

# FYI in 45

# Emerging Contaminants:

## Research to Reality

Panelists:

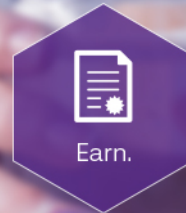
Melissa Harclerode

Charles Schaefer

Moderated by:

Andrew Beaton

*March 29, 2018*



**CDM  
Smith**

# Today's Discussion

- ▶ Where do these contaminants come from, and why are they a concern?
- ▶ What do we currently know about how to treat for these compounds?
- ▶ How can public outreach to stakeholders be successfully managed?
- ▶ What are the key topics for ongoing research?



# Our Panel



**Melissa A. Harclerode, PhD, BCES**  
Environmental Sustainability Scientist

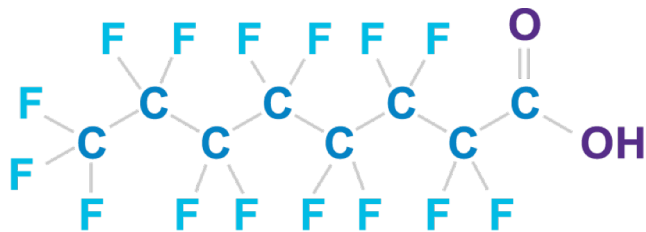


**Charles E. Schaefer, Jr. PhD**  
Principal Environmental Scientist

A person is holding a glass of water, with their hands visible. The image is overlaid with a semi-transparent blue filter. The text "Emerging Contaminants 101" is centered in white.

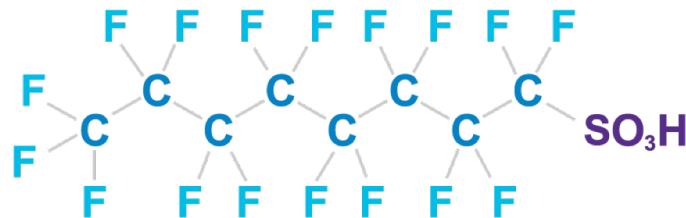
# Emerging Contaminants 101

# Per- and Polyfluoroalkyl Substances (PFAS)



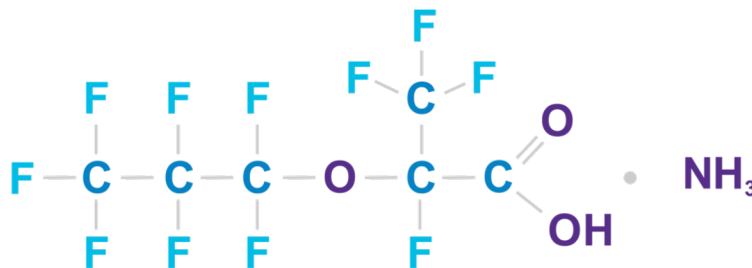
**PFOA**

Perfluorooctanoic Acid



**PFOS**

Perfluorooctanesulfonic Acid

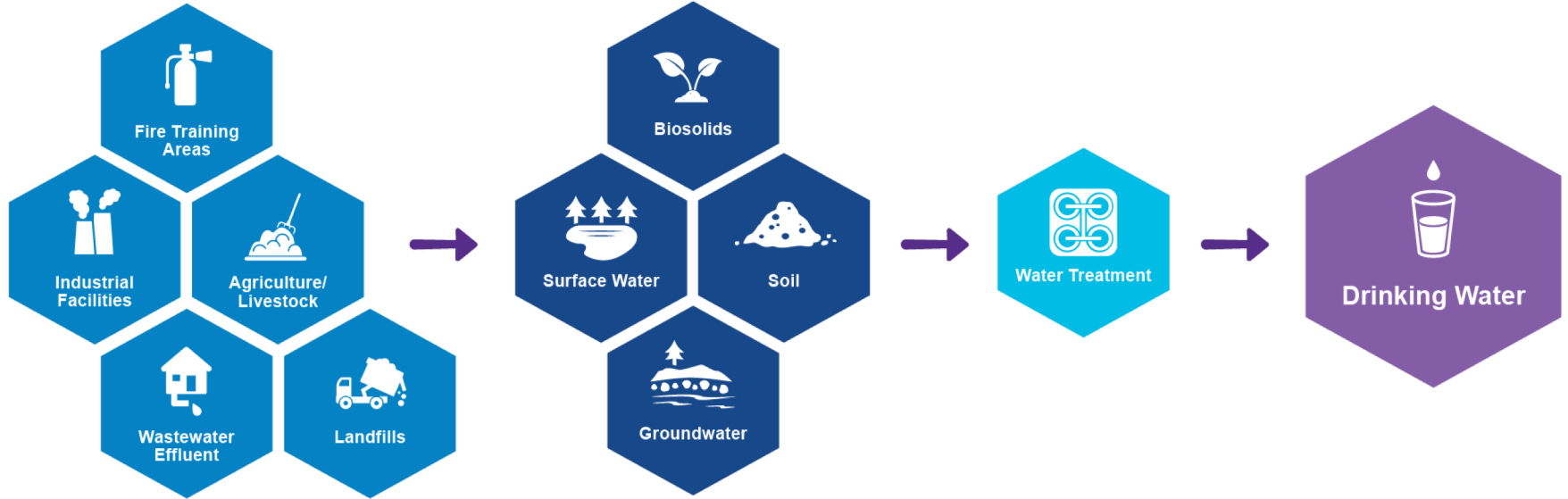


**GenX**

# Uses of PFAS, 1930s-Present



# PFAS Contamination of Drinking Water



# Potential Health Effects

- ▶ Bioaccumulation
- ▶ CDC: studies suggest PFAS may be harmful
- ▶ Effects are not yet completely understood; research is active and ongoing



*Scientists are still learning about the health effects of exposures to mixtures of PFAS. For the most part, laboratory animals exposed to high doses of one or more of these PFAS have shown changes in liver, thyroid, and pancreatic function, as well as some changes in hormone levels. Because animals and humans process these chemicals differently, more research will help scientists fully understand how PFAS affect human health.*

**Agency for Toxic Substances and Disease Registry, US HHS**

# PFAS Laws and Regulations

- ▶ **Health advisory for PFOS + PFOA > 70 ppt**
- ▶ No MCL for PFAS
- ▶ SDWA / UCMR 3: Monitoring for the “basic six”
  - ▶ perfluorooctanesulfonic acid (PFOS)
  - ▶ perfluorooctanoic acid (PFOA)
  - ▶ perfluorononanoic acid (PFNA)
  - ▶ perfluorohexanesulfonic acid (PFHxS)
  - ▶ perfluoroheptanoic acid (PFHpA)
  - ▶ perfluorobutanesulfonic acid (PFBS)
- ▶ EPA tracking and monitoring PFAS via Toxic Substance Control Act, more
- ▶ Michigan now enforcing EPA health advisory level for PFOS+PFOA



# Challenges of Dealing with PFAS

- 1 Optimal Risk Management Approach is Unclear
- 2 Uncertainty Creates a Communication Challenge
- 3 Multiple Point and Non-Point Sources
- 4 Regional Groundwater/Water Supply Contaminations
- 5 Field Sampling Precautions





# Analysis and Treatment Considerations

# Analysis & Sampling



Sampling

# Analysis & Sampling



Sampling



Analysis for PFAS

# Analysis & Sampling

- ☒ Sampling
- ☒ Analysis for PFAS
- ☒ Bench-scale testing of treatment options

# Analysis & Sampling



Sampling



Analysis for PFAS



Bench-scale testing of treatment options



Treatment selection

# Analysis & Sampling

- ☒ Sampling
- ☒ Analysis for PFAS
- ☒ Bench-scale testing of treatment options
- ☒ Treatment selection
- ☒ Design and Construction

# Treatment Methods in 2018



Water  
Contaminated  
with PFAS

## Treatment Process Options



1

Granular Activated Carbon

2

Ion Exchange



PFAS Safe  
Water



# Case Study: Westfield, MA



Westfield, MA











# Stakeholder Engagement

# 3 Dimensions of Risk Communication



Understand

**Understand** the processes of risk assessment and management

Perception

To form scientifically valid **perceptions** of the likely hazards

Participate

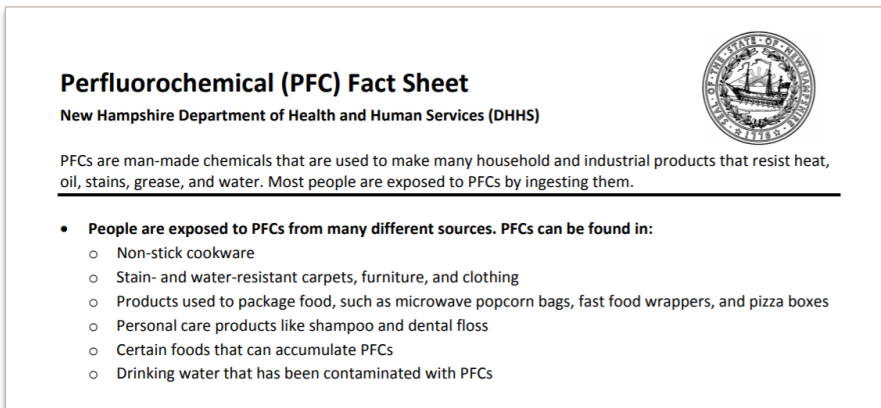
To **participate** in making decisions about how risk should be managed

# Fact Sheets & Frequently Asked Questions



Understand

- ▶ **Table compilation** in National Groundwater Association (NGWA) *Groundwater and PFAS: State of Knowledge and Practice, 2018*



<https://www.dhhs.nh.gov/dphs/pfcs/documents/pfc-fact-sheet.pdf>

- ▶ Include various modes of distribution



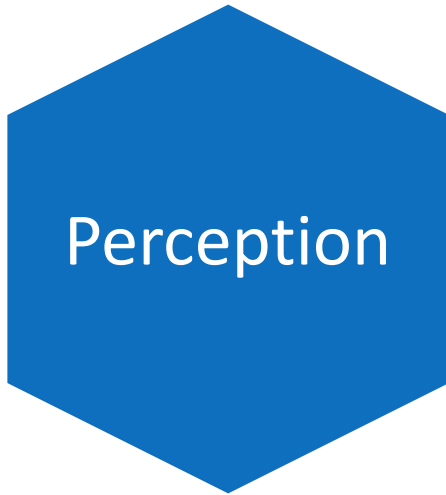
# “Understanding PFOA”

Bennington College, VT | Hoosick Falls, NY site

Understand



# Heightened Sense of Risk to PFAS



## Risk Perception

**Amplification: Heightened sense of risk** due to emerging characteristics and physical, social, psychological, demographic factors

## Challenge

Persuade stakeholders to **accept** your approach to managing the risk

## Solutions

1. Communicate **Transparent CSM**, include uncertainties
2. Secondary risk management **performance metrics**
  - Source control/ removal
  - Reduction in contaminant bioavailability/loading
  - Mitigation of exposure pathways



# Overcome Risk Perception Barriers: Sustainable Risk Management Framework

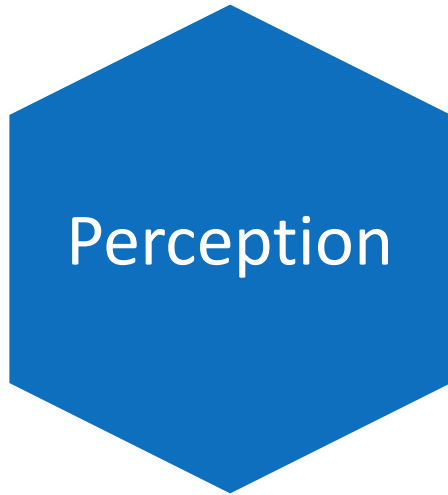


# JCDOH Case Study

Perception



## JCDOH Case Study: Inaction Risk Perception Factors



- ☒ Knowledge of adverse health effects
- ☒ Household paint and/or blood testing
- ☒ Residing in close proximity to lead-impacted properties
- ☒ Vulnerable populations (tenants, under 3 years of age, and residing in Jersey City between 5 to 10 years)
- ☒ High perception of water and air pollution

# Case Study: Little Hocking Site, Ohio

## Role of Risk Perception



### Risk Perception Factors






- ▶ Resident's knowledge and associated illnesses
- ▶ Ability to access a physician
- ▶ Presence of vulnerable sub-populations
- ▶ Proximity of individual residences to study



### Outcome

- ▶ Approximately 95% of the study participants had made a change in their water source
- ▶ A median reduction of 26-percent in blood serum PFOA levels
- ▶ Reestablished trust with authorities

# Stakeholder Communication Principles

-  1 Keep Context in Mind
-  2 Use Multiple Modes of Communication
-  3 Emphasize Trust Building
-  4 Maintain Transparency
-  5 Identify Performance Metrics That Meet Stakeholder Needs

A person is holding a smartphone, with their hands visible. The image is overlaid with a semi-transparent blue filter. The text "The Latest Research" is centered in white.

# The Latest Research

# Key Areas of Research



Fate &  
Transport

Treatment

Toxicology,  
Biological  
Uptake & Soil  
Contamination

# Grants




“Key Fate and Transport Processes Impacting the Mass Discharge, Attenuation, and Treatment of Poly-and Perfluoroalkyl Substances and Comingled Chlorinated Solvents or Aromatic Hydrocarbons”

“Insights into the Long-Term Mass Discharge & Transformation of AFFF in the Unsaturated Zone”

“A Mechanistic Understanding of PFASs in Source Zones: Characterization and Control”



# Hot Topics

-  1 Basic chemical/physical properties
-  2 Precursor transformation in the subsurface
-  3 Nature and persistence of PFAS sources

## Grants

“Investigating Electrocatalytic and Catalytic Approaches for the In Situ Treatment of Perfluoroalkyl Contaminants in Groundwater”

“Perfluorochemical Treatment by Nanofiltration plus Sequential UV Oxidative/Reductive Treatment of Reject Water”

“Regenerable Resin Sorbent technologies with Regenerant Solution Recycling for Sustainable Treatment of Per- and Polyfluoroalkyl Substances (PFASs)”




“Field Demonstration and Life Cycle Comparison of Ex-Situ Treatment Technologies for Poly- and Perfluoroalkyl Substances (PFASs) in Groundwater”

“Complete Reductive Defluorination of Poly- and Perfluoroalkyl Substances (PFASs) by Hydrated Electrons Generated from 3-Indole-acetic-acid in Chitosan-Modified Montmorillonite”

# Hot Topics

- 1 Identification and qualification of transformation products
- 2 Energy requirements
- 3 Effectiveness on the wide ranges of PFAS that may be present
- 4 Treatment optimization

# Hot Topics

-  Impacts of biosolids/compost w/PFAS
-  Human health risks
-  Accumulation potential in produce, beef, etc.

A blurred background image of a person holding a glass of water, with a blue overlay. The text 'Final Thoughts' is centered in white.

# Final Thoughts

# 3 Dimensions of Risk Communication



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of risk assessment  
and management



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of the likely hazards



Participate

To **participate** in making  
decisions about how risk  
should be managed





# Questions & Answers



# Contact Information

## Panelists



**Melissa A. Harclerode,  
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## Moderator



**Andrew Beaton**

Moderator  
BeatonAJ@cdmsmith.com

A photograph of a person's hands holding a clear glass filled with water. The person is wearing a white tank top. The background is blurred.

Thank You