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Lessons Learned Addressing Contaminants of Emerging Concern (CEC) at Federal Facility Cleanups

FINAL Report

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State Federal Coordination Focus Group
Federal Facilities Subcommittee

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ASTSWMO is an organization supporting the environmental agencies of the States and Territories (States). 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 mission of the State Federal Coordination Focus Group is to promote and enhance communication, policy development, and program implementation by and between States, Territories, and Federal partners related to Federal Facilities restoration. This includes identifying and investigating national policy and programmatic issues; developing policy positions, guidance documents, fact sheets and other tools; and facilitating and strengthening communication with State and Federal partners.

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I. INTRODUCTION

Over the past decade, State and Territorial Regulators have begun to prioritize contaminants of emerging concern (CEC) as information on substances like Per- and Fluoroalkyl Substances (PFAS) surfaces. ASTSWMO defines CECs to include any physical, chemical, biological, 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. Recent experiences with CECs, like PFAS, present unique challenges for States and Territories (States) at Federal Facility cleanups related to:

- Regulatory frameworks;
- State Involvement;
- Incorporating evolving science into government regulations and policies;
- Varied sources, processes, and findings in research; and
- Risk communication.

The discovery of CECs and a dearth of scientific information about their toxicity creates situations where risks at some Federal Facility cleanup sites are uncertain and potentially underestimated. Project teams may not have reliable information regarding site concentrations and risks, fate and transport, or standardized policies or methods for sampling or remediation of these contaminants. Stemming from this lack of information, public concern over CECs can create tension between regulatory agencies which can erode trust in public health institutions.

The purpose of this paper is to 1) identify issues that have complicated and slowed CEC evaluation at Federal Facilities, and 2) make recommendations for more efficient and comprehensive responses in the future. The paper is primarily focused on experiences with PFAS and related compounds as they are the most recent and pressing class of CECs regulators are faced with.

II. REGULATORY FRAMEWORK

When CECs like PFAS are initially identified, they are managed under a disparate and diverse Federal and State regulatory structure that is not nimble enough to address the challenges these substances pose to human health and the environment. Historically many States relied on the legal structures and promulgated standards established at the Federal level to regulate toxic substances. More recently, rather than wait for Federal action, some States have enacted parallel legislation or have the resources to develop and promulgate their own standards. The speed at which the federal regulatory structure responds to CECs can have major impacts on the ability of States to take action to protect their residents.

Overall, the most useful course of action when addressing CECs comes from EPA establishing Federal, enforceable standards under the Safe Drinking Water Act (SDWA) and Clean Water Act (CWA) (e.g., maximum contaminant levels (MCLs) and Effluent Limit Guidelines, respectively) and designating these chemicals as hazardous substances under the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) and hazardous wastes under the Resource Conservation and Recovery Act (RCRA). Although utilization of significant legal and technical resources may be required, promulgating an enforceable standard, and designating these chemicals under Federal statutes allows a more consistent regulatory framework for dealing with permitting, assessment, investigation, and remediation of these compounds. While Federal Facilities have, for the most part, been proactive in dealing with CECs, such as PFAS, by assessing and investigating these chemicals, the lack of a uniform national regulatory framework results in potentially inconsistent and duplicative assessments and investigations.

Federally, the Toxic Substances Control Act (TSCA) and SDWA are typically the most used statutes in the initial responses to CECs[1]. TSCA provides a regulatory structure by which new chemicals are evaluated and potentially regulated under Section 5 of the statute. Existing chemicals can be evaluated via significant new use rules when the use or understanding of a chemical's properties changes. Manufactures may be required to provide additional testing to answer questions regarding environmental risks. In 2016 TSCA received its first update since its adoption in 1976. The reforms eliminated the cost-benefit standard for EPA's evaluations and clarified that EPA's determinations be made using an "unreasonable risk" standard. The amendment also gave EPA the mandate to actively review all new chemical substances under TSCA as well as 62,000 chemicals grandfathered into TSCA that did not require review at its inception. However, the

[1] The Frank R. Lautenberg Chemical Safety for the 21st Century Act, passed by Congress and signed into law by President Obama in June 2016, is the first overhaul in 40 years of the Toxic Substances Control Act of 1976, the main nationwide law governing toxic chemicals.

timeframes given for EPA to act before a new chemical substance is released to market and the sheer volume of new chemicals produced every year provides substantial challenges.

Detections of CECs in ground and surface water often draw attention to releases into the environment and potential exposures to the population, making the SDWA an important pathway for the regulation of PFAS and other CECs. The act requires the EPA to issue a list of unregulated contaminants to be sampled by public water systems every five years. The most recent Unregulated Contaminant Monitoring Rule required the monitoring of 29 PFAS chemicals and lithium in these public water systems. The SDWA permits EPA to set lifetime health advisories for CECs. While these levels are non-enforceable at a Federal level, they and their supporting documentation provide valuable information to States, and other public health officials, on health effects and analytical methodologies associated with drinking water contaminants. The SDWA also provides the framework for the establishment of MCLs, which provide regulatory limits for contaminants in drinking water sources.

CERCLA authorizes the Federal government to undertake a response action consistent with the NCP where there is a release or threat of release of a hazardous substance, or a release or substantial threat of a release of any "pollutant or contaminant," which may present an imminent and substantial danger to public health or welfare. (https://www.epa.gov/superfund/superfund-cercla-overview)

TSCA enables EPA to better characterize sources and quantities of certain manufactured chemical substances and/or mixtures. (https://www.epa.gov/assessing-and-managing-chemicals-under-tsca)

The **SDWA** regulates public drinking water supplies in the United States and sets national standards for drinking water including advisory levels for unregulated contaminants and maximum contaminant levels (MCLs) for regulated contaminants. (https://www.epa.gov/sdwa)

Under the SDWA, EPA uses the Unregulated Contaminant Monitoring Rule (**UCMR**) to collect data for contaminants that are suspected to be present in drinking water and do not have health-based standards set under the SDWA. (https://www.epa.gov/dwucmr/learn-about-unregulated-contaminant-monitoring-rule)

Under CERCLA, the Federal government has broad authority to undertake a response action consistent with the National Oil and Hazardous Substances Spill Contingency Plan (NCP) where there is a release or threat of release of a hazardous substance, or a release or substantial threat of a release of any "pollutant or contaminant," which may present an imminent and substantial danger to public health or welfare. Pollutant or Contaminant as defined by section 101(33) of CERCLA, includes, but is not limited to, "any element, substance, compound, or mixture, including disease-causing agents, which after release into the environment and upon exposure, ingestion, inhalation, or assimilation into any organism, either directly from the environment or indirectly by ingestion through food chains, will or may reasonably be anticipated to cause death, disease, behavioral abnormalities, cancer, genetic mutation, physiological malfunctions (including malfunctions in reproduction) or physical deformations in such organisms or their offspring." This designation as a pollutant or contaminant is critical in responding to releases of PFAS and other CECs when a hazardous

substances designation has not occurred, and other regulatory standards have not been promulgated. Demonstrating these impacts requires sufficient data available to regulators, and the data falls into a hierarchy of applicability. This hierarchy provides a mechanism by which State developed guidance or toxicity data can drive the cleanup of CECs in the absence of Federal standards, but also puts a greater burden on States to establish causation between the above impacts and exposure to the pollutant or contaminant.

CERCLA utilizes a set list of contaminants officially defined as "hazardous substances" to help establish compounds it has clear authority over. Hazardous substances are defined in 42 USC 9601 (14) through reference to several other laws including:

- The Clean Water Act (CWA), Sections 307(a) and 311
- Clean Air Act (CAA), Section 112
- Resource Conservation and Recovery Act (RCRA), Section 3001
- Toxic Substances Control Act (TSCA), Section 7

The EPA Administrator also has the authority through 40 CFR part 32 to designate additional Hazardous Substances through promulgated regulation. In September of 2022, the EPA Administrator proposed that PFAS and related compounds be designated Hazardous Substances. At the time this paper was published, the designation had not been made final. While not required to drive action at CERCLA sites, the classification of a CEC as a hazardous substance either by reference or Administrator designation can eliminate many complications when addressing CECs.

Facilities regulated under RCRA have a responsibility to address releases of hazardous constituents because of past waste management practices. RCRA is implemented by the States across most of the country, giving States the authority to address PFAS and other CECs at facilities covered under the provisions of State law. This process is referred to as the Corrective Action (CA) process. There are no rigid requirements for the CA process, but rather it is set forth in a series of guidance documents that mirror the CERCLA process. States may also issue their own guidance and standards. Often Federal Facilities meet both CERCLA and RCRA CA requirements simultaneously under a joint process outlined in a Federal Facilities Agreement or equivalent.

Other State or Federal advisories, guidance, and criteria that are not promulgated or legally binding but may be useful in developing CERCLA remedies or interpreting State laws, may be incorporated into a cleanup as "To-be-Considered" materials (TBCs). Examples of TBCs may include a State's reference dose, additive effects, and guidance documents, or proposed regulations that States develop and release regarding CECs. TBCs are not regulations but should be evaluated along with regulations because they provide supplemental information that may be necessary to evaluate whether the remedy protects human health and the environment.

In 2023, EPA's Office of Land and Emergency Management issued a memorandum clarifying that decisions regarding PFAS and other contamination at Federal Facilities currently on the National Priorities List (NPL) should be made through the CERCLA process with appropriate regulatory review and concurrence. While roles and responsibilities may change at Federal Facilities not on

the NPL, the general CERCLA framework remains the same. The memorandum is focused on PFAS but should also be considered applicable to other CECs. States should expect to play a critical role in decisions regarding current and future CECs, either as co-regulators with EPA, or in their role as lead regulatory agency at non-NPL sites.

III. STATE INVOLVEMENT

Early State involvement is key to the transparency of identifying and investigating CECs at Federal Facility cleanups. This allows both regulators and the Federal Agencies to "be on the same page" when communicating with the public. This uniform messaging can help foster trust within the local community and reflects best practices regarding community involvement at Federal Facilities. One tool that can be helpful is sharing an inventory of preliminary assessment sites and tracking progress throughout the regulatory process (both CERCLA and RCRA). Conversely, if there is no transparency between the State and Federal Agencies, the community may not know who to believe and regulators may not have the information required to make decisions.

Data Sharing Concerns:

With the recent focus on PFAS investigation by the Department of Defense (DoD) at Federal Facilities across the country, data sharing challenges have arisen for State regulators. The National Defense Authorization Act (NDAA) for Fiscal Year 2022 included PFAS investigation funding for the Defense Environmental Program. Section 345(a)(2) of the NDAA prohibits the Secretary of Defense from publicly disclosing the testing results for PFAS and other CECs conducted on private property without the consent of the property owner for protection of personally identifiable information (PII).

The DoD, U.S. Air Force (Air Force) in particular, treats location data as PII and does not share the locations of sampled wells with State regulators due to property access agreements which indicated that data would not be disclosed to State regulators unless the property owner provided approval. Sample results may be shared, but locations, and sometimes the entire sampling report for private properties, are withheld. They share the locations with EPA because the two agencies signed a formal agreement to keep the location information confidential (February 7, 2022); however, the EPA is only involved with facilities that are on the NPL. Many military facilities are overseen only by State regulatory agencies (aka non-NPL sites).

Not knowing the sampled well locations reduce the States' ability to adequately oversee and regulate the investigation efforts. These limitations prevent the State regulators from understanding the impact PFAS may have on groundwater and drinking water around these facilities and ensuring that all drinking water well owners are protected, effectively crippling the State's involvement. Without location data, the States are unable to confirm that an alternate water supply has been provided and is functioning as designed at all necessary locations. Additionally, States must understand the extent of the PFAS plumes for investigation and remediation purposes. Under the direction of the Secretary of the DoD, there are plans to revise

access agreements to clarify that the data will be disclosed to the State regulators unless the property owner indicates otherwise.

Regulatory Coordination:

As CECs enter the spotlight for consideration, one of the key questions is how to identify if there are sources and releases, and if so, where to look for contamination. DoD chose to use the Preliminary Assessment/Site Investigation (PA/SIs) framework to conduct systematic scoping, but this is not the only approach. State and Federal Agencies must coordinate from the beginning to the end of the effort to identify all potential sources of contamination. Disagreements can lead to the reevaluation of sites and the duplication of efforts. As policy and science evolves, early coordination can reduce the number of times a site is reviewed. Often, States experience a delay in receiving CEC data from Federal Agencies due to their internal data validation process, leading to questions of who has the most up to date information to share with the public. Understanding this issue early and determining who will lead the data sharing initiative to the public helps avoid potential contradictions and sending "mixed messages." Collaboration is key to the success of a CEC cleanup effort. EPA guidance published in February 2023 assists with clarifying the use of CERCLA RIs for scoping releases and defining the nature and extent of PFAS and other CECs at Federal Facilities.

IV. SCIENCE VS. REGULATIONS AND POLICY

The science behind CECs continuously evolves, beginning with the discovery of these contaminants in media where populations are potentially exposed. Some States, such as New Jersey, put standards in place and conduct work developing the scientific basis for guidance values, fish consumption advisories, as well as research and technical support on their environmental occurrence and fate and transport. These efforts require large bodies of work from studies performed at academic institutions or dedicated government research with the resources to synthesize them, meaning that government policies are often lagging behind and reacting to the emerging science.

Scientific Approach to Evaluating CECs

Due to the overwhelming amount of chemicals in commerce, scientists must work to develop new and/or improved screening methods for determining the toxicity of chemicals in environmental and biological media to protect the public oftentimes before the attributes and risks of the chemicals are fully understood. This proactive approach to address CECs prior to fully understanding their safety and toxicity is necessary to protect public health and the environment. As science and our understanding of CECs evolves, so can the risks and associated screening and cleanup numbers. However, creating policy before scientific consensus and understanding of CECs is reached may lead to inaccurate assessment of risks, misidentification of environmental screening levels, and incorrect cost analysis. A reactive approach may have detrimental impacts including the loss of valuable time needed to address risk or remedy the potentially pervasive

issue State and Federal approaches to the toxicity of CECs attempt to account for this with an intentionally conservative approach when interpreting the science and translating it into policy.[2]

The limited available information associated with CEC toxicities and their adverse effects on public health and the environment, including accumulation within the environment and bodies of humans and/or wildlife, can create challenges amongst regulatory agencies on determining how CECs should be addressed which leads to a reactive approach. This also confuses Responsible Parties, as there is no clear and concise message among regulators.

Establishing Policy to Address CECs

To proactively address CECs, such as PFAS, some States have established legally enforceable values for PFAS in drinking water, groundwater, surface water, soil, or other environmental media. Other States and regulatory agencies have opted for non-enforceable values such as guidance levels, screening numbers, or advisories that may apply to PFAS. Many States lack the capacity or resources to effectively regulate CECs including PFAS. Barriers include lack of technical expertise needed for toxicity interpretation and standard development, labs certified to test for CECs, legislative support, and funding. While the manner of addressing CECs such as PFAS vary, PFAS receives the most attention from the public and its governing bodies. "In 2020, State legislatures across the US considered at least 180 bills with language on PFAS. At least 15 States enacted at least 27 bills focused on efforts like regulating PFAS in firefighting foam and consumer products, establishing MCLs for PFAS in drinking water, and appropriating funds for remediation activities to address PFAS contamination."

In addition, some States may have different mandates (e.g., regulations, policies) that direct them to interpret toxicity data (including considering exposures to sensitive life stages like infants or pregnant women) to develop risk assessments or require them to use the EPA's risk assessments as the basis for their guidelines. For example, several States have developed drinking water guidelines for PFOA and PFOS that are lower than the EPA's LHA level due to considerations of more recent scientific information, more sensitive toxicological endpoints, and/or more stringent exposure parameters. States that lack the necessary resources to develop their own policies have simply adopted the EPA's LHA for PFOA and PFOS in drinking water and/or groundwater to guide their efforts upon detection of contamination.

It is important for regulatory agencies to know which States are developing guidelines, understand the development process, and be able to educate others, including legislators, on differences between State, Federal, and other guidelines. Understanding these differences is essential for States to make informed decisions when implementing their own regulations and/or risk communication practices to address CECs. Additionally, the approaches taken by one State can inform and support actions taken in another.

In California, prior to a regulatory standard being established for a CEC, studies are performed by the Office of Environmental Health Hazard Assessment (OEHHA) to determine notification levels

[2] *This conservatism can create issues where laboratories may have difficulties achieving reporting limits able to detect the low concentrations of derived MCLs. This discrepancy presents challenges for the regulatory community to accurately quantify or report on CEC contamination in policymaking decisions.*

(NLs) for individual CECs. OEHHA then provides recommendations to the State Water Resources Control Board (Water Board) to implement the NLs by notifying water purveyors.

Like Federal LHAs, California NLs are nonregulatory, health-based advisory levels that the Water Board establishes as a precautionary measure for contaminants for which regulatory standards have not yet been set. Certain requirements are triggered when chemicals are detected at levels that exceed their respective NL. These NLs are put in place to serve as an initial protection against exposure.

Establishing Federal Regulation to Address CECs

In 2019, the EPA released a PFAS Action Plan outlining an approach for their response, and on April 10, 2024, EPA announced the final National Primary Drinking Water Regulation (NPDWR) for six PFAS. As demonstrated over the five years it took to establish MCLs for six PFAS, establishing an MCL for CECs is a long, complex process that typically takes many years to complete.

The SDWA establishes the creation of a Contaminant Candidate List (CCL), which is composed of a discrete list of known or potential CECs in drinking water. EPA then must make a regulatory determination for at least five of those contaminants within five years of publishing the list. The decision to regulate is based on the availability and quality of scientific data about a CEC, the potential risks it presents, and its presence in drinking water. These evaluations require a large body of credible studies and data, and the time to synthesize that body of work. Once public comments have been addressed and the determination to regulate via a National Primary Drinking Water Regulation is made, which initiates the process of developing an MCL. A more thorough review is then conducted to quantify risks and evaluate available treatment technologies. PFOA and PFAS were added to the CCL in 2016, and EPA made the determination to regulate them in 2021. An MCL was established for PFOA and PFAS on April 10, 2024 after receiving thousands of public comments regarding the CECs.

Further adding to the complexity of regulating CECs such as PFAS at Federal Facilities is the Federal Government's process for accepting or rejecting State standards, which can lead to expensive, time-consuming disputes that significantly slow cleanup progress. CERCLA §121(d)(2)(A) states that any State promulgated standard, requirement criteria, or limitation that is identified in a timely manner and that is more stringent than any Federal standard, requirement, criteria, or limitation may be considered regulation. EPA and/or the lead Federal Agency may assert that some State requirements are procedural or administrative in nature rather than substantive and resist including them as ARARs in decision documents over the objection of States.

The policies and regulations governing CECs typically exist in an environment of fluid scientific understanding. This creates tension for regulators under pressure to make deliberate and effective regulatory determinations and policy recommendations consistent with the requirements of State and Federal law on timelines useful for project teams to act consistently. In the interim, project teams responsible for cleanups at Federal Facilities must plan around

scientific uncertainties, policy disputes between relevant agencies, and limited resources for interpreting the evolving scientific landscape.

V. RESEARCH

The research needs surrounding CECs can be daunting given the sheer volume of compounds in use and the data needs of regulators. Not only are there challenges identifying which compounds could potentially become CECs, but amassing information on sources, toxicity, and exposures are separate challenges. Regulators are forced to draw on multiple and sometimes conflicting sources to make policy and project level decisions, without relevant subject matter expertise available to them. The framework by which stakeholders in the CERCLA process at Federal Facility cleanups process can impact the speed at which regulators can both identify and respond to CECs.

Data on CECs are collected from a variety of sources, both public and private. Academic institutions routinely perform laboratory and field studies which flag a compound as a risk to the public. Separately, manufacturers have their own programs to reduce liability or meet production goals and well-funded Non-Governmental Organizations can commission their own studies to assist in advocacy. State and Federal Agencies also have their own divisions, workgroups, or staff tasked with either independent research or evaluating data generated from the above sources. These various entities approach their research through different lenses with various goals and considerations, which makes comparing their research and conclusions challenging.

Within this complicated network of CEC research, there is no one unified approach to the identification and research of potential CECs within EPA. The Center for Public Health and Environmental Assessment and the Office of Research and Development (ORD) both have resources to research and evaluate CECs and hold the primary responsibility for these efforts within the agency, in coordination with other divisions. Research priorities within EPA's ORD are covered under a series of Strategic Research Action Plans (StRAPs) for each of its six National Research Programs. CEC research appears to be handled through these StRAPs on an as needed basis. Additionally, other EPA programs can also contribute to CEC research relevant to their purview. These efforts are usually organized and coordinated via intra-agency workgroups, like the current approach for PFAS.

DoD handles CEC research through its Emerging Contaminants Program, currently governed by DOD Instruction 4715.18. The Emerging Contaminants Program uses the following 3 criteria to identify a potential CEC as outlined in Instruction 4715.18:

1) Be relevant to DoD (e.g., used by the DoD, incorporated into research and development);
2) Have a perceived or real threat to human health or the environment; and
3) Have new or changing toxicity values or regulatory standards because of new science, detection capabilities, or new pathways.

After research and an evaluation of these criteria, DoD program staff make recommendations to the Emerging Chemicals of Concern Steering Group (ECGC) as to whether a compound should be

considered an emerging contaminant and placed on a watch list. The EGSC makes the determination as to whether the contaminant should be retained as an emerging contaminant. Once this determination is made, a more in-depth assessment is performed by program staff and outside subject matter experts to determine the risk of impacts to DoD operations. Based on the level of risk, risk management recommendations are made to guide the DoD moving forward.

States may have their own CEC programs similar to DoD's or may evaluate CECs on an as-needed basis. State approaches to CEC identification and research of compounds like PFAS are determined by the legal authorities granted to State agencies, available resources, and other policy considerations. These programs can provide States with valuable information and leverage in discussions of how to address CECs during the cleanup of Federal Facilities.

The variety of approaches utilized to research and identify CECs along with the different goals of these agencies and their programs can lead to duplication of work and conflicting conclusions about the best approach to handle a specific CEC. At the project level, cleanups at Federal Facilities may become contentious or halt as Federal stakeholders negotiate the appropriate approach to a CEC, generally at an organizational level well beyond those directly working on the project. These delays can have implications for risk, funding, project team cohesion, or directly impact the ability to effectively remediate sites.

VI. RISK COMMUNICATION

All regulatory agencies should consider implementing a standardized approach to address CECs at sites and use that process to help guide risk communications. Risk communication for CECs is often a challenge because there are many uncertainties and opportunities for misinformation as a whole and on individual sites. Risk communication should be early, cooperative, clear, and scheduled. Effective communication strategies can maintain or increase public trust in the regulatory process, and in turn increase community acceptance of desired remedial options.

Communicating risk is a cooperative task between all Federal, State, and local agencies. Highlighting areas of agreement and disagreement between Federal responsible parties and regulatory agencies will help build trust in the community. Agencies must be able to clearly explain scientific issues to those that may not have a science background. Understanding the risk perceptions and concerns of the agencies, local governments and community will lead to more productive engagement. Federal responsible parties and regulatory agencies should clearly plan the schedule and methods of communication with each other, the local government, and community. Agency transparency is needed to build trust in the affected community through the development of schedules, mechanisms, and platforms for releasing information to the State, local agencies, and public.

Federal responsible parties and regulatory agencies must start communication early. Starting risk communication early in the environmental cleanup process for sites will assist in eliminating miscommunication about risk, and perceived risk. This ensures that stakeholders understand

what risk is (toxicity x dose), proactively engage other agencies, the media, and community. This emphasis on risk communication helps control messaging and discourages misinformation.

The process for risk communication for urgent situations should be developed first, then agencies should take steps to create a cohesive long-term risk communication strategy. This can standardize how regulators deal with future emerging contaminants and cut through much of the potential duplicative work discussed in Section II. PFAS are only the latest in a long line of CECs, and regulators should expect to have to deal with more in the future.

VII. CONCLUSIONS AND RECOMMENDATIONS

While the specifics vary, CECs have been a feature of the landscape in environmental regulation since the inception of the modern regulatory structure. The inadequate patterns of response to CECs means that the State Federal Coordination Focus Group feels comfortable making several recommendations to States dealing with CECs at Federal Facilities.

CONCLUSION: PROACTIVE IS BETTER THAN REACTIVE

One of the more challenging aspects of CECs is that regulators often preemptively react rather than acting on known data. While some of this is unavoidable given the nature of CECs, States and their Federal partners that work proactively to identify, characterize, and evaluate releases of CECs are in a much better position to take quick action as science becomes clearer. Delays enable CECs to migrate further from their release and sow distrust in communities, who are fearful of impacts on their health and environment.

Many of the challenges that CECs present in this paper are the direct result of industry, government, and community stakeholders grappling with uncertain risks from compounds previously thought safe, often with no viable immediate alternatives and policy frameworks unable to deal with the problems presented. CECs with more limited use (such as explosive constituents) have proven less pervasive than those that are in broad use across many applications like PCBs or PFAS. Federal facilities may not utilize the full range of compounds that enter the market but utilize many of them in their day-to-day operations. The volume of new compounds entering the market every year without robust toxicity data compounds this problem for regulators. While the chemical approval process is outside of the scope of this paper, there is a strong link between it and the number and frequency of CECs regulators at Federal Facilities must contend with.

History shows that the Federal government can be slow in adopting or promulgating CEC toxicity data most reflective of current science. The processes by which the Federal government develops policy and regulation are time and process intensive, often requiring years to reach completion. For example, the science underlying the current PFAS MCLs continues to evolve such that for PFNA and PFHxS, the MCL will be outdated within a year. Because it takes years to go through rulemaking, the public will be stuck with outdated and under protective MCLs for a long time.

Responsible Parties may be reluctant to act while such efforts are ongoing, which may be frustrating if a State or its communities believe current conditions present unacceptable risks. States that wait for Federal policy or regulation might wait years for the official authority to compel action from CERCLA lead agencies. A growing number of States have begun to promulgate their own standards for CECs to drive cleanups at Federal Facilities while the Federal government is still evaluating adopting or changing its standards. At the time of publication, 26 States promulgated drinking or groundwater regulations related to PFAS, taking advantage of the relative speed at which they can move compared to the Federal government, solidifying their authority to compel action to address releases. Similar measures were employed when perchlorate was identified as a CEC, providing a roadmap for States to deal with new emerging CECs. While many States lack the funding and capability to develop their own toxicity factors, other States with resources may develop standards as the need arises.

As a DoD Inspector General's (IG) report notes, Federal Agencies can develop proactive risk management strategies that can limit exposures of CECs which do not require waiting for the full regulatory process to reach completion. As soon as potential CECs are identified, the IG report recommends proactive measures before the CEC has completed the formal processes and designations. Both States and their Federal partners should evaluate options within their authority to minimize the potential for releases and investigate potential sources and releases. When States and Federal Agencies are proactive in both their investigations and remedial actions, they can both save significant amounts of time and money and limit unnecessary exposures to CECs. While some issues have arisen, the DoD should be commended for taking a more proactive approach to PFAS than previous CECs. And their response has been proactive compared to many potential RPs in the private sector that hesitate to act until the rules regarding PFAS are finalized.

Proactive and collaborative approaches will assist in proper risk communication. When government authorities attempt to get ahead of the problem, rather than only acting when certain regulatory markers are met, community trust increases. Community involvement best practices already promote a proactive "early and often" mindset and work best when paired with an equally proactive approach to the investigation and remediation.

RECOMMENDATION: DEVELOP PROACTIVE FRAMEWORKS TO ADDRESS CONTAMINANTS OF EMERGING CONCERN BEFORE THE NEED ARISES

The evolving nature of CECs requires policy frameworks and structures that meet their changing challenges. States and Federal Agencies need organizational structures that can identify potential CECs early on and assist their organizations in developing and coordinating proactive steps to address them. DoD has established a structure for identifying and developing enterprise-wide recommendations for CECs. The Scan-Watch-Action process provides a formal structure by which DoD identifies compounds for further study based on DoD use, synthetizes the science, and makes formal recommendations through its Emerging Chemicals of Concern Governance Council. The program has allowed DoD to proactively examine and prioritize evaluations of lead, hexavalent chromium, and PFAS through the years, even if some problems remain.

Several States have developed similar programs, and in January 2023 ASTSWMO's Contaminants of Emerging Concern Steering Committee issued recommendations for States seeking to establish their own CEC programs. The Steering Committee found 3 major recommendations for States seeking to develop such programs: leadership engagement, defining the scope of the program, and maintaining the ability to compile and assess information. Where practical, the State Federal Coordination Focus Group recommends States develop CEC frameworks in a manner consistent with the Steering Committee's recommendations.

The SFC FG research did not find any specific or formally established EPA program tasked with compiling, evaluating, and coordinating CEC related topics akin to DoD's ECGC. Instead, each office identified as having a role in identifying CECs appears to act independently unless otherwise directed. The SFC FG recommends EPA create a standing office tasked with coordinating the efforts of other programs and focused on agency-wide considerations. In the past this created some confusion about which approach or values to use when addressing CECs (e.g., health advisory numbers vs RSLs, etc.). The SFC FG commends the work EPA has done creating and implementing its PFAS Roadmap, however actions to address future CECs could be implemented more quickly if there is a defined organizational and policy framework in place at the time of their discovery.

RECOMMENDATION: MAINTAIN TRANSPARENCY AND COMMUNITY ENGAGEMENT FOR PROPER RISK COMMUNICATION

Community engagement is an important component of Federal Facility cleanups, and even more critical when CECs have the potential to impact the surrounding communities. Without proper engagement, concerned community members will seek other sources of information that may not have the most up-to-date information regarding CECs. The proper use of community engagement best practices can mitigate this phenomenon, enhance cooperation from communities during investigations and remedial actions, and increase the chances of community acceptance of remedial actions.

RECOMMENDATION: STAKEHOLDERS SHOULD NOT ASSUME CONTAMINANTS OF EMERGING CONCERN BEHAVE THE SAME AS OTHER CONTAMINANTS

The unique properties of CECs present challenges to traditional understandings of contaminant fate and transport since organo-pesticides and PCBs were identified as the first known persistent organic pollutants that could move through the food chain. As time goes on, newly identified pathways or exposure routes can drive risks to communities and the environment that were unaccounted for. Through fish consumption of PCBs, vapor intrusion from organic solvents, or prenatal exposures to TCE, the scientific community regularly finds gaps in our knowledge and understanding of how some contaminants move through the environment and impact communities and the environment. One challenge to addressing PFAS is its unique properties which allows it to move through the environment more quickly than other compounds and to bioaccumulate through a different mechanism than traditional persistent organic pollutants. This

means that many existing models for the prediction of groundwater flows and bioaccumulation are not applicable to these compounds. When dealing with CECs, State regulators should push their Federal partners to fully characterize releases of CECs, and not use short cuts based on assumptions from the behavior of other compounds.

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