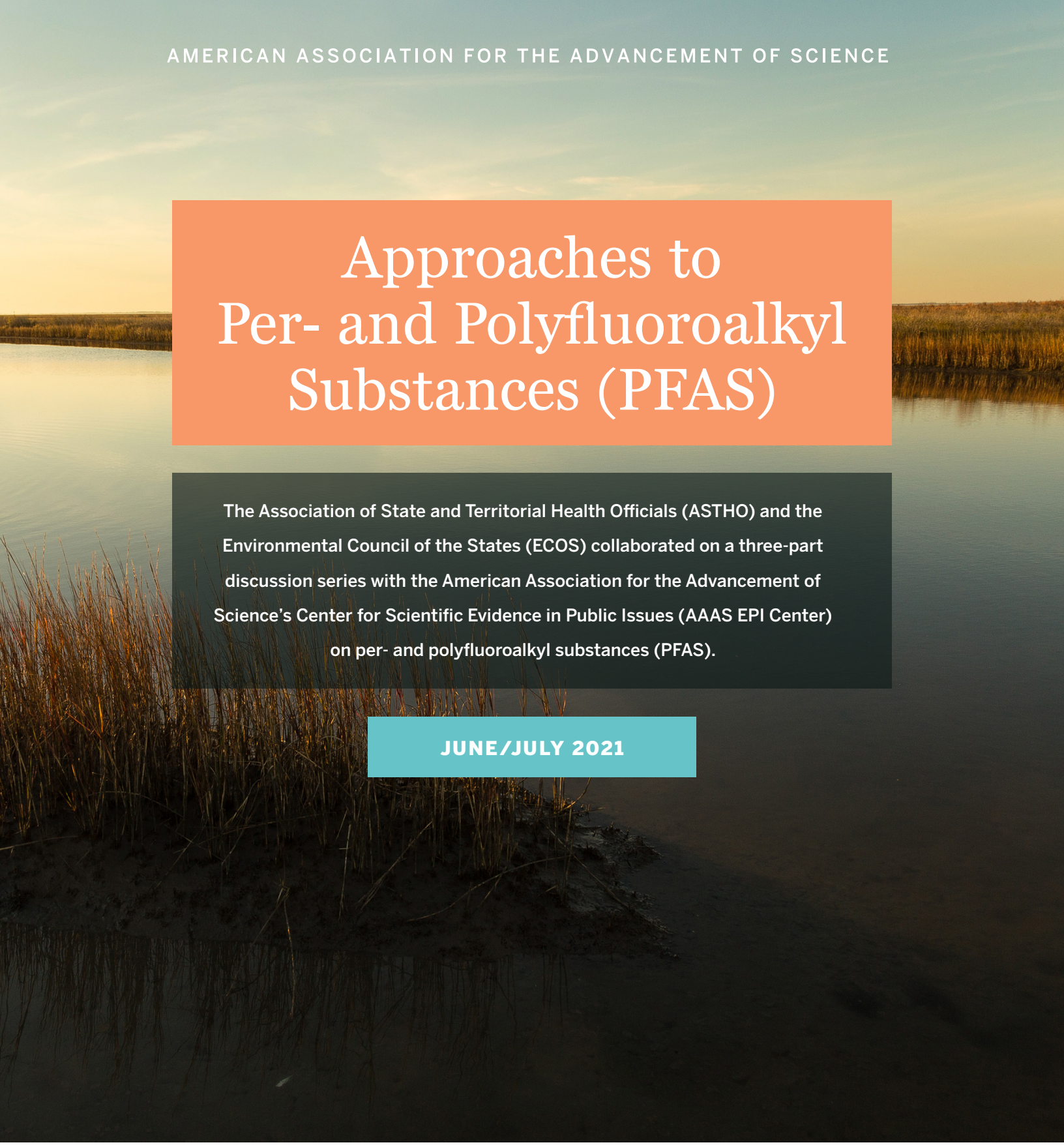

AMERICAN ASSOCIATION FOR THE ADVANCEMENT OF SCIENCE

Approaches to Per- and Polyfluoroalkyl Substances (PFAS)

The Association of State and Territorial Health Officials (ASTHO) and the Environmental Council of the States (ECOS) collaborated on a three-part discussion series with the American Association for the Advancement of Science's Center for Scientific Evidence in Public Issues (AAAS EPI Center) on per- and polyfluoroalkyl substances (PFAS).

JUNE/JULY 2021

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CENTER FOR SCIENTIFIC EVIDENCE IN PUBLIC ISSUES

In June and July of 2021, the Association of State and Territorial Health Officials (ASTHO) and the Environmental Council of the States (ECOS) collaborated with the American Association for the Advancement of Science's Center for Scientific Evidence in Public Issues (AAAS EPI Center) for a discussion series on per- and polyfluoroalkyl substances (PFAS). The 10 panelists included state regulators, scientists, and community advocates who addressed PFAS in drinking water and underserved communities, risk communication, and toxicology, among other topics. This document includes key takeaways and summaries of these sessions.

For more information and assistance, please contact ASTHO, ECOS, or AAAS EPI Center

Key Takeaways

Evidence and Guidelines

Concern about low levels of PFAS exposure. Although there are many toxicological unknowns, there is consensus that low levels of exposure to PFAS are of concern. In the absence of enforceable federal standards, states are setting their own guidance and/or enforceable standards for a number of PFAS in various environmental media. Guidance may differ based on which PFAS are present, which scientific studies are referenced and when they are accessed, and which toxicological endpoints are used. An increasing number of states are setting these advisory and/or regulatory values in the single-digit parts per trillion (ppt) range, which is far below the U.S. Environmental Protection Agency's (EPA) current drinking water health advisory of 70 ppt for perfluorooctanoic acid (PFOA) and perfluorooctane sulfonate (PFOS).

Need for more scientific evidence and data collaboration. Our understanding of PFAS toxicology and impact on human health and the environment is constantly evolving. Responding to PFAS requires collaboration among state and federal agencies, researchers, industry, and the public. State environmental and health agencies indicate that they need more toxicological data; more robust testing of small drinking water systems and private wells; and increased information on PFAS fate and transport through non-drinking water media such as soil, wastewater, surface water, biosolids, environmental uptake, and landfills.

Variations of critical endpoints used in risk assessments. States may choose similar or different risk assessment factors based on which PFAS are present and environmental medium is impacted. For example, New Jersey uses increased liver weight and delayed mammary gland development in mice and testicular tumors in rats as the critical endpoints for PFOA in drinking water; decreased immune system response in mice and liver tumors in rats for PFOS; and increased liver weight in mice for perfluorononanoic acid (PFNA). For a more comprehensive list of assessments conducted and factors used in different states, see ECOS' white paper on state processes and considerations for setting PFAS standards.

The limits of existing analytical methods and treatment options. Practical factors, such as the level at which drinking water laboratories can reliably detect PFAS, as well as the ability of available treatment to remove PFAS, can limit efficient and effective standard setting. The development of analytical methods for more PFAS at lower levels in more environmental media, as well as options to treat more PFAS in the varied media, will help regulators regulate and remediate PFAS contamination.

Expertise from in-house toxicologists and assistance from an independent advisory body for standards recommendations. As states develop guidance for a number of PFAS in different environmental media, it may be helpful to consider in-house toxicologists (as resources exist) and advisory bodies to assist in science development and regulation implementation. For example, New Jersey became the first state to establish a maximum contaminant level (MCL) for PFAS in drinking water. The guidance was based on New Jersey's prior development of a drinking water guidance value for PFOA that was more stringent than that in other states and federal guidance at the time, based on agency research and recommendations.

Usefulness of biomonitoring. Biomonitoring can demonstrate that public health actions and interventions reduce individual

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exposures to PFAS. Biomonitoring can assure the public that regulators are taking action to assess and reduce exposure, despite the challenge of explaining relative health risks related to PFAS levels measured in the body. Medical guidance and blood testing information should be provided to affected people. Health providers and clinicians will need guidance. There is no treatment for PFAS exposure, and blood testing does not provide a clinical diagnosis or definitively say if a person's health has been or will be affected.

Implementation of monitoring and tracking. States use monitoring and tracking to collect information on PFAS occurrence in various waterbodies and watersheds, at airports, in solid waste landfills, at chrome plating facilities, from bulk fuel terminals and refineries, at public treatment works, and in public water systems. In California, this is tracked by various programs, such as CalRecycle, which monitors the degradation of compostable plastics and the California Air Resources Board (CARB), which oversees emissions reporting. California is also working to pioneer some new approaches to biomonitoring by developing semi-targeted approaches for PFAS not covered by current standard measurement methods to identify the full range of PFAS that people have in their bodies.

Partnerships and Community Engagement

Partnerships to support multi-agency PFAS response. PFAS responses require extensive collaboration and planning among federal, state, and local agencies on environment, health, agriculture, etc. Environmental and health agencies often coordinate across other programs within the state to regulate PFAS in different media, and implement legislative bans and/or bills relating to firefighting foam, PFAS in food packaging, etc. Residents need to see evidence that their governments are working together.

Efficiency of county and local health departments to reach impacted communities. County and local health departments are often the lead on delivering health services. When communicating about PFAS contamination, the public may expect those officials to inform them about what levels are considered "safe." More transparency on what departments know and do not know builds a higher level of trust among constituents.

Emphasis on environmental justice. There is a need for research and policy that amplifies the voices and experiences of those impacted by PFAS contamination. Officials should proactively target testing in low-income and black, indigenous, people of color (BIPOC) communities; prioritize these communities for remediation; offer financial support for expensive remediation needs; and stop new manufacturing, uses, and emissions of PFAS for all non-essential uses.

Community engagement. Directly engage communities to involve them in PFAS response. It is important to explore different communication avenues for sharing information to reach more people.

Risk Communication

Principles of effective risk communication. Effective risk communication on PFAS should:

- Establish dialogues early and continue through resolution.
- Include communities in the decision-making process.
- Present accessible and clear information.
- Communicate both the knowns and the uncertainties. Be transparent, particularly about human health concerns.
- Listen, acknowledge, and follow up on specific concerns.
- Communicate the context for the risks.

Examples of suggested messages are included in the Risk Communications session summary.

Assess community concerns and knowledge. Check social and news media, reach out to municipal representatives to hear their concerns, and identify the community's risk perception factors. Integrate the findings from the community assessment into your communications and use key messages to directly answer the concerns.

Resources

PFAS Central • Green Science Policy Institute

PFAS Project Lab • Northeastern University

PFAS-Exchange • Silent Spring Institute

Addressing Per- and Polyfluoroalkyl Substances (PFAS) in Drinking Water: Guides for Local and State Leaders • AAAS EPI Center, January 2021

PFAS Risk Communications Hub • ASTHO and ECOS

Risk Communication • ITRC, September 20, 2020

Processes and Considerations for Setting State PFAS Standards, • ECOS, February 13, 2020

Perfluoroalkyl Substances (PFAS) • Minnesota Department of Health

New Jersey MCL Development Process • NJ Department of Environmental Protection (NJDEP)

New Jersey Drinking Water Quality MCL Recommendation Documents • New Jersey Drinking Water Quality Institute, August 5, 2021

Approaches for Addressing Drinking Water and Wastewater Contaminants of Emerging Concern (CECs) in a Broader Context: Identification, Ranking and Treatment Removal • NJDEP Science Advisory Board, April 20, 2020

Public Health Goals: First Public Review Draft – Perfluorooctanoic Acid and Perfluorooctane Sulfonic Acid in Drinking Water • CA Environmental Protection Agency, Office of Environmental Health Hazard Assessment, July 2021

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Historic Buildings on the bank of Kennebec River in downtown Augusta, Maine

Session Summaries

How does PFAS in drinking water impact communities? What are the environmental justice issues?

JUNE 16, 2021

- Michael Scott, Director for the Division of Waste Management, North Carolina Department of Environmental Quality
- Michael Abbott, Associate Director, Division of Environmental and Community Health, Maine Department of Health and Human Services' Center for Disease Control and Prevention
- Phil Brown, Ph.D., Distinguished Professor, Northeastern University
- Alissa Cordner, Ph.D., Associate Professor of Sociology and Paul Garrett Fellow, Whitman College

Panelists from North Carolina and Maine, two states grappling with legacy PFAS pollution, discussed the need for increased coordination on a number of PFAS issues, such as their approaches to regulation and communication.

Both state officials noted that not all communities are the same, so regulators need to use different avenues to share information with all constituents. They stressed the need to directly engage with communities and impacted residents and to reach private well owners.

State officials stressed the need for collaboration to gather data. Researchers warn that many locations with PFAS contamination may not have been detected yet, and data gaps may underestimate PFAS exposure inequalities. There is a need for increased coordination on research and policy that amplifies the voices and experiences of those impacted.

MICHAEL SCOTT

Director for the Division of Waste Management, North Carolina Department of Environmental Quality

Since 2017, North Carolina has tested thousands of residences around the DuPont/Chemours Fayetteville Works plant and found high levels of PFAS in drinking water. The NC Department of Environmental Quality (NC DEQ) is currently undertaking an under-sink Reverse Osmosis filter study to assess PFAS removal efficacy at high and low concentrations.

Michael Scott, Director for the Division of Waste Management, NC DEQ, emphasized that PFAS data needs are extensive and require collaboration from all parties. Tests included drinking water, groundwater, landfill leachate, surface water and residential wells, but has largely overlooked small water systems, private wells, and non-drinking water contamination such as soil, wastewater, and landfills. The agency is working with citizens to collect more data on these areas of concern and is coordinating with the North Carolina Department of Health and Human Services (DHHS) to advance the knowledge base of emerging compounds.

NC DEQ is focused on assessing environmental impacts, addressing the needs of communities, ensuring current regulatory standards are met, and evaluating future regulatory needs. NC DEQ is working closely with local health departments and community leaders to publish newsletters with information on private well sampling, treatment systems and state agency contacts. NC DEQ coordinates with the Secretaries' Science Advisory Board and NC Environmental Management Commission to address impacts to groundwater, surface water, soil and air as information becomes available. The groups are

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focusing on risk communication and are evaluating next steps beyond practical quantitation limits of 70 ppt for PFOA and PFOS in groundwater.

MICHAEL ABBOTT
Associate Director, Division of Environmental and Community Health, Maine Department of Health and Human Services' (ME DHHS) Center for Disease Control and Prevention

EPA's lifetime health advisory for PFOA and PFOS was not yet developed when Maine first discovered PFAS in one of its public water systems. Maine's primary PFAS sources include biosolids applied on farms to neutralize the acidity of soil (a beneficial use) and local industries such as paper mills. Several decades of applying biosolids resulted in some of the highest levels in the country of PFAS detected in drinking water. PFAS was also detected in the milk of dairy cows at 1420 ppt, indicating a more widespread problem than initially thought.

The costs incurred by rural communities that rely on private wells are overwhelming. More than half of Maine's population gets water from private wells, which are expensive to maintain and treat, and the cost of running public water to rural areas can be prohibitive. Farmers face the loss of their livelihoods and residents are concerned about the decline in property value due to PFAS contamination.

Maine is likely to soon adopt a new set of standards for six PFAS.

PHIL BROWN
Distinguished Professor, Northeastern University

ALISSA CORDNER
Associate Professor of Sociology and Paul Garrett Fellow, Whitman College

Decades of research on environmental hazards indicates an uneven distribution of risk for people of color and those in low-income communities. Environmental justice considers the cumulative exposure of such hazards, including chemical and non-chemical stressors.

PFAS exposure is ubiquitous in the U.S. and data gaps may underestimate PFAS exposure inequalities. One study based on a small body of research found that higher income communities have higher levels of PFAS contamination (presumably related to fish consumption), while another study suggests that non-Hispanic Black Americans and Asian Americans have the highest reported levels of exposure to certain PFAS. Overall, there is a need for research and policy that amplifies the voices and experiences of those impacted. Officials should proactively target testing in low-income and BIPOC communities; prioritize these communities for remediation; offer financial support (remediation is expensive); and stop new manufacturing, uses, and emissions of PFAS for all non-essential uses.

PFAS Risk Communication and Dialogue
JUNE 23, 2021

- Melissa A. Harclerode, Ph.D., BCES, CDM Smith and Interstate Technology Regulatory Council (ITRC) PFAS Risk Communication Team Leader
- James Kelly, Manager, Minnesota Department of Health
- Laurene Allen, Merrimack Citizens for Clean Water and National PFAS Contamination Coalition

Communicating the science on PFAS toxicology and remediation can help communities understand options for reducing or eliminating risks posed by PFAS. However, continued uncertainty about what is considered "safe" can make public communication about PFAS a challenge. Panelists shared strategies for communicating complex PFAS-related science to the general public and discussed the value of communicating and partnering with community stakeholders and other constituents to address PFAS.

MELISSA A. HARCLERODE, PH.D., BCES
CDM Smith and Interstate Technology Regulatory Council (ITRC) PFAS Risk Communication Team Leader

Dr. Melissa A. Harclerode shared highlights from the ITRC risk communication guidance document, which uses communications on PFAS as an example throughout. As

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mentioned in the key takeaways, the principles of risk communication include:

- Establish dialogues early and continue through resolution.
- Include community in the decision-making process.
- Present accessible and clear information.
- Communicate both the known and the uncertainties. Be transparent, particularly about human health concerns.
- Listen, acknowledge, and follow up on specific concerns.
- Communicate the context for the risk.

Dr. Harclerode also noted that it is important to do your due diligence to assess community concerns and knowledge of the issue, such as checking social and news media, reaching out to municipal representatives to hear their concerns, and identifying the risk perception factors. Integrate findings from the community assessment into communications and use consistent messages to directly respond to concerns.

JAMES KELLY

Manager, Minnesota Department of Health

"We all have to think about how communities perceive a risk, especially a risk like PFAS that felt like it was thrust upon them almost overnight."
– James Kelly, Manager, Minnesota Department of Health

James Kelly of the Minnesota Department of Health (MDH) emphasized the challenge of the constantly evolving science around these chemicals. The role of MDH is to share information and involve communities in the process of identifying and resolving PFAS contamination. This includes building partnerships with county health departments to reach impacted communities. People want to know that their state, local, and county governments are working together to protect their health and the environment. He noted that the county/local jurisdictions are often the lead on delivering services, so the public is used to hearing from and trusting them.

Minnesota, like a number of other states, established cross-agency teams that meet regularly and coordinate on various aspects of PFAS. In early 2021, Minnesota developed a PFAS blueprint, which is the state's gameplan for how it will address PFAS contamination. The blueprint and its implementation represent an ongoing collaboration among the state's agencies.

In Minnesota, biomonitoring was implemented to demonstrate that public health actions and interventions reduced the levels of PFAS measured in exposed individuals.

"That did a lot to assure the public that even if we didn't have all the answers, we were taking sound actions that were reducing their exposure and potential health risks," said Kelly. "It is one tool to show effectiveness, even in the absence of being able to explain what those relative health risks are."

Merrimack Citizens for Clean Water and National PFAS Contamination Coalition

"There were no laws to prevent this type of contamination, that is a hard thing for a community to get their head around."
– Laurene Allen, Merrimack Citizens for Clean Water and National PFAS Contamination Coalition

The state can only go by what they know, which is challenging for emerging contaminants such as PFAS. The questions from the public will always be: how does this impact us and what is going to be done about this?

Trust must be established; you need to find people in the community who are trusted and work with them to build trust.

MESSAGE GUIDANCE

From Minnesota

- Take a cautious approach to protecting health.
- PFAS is a very active area of scientific research and there is still a lot that we are learning. As new information becomes available, let communities know.
- Acknowledge uncertainties by clearly stating that you do not know everything, but that you are going to share what you know when you know it.
- It is necessary to explain how the state developed its standards and why they may differ from EPA guidance or those in other states.

From ITRC

- Describe the actions being taken to address uncertainties and when you expect to get more information on the uncertainties. Provide a sense of the timeline for new information.
- Share secondary performance metrics to show communities that you are reducing exposure and risk in the long term. It may not be possible to clean up to a specific level, but maybe source control is achieved, and the bioavailability and leaching of these compounds are reduced.
- Help the public better understand risk assessment factors. What is the receptor associated with your clean up value? What is the dosage?

From Merrimack Citizens for Clean Water

- Building community trust is paramount.
- Focus on communicating about what you can do or are already doing.
- Follow up on any unanswered questions at a later date.
- Ensure that community messages come from trusted individuals.

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How does scientific evidence inform state policies for PFAS in drinking water?

JULY 20, 2021

- Katrina Angarone, Associate Commissioner for Science and Policy, New Jersey Department of Environmental Protection
- Lauren Zeise, Ph.D., Director, California EPA Office of Environmental Health Hazard Assessment

Panelists discussed strategies for incorporating evolving scientific evidence into the policymaking process, as well as tools to effectively regulate PFAS at the state level in the absence of enforceable federal standards. They noted that federal funding of research on PFAS health effects has been invaluable, and federally-funded studies can also provide robust data on treatment. There is consensus around the concern of low levels of PFOA and related PFAS exposures. Although states may set different guidance or standards, the resulting levels generally do not significantly differ from one another.

"There's a confluence of evidence that says that we're concerned about low parts per trillion levels. We may pick different end points — we have immune system effects, liver system effects — and they're coming together sending a signal. Low levels are a concern."

– Lauren Zeise, Director, California EPA Office of Environmental Health Hazard Assessment

In an interactive poll, attendees identified the following top PFAS information gaps that make protecting public health more difficult (these attendee-submitted results had the most net "upvotes," with each entry receiving 5 net upvotes):

- Determining health effect levels of PFAS, either individually or culmulative;
- Lacking national limits on many PFAS;
- Determining exposure to the public; and
- Lacking robust knowledge of toxicology and/or health effects for a majority of PFAS.

In the same poll, attendees indicated that "having water companies conduct source water assessment to determine their vulnerability to PFAS contamination" was a top "upvoted" response to the question: "What have you found to be effective policy actions for addressing PFAS contamination and human exposure at the state level in the absence of a federal standard?" Other top "upvoted" responses included:

- Making resources available to drinking water providers to treat PFAS;
- Development of health advisory levels; and
- Development of guidance values followed by standards.

KATRINA ANGARONE

Associate Commissioner for Science and Policy, New Jersey Department of Environmental Protection

New Jersey has the authority to set standards for PFAS in drinking water and to compel testing. "New Jersey is lucky to be able to develop its own standards, some states don't have that ability," said Angarone. The state's in-house toxicologists did much of the scientific evaluation and reviewed the development of the standards. Prior to the development of New Jersey's MCLs, the toxicologists developed a preliminary drinking water guidance value for PFOA that was much more stringent than any other state or federal guidance at the time.

The state established MCLs for PFOA, PFOS, and PFNA. The critical endpoints used in the risk assessments for PFOA are increased liver weight and delayed mammary gland development in mice, and testicular tumors in rats. For PFOS, critical endpoints are decreased immune system response in mice and liver tumors in rats. For PFNA, a PFAS not as commonly regulated in other states, the critical endpoint is increased liver weight in mice.

New Jersey was also able to develop standards due to its independent advisory body, the NJ Drinking Water Quality Institute, which was formed in 1985. The Institute evaluates health effects, analytical ability, and treatment capability when making decisions; it developed detailed PFAS endpoints after reviewing over 2,000 documents and publications. Based on recommendations from the Institute in 2018, New Jersey became the first state to establish a maximum contaminant level for a PFAS: PFNA at 13 ppt. In 2020, MCLs were adopted for PFOA (14 ppt) and PFOS (13 ppt). There are also times when the state establishes an interim groundwater standard, oftentimes in an emergency situation, in advance of an MCL.

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In addition to the health-based values, New Jersey considers practical factors, including analytical factors, such as the quantitation level that can be achieved by drinking water laboratories, as well as the ability of available treatment technologies to remove PFAS. In this case, and it's not always the case, neither the analytical method nor the treatment technologies were the limiting factors, so the state was able to go with the health-based MCL.

New Jersey uses its Private Well Testing Act to compel testing and disclosure of private well results during private residence sales and periodically for rentals. PFOA, PFOS, and PFNA will be included in this testing starting in late 2021.

Like Minnesota, New Jersey is developing a comprehensive PFAS workplan with all relevant parties that helps keep the process moving. New Jersey defines PFAS as chronic contaminants. However, some emerging contaminants do not fit neatly into acute or chronic drinking water contaminants.

LAUREN ZEISE

Director, California EPA Office of Environmental Health Hazard Assessment

In California, the Office of Environmental Health Hazard Assessment (OEHHA) issues recommended notification levels, and the Water Board adopts notification levels and response levels. OEHHA also develops public health goals as input to the development of the state's drinking water standards.

Notification levels refer to "nonregulatory, health-based advisory levels established for contaminants in drinking water for which maximum contaminant levels have not been established. Notification levels are established as precautionary measures for contaminants that may be considered candidates for establishment of maximum contaminant levels but have not yet undergone or completed the regulatory standard setting process prescribed for the development of maximum contaminant levels and are not drinking water standards."

Response levels refer to "a recommended chemical concentration level at which water systems consider taking a water source out of service or provide treatment if that option is available to them."

The ability to set a notification level prior to adopting drinking water standards affords CA some flexibility in how to approach the problem as well as the ability to address the problem rapidly. In 2018, when CA developed interim notification levels for PFOA and PFOS, the interim notification level was initially based on New Jersey's work.

CA implemented a multifaceted, coordinated effort to address PFAS through source control, as well as monitoring and tracking, and is developing regulations to require air emissions reporting of a larger set of chemicals, including some PFAS.

A water pollution control plant in California.

CALIFORNIA'S SOURCE CONTROLS

Addressing Primary Sources

- Department of Toxic Substances Control (DTSC): Safer Consumer Product Program (e.g., carpets and rugs with PFAS a priority product).
- California Air Resources Board (CARB): Alternative processes to suppress toxic fumes in plating.
- OEHHA: Proposition 65 listings requiring warning prior to exposure.
- CalRecycle: Prohibit PFAS in recyclable or compostable food packaging in state facilities.
- Department of Pesticide Regulation (DPR): Working with EPA and pesticide registrants to exchange fluorinated containers that leach PFAS.
- Legislature: Ban on Aqueous Film Forming Foam (AFFF).

Addressing Legacy Sources

- Water Board: Drinking water standards supported by OEHHA Public Health Goals; response levels prior to adoption of a standard.
- OEHHA: Fish advisories.

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California's Monitoring and Tracking

- Department of Toxic Substances Control (DTSC)/OEHHA/ Department of Public Health: Biomonitoring PFAS in people in regions across the state.
- Water Board: Investigative orders to collect information on the occurrence of PFAS in water sources and watersheds. Common sources of contamination include releases from:
  - Airports;
  - Municipal solid waste landfills;
  - Chrome plating facilities;
  - Bulk fuel terminals and refineries;
  - Publicly owned treatment works; and
  - Public water systems.
- CalRecycle: PFAS from degradation of compostable plastics.
- CARB: Future emissions reporting requirements.

California's biomonitoring program is trying to pioneer some semi-targeted approaches for PFAS not covered by current standard measurement methods and identify the full range of PFAS that people are carrying in their bodies.

California's Water Board requested OEHHA to develop recommended notification levels for PFAS identified in the monitoring process; in addition to PFOA and PFOS, included are perfluorohexane sulphonic acid (PFHxS), PFBS (completed in March 2021), perfluorohexanoic acid (PFHxA), perfluoroheptanoic acid (PFHpA), PFNA, perfluorodecanoic acid (PFDA), and ADONA (the trade name for 4,8-dioxa-3H-perfluorononanoate).

Rapidly emerging science and the limits of analytical methods are a challenge when developing these recommended notification levels. Interim notification levels were adopted in 2018 for PFOA and PFOS and were subsequently updated in 2019.

The Water Board adopted response levels of 10 ppt for PFOA, 40 ppt for PFOS, and 5 parts per billion (ppb) for perfluorobutanesulfonic acid (PFBS), above which the well or water source should not be used for drinking water.

"We came up with some very low target levels, lower than could be measured. Monitoring couldn't identify levels that low in water. And so we made the recommendation that the notification levels for PFOA and PFOS be set at the lowest level at which they can be reliably detected in drinking water."

– Lauren Zeise, Director, California EPA Office of Environmental Health Hazard Assessment

The 2021 Draft Public Health Goals for PFOS and PFOA in Drinking Water considered information from the most recent systematic literature searches as well as studies identified earlier by the EPA, New Jersey, and the Agency for Toxic Substances and Disease Registry (ATSDR). Recent epidemiological information, when combined with earlier literature, enabled California to base public health concentrations on human data. California is looking at newer approaches to grouping PFAS compounds by biological activity and structure.

FOR MORE INFORMATION

REBECCA AICHER

Project Director; AAAS Center for Scientific Evidence in Public Issues, American Association for the Advancement of Science

The Center for Scientific Evidence in Public Issues (AAAS EPI Center) is an initiative from the American Association for the Advancement of Science (AAAS) designed to provide scientific evidence to policymakers and other decision-makers in ways that are clear, concise, and actionable. The AAAS EPI Center makes it easier for people to access scientific evidence and information and then integrate that evidence into their decision-making process. AAAS is the world's largest general scientific society with nearly 250 affiliated societies and academies of science and is the publisher of the *Science* family of journals. Visit us at aaas.org/epicenter, or contact us epicenter@aaas.org.

NICHOLAS PORTER

Director, Environmental Health; Association of State and Territorial Health Officials

The Association of State and Territorial Health Officials (ASTHO) is the national nonprofit organization representing public health agencies in the United States, the U.S. Territories, and the District of Columbia, and over 100,000 public health professionals these agencies employ. ASTHO members, the chief health officials of these jurisdictions, formulate and influence sound public health policy and ensure excellence in state-based public health practice. ASTHO's primary function is to track, evaluate, and advise members on the impact and formation of public or private health policy which may affect them and to provide them with guidance and technical assistance on improving the nation's health. For more information on ASTHO's environmental health work, please contact us at environmentalhealth@astho.org.

SARAH GRACE LONGSWORTH

Project Manager; Environmental Council of the States

Environmental Council of the States (ECOS) is the national nonprofit, nonpartisan association of state and territorial environmental agency leaders. The purpose of ECOS is to improve the capability of state environmental agencies and their leaders to protect and improve human health and the environment. For more information on ECOS' PFAS work, please see www.ecos.org/pfas, or contact us at slongsworth@ecos.org.

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