposure pathway over another. For PFAS, for example, the ingestion pathway is the most predominant pathway for human exposure. The testing and treatment of water sources used for

[3] Sources of PFAS and modes of human exposure. Image credit: Maine Drinking Water Program, Service Connection newsletter, Volume 25, Issue 4. Image adapted from Oliaei et al., 2013.

drinking water protects a large consumer group that would otherwise be ingesting PFAS-containing water, including all sensitive subpopulations.

Waste management facilities, such as wastewater treatment facilities and landfills, are other potential CEC sources with migration and exposure pathways of concern. As an example, PFAS has been identified in effluent and sludge from wastewater treatment plants. Unless the wastewater is treated specifically for PFAS, the volume that passes through the filtration plant could be: 1) returned to groundwater or surface water; and/or 2) concentrated in wastewater sludge created as part of the treatment process. Regulators involved in the issuance of National Pollutant Discharge Elimination System (NPDES) permits for large systems, or pretreatment discharge permits for industrial users or landfills utilizing these wastewater facilities, are working together to learn more about this contamination cycle by sampling for PFAS in the influent and effluent. Similarly, wastewater residuals often are reused as fertilizer in many States. Research performed by the States of Maine, Vermont, and others regarding land application and derivation of screening levels protective of human health and the environment is informing a better understanding of contaminant cycling in these media.

CECs in food constitute another important human exposure pathway, and one that may require consideration when forming the State CEC workgroup, to ensure that appropriate representation is available. For example, regulator knowledge about ongoing work by the Food and Drug Administration concerning PFAS in the food supply may assist regulators with risk communication concerning the presence of PFAS in food and consumer products, as well as appropriate disposal methodologies associated with these products, to minimize potential environmental release.

Another CEC source depicted in the PFAS-specific conceptual exposure model (Figure 2) is PFAS-containing firefighting foam. Application of PFAS-containing foam to suppress fires has been identified as the most prevalent release of this CEC to the environment. Removing this type of foam through take-back programs is an example of an effective way to reduce future releases to the environment.

A State's CEC program can further increase its success by actively collaborating with other States and leveraging their research efforts. Another example of State-specific CEC program action related to PFAS is the State of Florida research described in the 2021 White Paper titled Florida Statewide PFAS Pilot Study at Drycleaning Sites. This research evaluated the relationship/occurrence of PFAS at drycleaners, and how PFAS may be transported in the environment. Likewise, other States have devoted resources to researching PFAS sources affecting the ambient air. In January 2021, the State of New York followed the State of Michigan by becoming the second State to regulate PFAS in air emissions.

V. SUMMARY

Developing a State CEC program is a complex process that requires action-driven executive leadership, dedicated staffing, funding, and a results-oriented approach to CEC identification and management. While there are many ways to design a CEC program, several tasks and considerations should be contemplated, including:

- Executive leadership is needed to ensure proactive and decisive action by all its programs, as well as to successfully compel funding and front-facing support and engagement from the federal government, legislators, industry, and the public at-large.

- Establish a CEC workgroup that is inclusive of all relevant programs, to ensure comprehensive information capture, scientific dialogue, policy deliberation, and coordination of subsequent actions;

- Assess staffing and funding levels needed to support State CEC-related work;

- Develop a scope and problem statement for the CEC program and workgroup that captures the workgroup's mission and goals and can be easily messaged to relevant stakeholders, including the governor's office, legislators, the public, media groups, and environmental advocacy groups;

- Identify internal/external partners for collaborative learning and task management;

- Identify federal, State, private, and academic programs that generate occurrence monitoring data. Use that information to evaluate trends which may serve to uncover the presence of CECs in the environment, with information ultimately informing the State CEC watch list;

- Apply screening criteria to the State's CEC watch list, with the goal of identifying CECs that should advance to a CEC action list;

- Identify a strategy for proactively responding to a CEC that considers existing policies, regulations, ability to enforce, remedial options (technical feasibility and cost), and community outreach and education; and

- Continue to monitor the CEC science, toxicology, and introduction of new analytical methods.

States with limited CEC program development experience may benefit from the experience of those States with a formal CEC program in place, as well as efforts from organizations such as the Interstate Technology and Regulatory Council (ITRC), ASTSWMO, Environmental Council of the States (ECOS), US EPA, and the DoD. The goal of a CEC program is to proactively position States to most effectively and successfully meet the challenges that CECs pose to our environment and public health.