Welcome to *The Current*, the North Central Region Water Network's Speed Networking Webinar Series

PFAS: What do we know and where are we headed next?

1. Submit your questions for presenters via the Q&A panel. There will be a dedicated Q&A session following the last presentation. The Q&A panel can be found via the Q&A icon at the bottom of the webinar screen.
2. If you are experiencing technical issues or have questions about the North Central Region Water Network or *The Current* Webinar Series, please use the chat feature. The chat feature is accessible via chat icon at the bottom of the webinar screen.
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This session will be recorded and available at northcentralwater.org.

Today's Presenters:

- **Jeff Flashinski**, Emerging Contaminants Coordinator, Wisconsin Department of Natural Resources
- **Tiffany Messer**, Associate Professor, University of Kentucky
- **Sarah Zack**, Pollution Prevention Extension Specialist, Illinois-Indiana Sea Grant

Jeffrey Flashinski

Jeff Flashinski has worked for the DNR's Drinking Water Section since June 2023 and previously worked for the Department of Environmental Management in Rhode Island. He is responsible for coordinating and implementing the emerging contaminants program for the Public Drinking Water Section. He reviews incoming PFAS compliance samples and check to see if any relevant standards have been breached. He also recommends future sampling requirements and puts together meetings with representatives for systems with public notice requirements. Jeff drafts code changes for emerging contaminants that have new federal regulations.

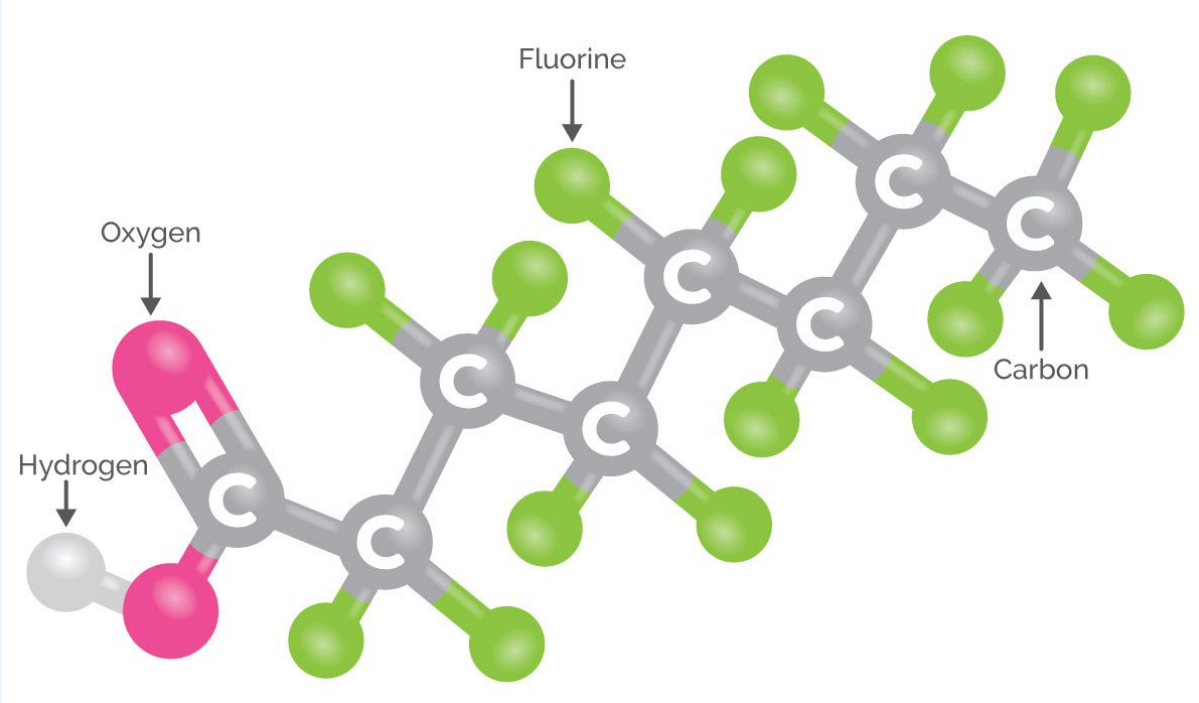
NR 809 PFAS COMPLIANCE DATA 10/1/2022 – 1/17/2024

Jeff Flashinski, Emerging Contaminants Coordinator

BRIEF OVERVIEW OF PFAS

(PER- AND POLYFLUOROALKYL SUBSTANCES)

- Called “Forever Chemicals” because they are nearly indestructible
- Some forms of PFAS take over 1,000 years to degrade in the environment
- All PFAS contain a chain of carbon atoms bonded to fluorine atoms
- The carbon-fluorine bond is one of the strongest in organic chemistry
- PFAS were useful because they are water, oil, grease, stain, and heat resistant (non-stick)
- Used as a fire suppressant for gas, diesel, propane, and jet fuel fires



BRIEF OVERVIEW OF PFAS

- PFAS are everywhere in nature and can travel by air, rainwater, and groundwater
- Research shows rising levels of PFAS in remote regions of Antarctica
- Studies have found PFAS worldwide at low levels in almost everyone's blood (>99% in US)
- Possible health impacts of PFAS include:
  - Impaired immune system
  - Higher cholesterol
  - Kidney Cancer
  - Testicular Cancer
  - Prostate Cancer
  - Endocrine disruption
  - Ulcerative colitis
  - Thyroid disease
  - Birth defects
  - Developmental issues
  - Reduced fertility in women

NR 809 PFAS COMPLIANCE SAMPLING

- Water suppliers for community and non-transient, non-community water systems need to take quarterly finished samples for PFAS using either Method 537.1 or Method 533 for lab analysis
    - Samples are taken after treatment but before distribution to the system
    - Avoid using PFAS materials while sampling (Tyvek, Gortex, etc.)
    - Samples must be ≤10C for first 48 hours and ≤6C after 48 hours
    - Labs must analyze for all compounds in the method used
    - All compounds above LOD must be reported
    - If all compounds are below LOD, only PFOA and PFOS must be reported
    - WI Max LOD ≤ 2 ppt; EPA Max LOD ≤ 4 ppt
- Waivers from quarterly sampling are granted based on sample results, well conditions, vulnerability of the population served, potential nearby sources, etc.

NR 809 PFAS MONITORING SCHEDULE

PWS Size	Starting Quarter
• PWS with non-transient populations ≥50,000	(Oct. 1 – Dec. 31, 2022)
• PWS with non-transient populations of 10,000 to 49,999	(Jan. 1 – Mar. 31, 2023)
• PWS with non-transient populations of 300 to 9,999	(Apr. 1 – June 30, 2023)
• PWS with non-transient populations of 50 to 299	(July 1 – Sept. 30, 2023)
• PWS with non-transient populations <50	(Oct. 1 – Dec. 31, 2023)

PWSs that have submitted compliance samples serve a total of 3,921,985 people

WISCONSIN'S PFAS STANDARDS AND REQUIREMENTS

- A public notice is required to be sent to the system's customers when a compliance sample has a Wisconsin Department of Health Services' Hazard Index exceedance
- DHS thresholds are set at a sample with a Hazard Index ≥ 1
  - DNR usually recommends that the well be taken offline if possible
- Wisconsin's MCL for PFAS is (PFOA+PFOS) >70 ng/L (annual avg.)
  - A public notice and corrective action is required
  - Based on 4 quarterly samples or a cumulative total of >280 ppt

DHS HAZARD INDEX APPROACH

The Hazard Index (HI) is made up of a sum of fractions (18 PFAS have groundwater standards)

Each fraction compares the level of each PFAS measured to the groundwater standard determined by DHS

A sample that receives an HI value equal to or greater than 1 requires a public notice to everyone in their system

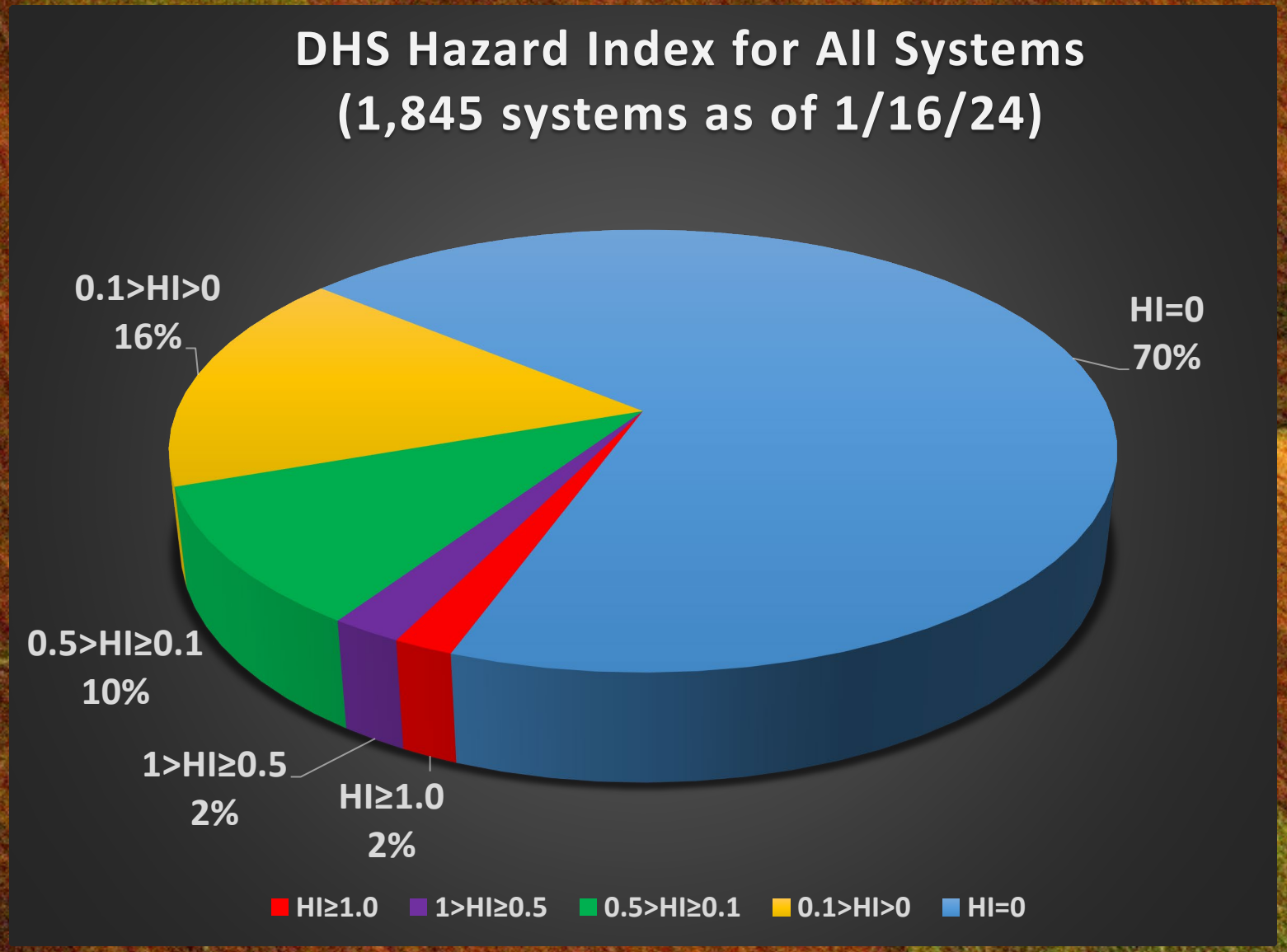
$$\text{Hazard Index} = \left(\frac{PFOA}{20\ ppt}\right) + \left(\frac{PFOS}{20\ ppt}\right) + \left(\frac{FOSA}{20\ ppt}\right) + \left(\frac{NEtFOSA}{20\ ppt}\right) + \left(\frac{NEtFOSAA}{20\ ppt}\right) + \left(\frac{NEtFOSE}{20\ ppt}\right) + \left(\frac{PFNA}{30\ ppt}\right) + \left(\frac{PFHxS}{40\ ppt}\right) + \left(\frac{Gen\ X}{300\ ppt}\right)$$

$$+ \left(\frac{PFDA}{300\ ppt}\right) + \left(\frac{PFDoA}{500\ ppt}\right) + \left(\frac{DONA}{3{,}000\ ppt}\right) + \left(\frac{PFUnA}{3{,}000\ ppt}\right) + \left(\frac{PFBA}{10{,}000\ ppt}\right) + \left(\frac{PFTeA}{10{,}000\ ppt}\right) + \left(\frac{PFHxA}{150{,}000\ ppt}\right) + \left(\frac{PFODA}{400{,}000\ ppt}\right) + \left(\frac{PFBS}{450{,}000\ ppt}\right)$$

HAZARD INDEX

DHS Hazard Index	# of systems	Percent
≥ 1.0	32	2%
≥ 0.5	70	4%
≥ 0.1	261	14%
> 0	562	30%
0	1,283	70%

- 32 Public Notice Requirements



32 PWSs with Hazard Index Samples ≥ 1.0

Top Ten Public Water Systems	Sample Date	Highest H.I.	County	Nontransient Population
3M CO GREYSTONE PLANT	9/29/2023	28.36	Marathon	50
HALES HAPPINESS SUBDIVISION	6/29/2023	12.80	Milwaukee	400
PINE RIVER SCHOOL FOR YOUNG LEARNERS	8/1/2023	7.19	Lincoln	145
WILLOW SPRINGS MHP 2 & 3	10/17/2023	4.16	Waukesha	446
FOX BROS PIGGLY WIGGLY INC - HUBERTUS	8/16/2023	3.91	Washington	85
WILLOW SPRINGS SCHOOL	9/21/2023	2.87	Waukesha	282
WESTWIND MOBILE HOME	7/17/2023	2.78	Adams	160
EDGAR WATERWORKS	5/8/2023	2.68	Marathon	1,491
MOSINEE EAST SYSTEM	11/6/2023	2.67	Marathon	1,046
ADAMS WATERWORKS	9/11/2023	2.50	Adams	1,847

HAZARD INDEX BY COUNTY AND PWS TYPE

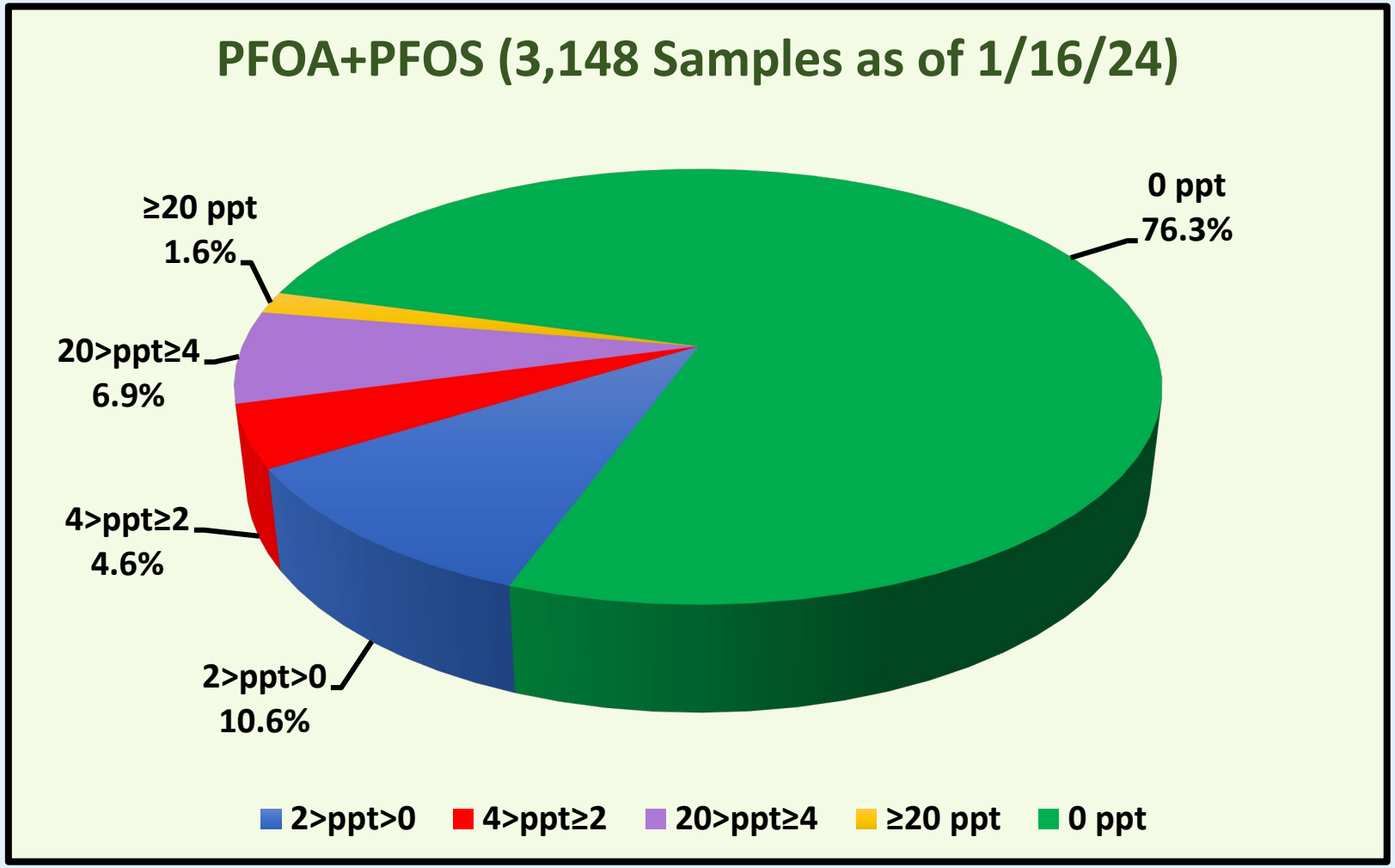
Top Counties	# of PWSs Sampled	PWSs HI≥0.1 ↓	PWSs HI ≥1
Waukesha	164	28	7
Marathon	40	25	5
Washington	50	14	1
Dane	77	12	0
Wood	25	12	0
Eau Claire	34	9	1
Oneida	23	7	1
Ozaukee	96	7	1
Grand Total	1,845	261	32

PWS Type	# of PWSs Sampled	PWS HI≥0.1 ↓	PWS HI≥1
Municipal Community	569	128	16
Nontransient Noncommunity	864	86	11
Other than Municipal Community	412	47	5
Grand Total	1,845	261	32

PFOA+PFOS SAMPLES COMBINED DATA

Highest 10 PWS Samples

Public Water System	PFOA+PFOS ng/L
3M CO GREYSTONE PLANT	520.0
PINE RIVER SCHOOL FOR YOUNG LEARNERS	131.0
WESTWIND MOBILE HOME	55.1
MOSINEE EAST SYSTEM	53.0
WILLOW SPRINGS MHP 2 & 3	52.1
HALES HAPPINESS SUBDIVISION	51.0
EDGAR WATERWORKS	49.3
ROTHSCHILD WATERWORKS	38.0
BROCKWAY SANITARY DIST 1	37.9
ANTHONY ACRES SCHOOL	34.0



EPA PROPOSED PFAS MCLs

- EPA's proposed PFAS MCL exceedances are:

  PFOA >4.0 ng/L

  PFOS >4.0 ng/L

- EPA's proposed Hazard Index is:

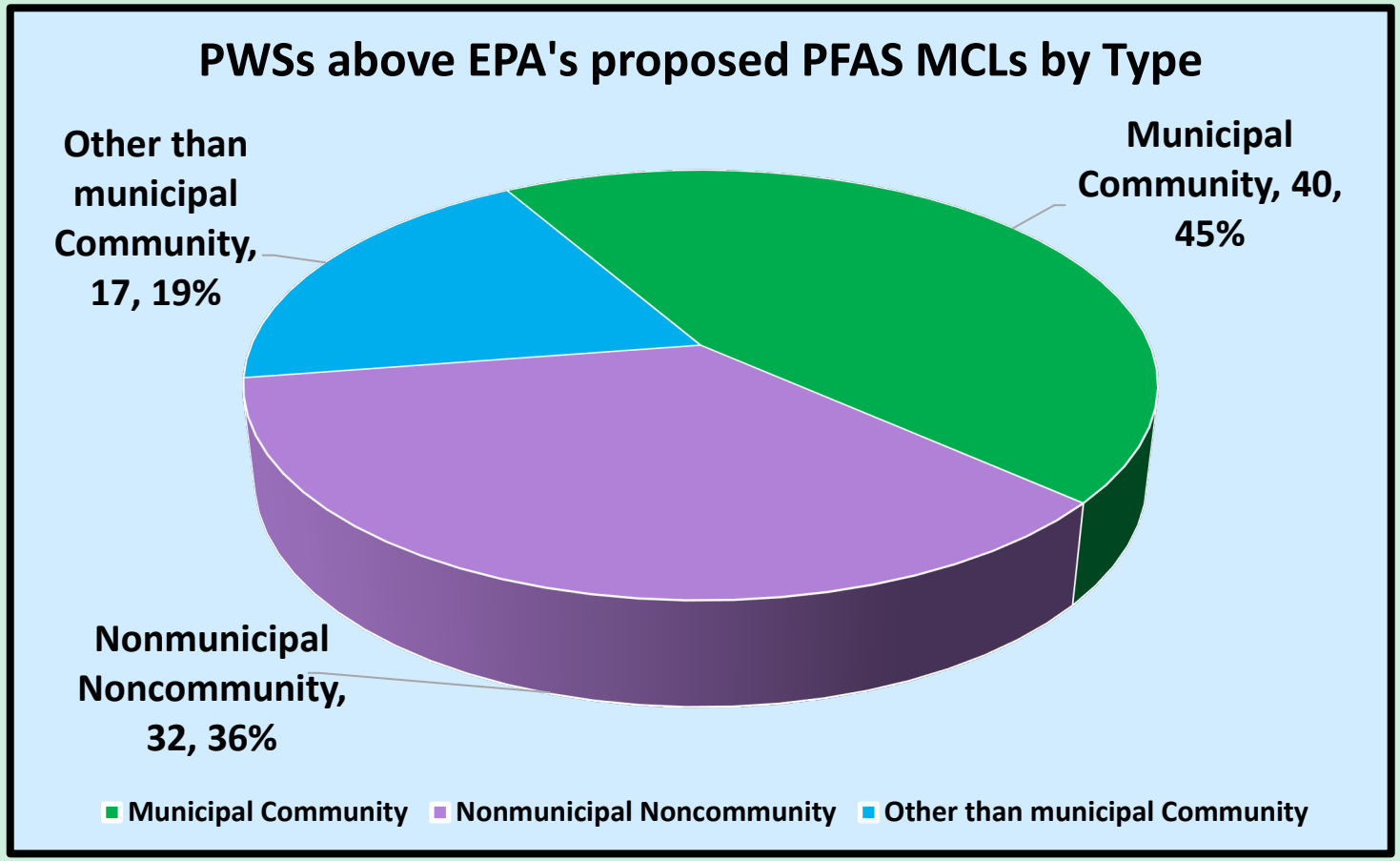
$$\left(\frac{PFBS}{2{,}000\ ppt}\right) + \left(\frac{PFHxS}{9\ ppt}\right) + \left(\frac{Gen\ X}{10\ ppt}\right) + \left(\frac{PFNA}{10\ ppt}\right)$$

- An HI >1.0 would exceed the MCL

SYSTEMS ABOVE EPA'S PROPOSED MCLS

89 PWSs would violate the EPA's proposed MCLs based on past samples

Top Counties	PWSs above EPA MCLs
Marathon	16
Waukesha	11
Washington	7
Eau Claire	5
Jefferson	4
Rusk	4
Oneida	3
Clark	3
Walworth	3
TOTAL	89



PFAS WITH THE HIGHEST DETECTION RATES

AS OF 1.16.24

Compound	Sample Count	Detects ≥2 ppt	% ≥2 ppt ↓	Average (ppt)	Max (ppt)	EPA Proposed Limit
PFBA	136	11	8.1%	0.90	41.0	
PFOS	3,151	251	8.0%	0.71	310.0	4 ppt
PFBS	3,151	250	7.9%	0.55	68.0	2,000 ppt (HI)
PFOA	3,151	240	7.6%	0.55	210.0	4 ppt
PFHXS	3,151	232	7.4%	1.14	410.0	9 ppt (HI)
PFHXA	3,151	182	5.8%	0.41	65.0	
PFHPA	3,151	88	2.8%	0.15	73.2	
PFPEA	136	3	2.2%	0.35	38.5	
PFPES	136	1	0.7%	0.03	4.0	
6:2 FTSA	136	1	0.7%	0.04	5.6	
NETFOSAA	3,026	8	0.3%	0.02	18.0	
PFNA	3,151	6	0.2%	0.05	76.0	10 ppt (HI)
PFDA	3,151	3	0.1%	0.01	8.3	
HFPO-DA (Gen X)	3,151	0	0.0%	0.00	0	10 ppt (HI)

SUMMARY OF PFAS DATA

- 1,890 PWSs are required to sample for PFAS
- As of 1/16/24, 1,845 PWSs have submitted samples
- 562 PWSs (30%) had a PFAS detect (>limit of detection)
- 32 PWSs (2%) have exceeded the DHS HI $\geq$ 1 and required a public notice to all customers
- 1 PWS has an MCL violation (based on annual average of PFOA+PFOS >70 ppt)
- 89 PWSs would exceed EPA's proposed MCLs (5% of PWSs)
- 45 PWSs still need to submit samples (3 from 3rd quarter)

PFAS Drinking Water Treatment

Effective Treatments	Percent Removal	
• Anion Exchange Resin (IEX)	90 to 99	- Effective
• High Pressure Membranes	93 to 99	- Effective
• Powdered Activated Carbon (PAC)	10 to 97	- Effective for only select applications
• Granular Activated Carbon (GAC)		
• Extended Run Time	0 to 26	- Ineffective
• Designed for PFAS Removal	> 89 to > 98	- Effective

- **Water treatment method must be PFAS certified**

Ineffective Treatments

- Conventional Treatment
- Low Pressure Membranes
- Biological Treatment (including slow sand filtration)
- Disinfection
- Oxidation
- Advanced Oxidation

CONNECT WITH US

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"WILD WISCONSIN:
OFF THE RECORD"

NORTH CENTRAL REGION WATER NETWORK

Tiffany Messer

Dr. Tiffany Messer grew up on a farm east of Winchester, Kentucky, where her love for water resources was sparked. She joined the Biosystems and Agricultural Engineering Department at the University of Kentucky in October 2020. She holds degrees in Biosystems and Agricultural Engineering (University of Kentucky, B.S., 2008) and Biological and Agricultural Engineering (North Carolina State University, M.S. 2010, PhD, 2015). Her research interests reside at the intersection of engineering, ecology, and agriculture with an emphasis on environmental biogeochemistry and water resources in human impacted ecosystems. She works specifically on identifying, tracing, and treating nutrients and emerging contaminants using ecological engineered designs.

Sarah Zack

Sarah Zack is the Pollution Prevention Extension Specialist with Illinois-Indiana Sea Grant (IISG) and University of Illinois Extension. Since joining IISG in 2011, she has worked to mitigate human impacts on the aquatic environment. In her current role, Zack develops and conducts extension and outreach activities related to the prevention of aquatic pollution, raising awareness of the impacts of pharmaceuticals and personal care products, microplastics, PFAS, and other contaminants of emerging concern on water quality, human health, and aquatic ecosystems. These activities include implementing the NOAA Great Lakes Marine Debris Action Plan in the Lake Michigan coastal waters of Illinois and Indiana, assisting communities in addressing unwanted medicine, and leading development of the 10-Year Water Resources Vision for National Sea Grant Program. She is also the co-coordinator of the annual Emerging Contaminants in the Environment Conference.

Identifying Social and Economic Impacts of PFAS in the Great Lakes and Lake Champlain Regions

Sarah Zack | Pollution Prevention Extension Specialist

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Illinois Extension

UNIVERSITY OF ILLINOIS URBANA-CHAMPAIGN

NOAA

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION

U.S. DEPARTMENT OF COMMERCE

PURDUE UNIVERSITY

Extension - Forestry and Natural Resources

Carolyn Foley
Co-Investigator

Sarah Zack
Co-Investigator

Tomas Hook
Co-Investigator

Amanpreet Kohli
Project Coordinator

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Sea Grant Funding Opportunity

Sea Grant CECs Special Projects "G"

- Announced in April 2022 – funding 2 projects
- Open to all Sea Grant programs
- Three major objectives/priorities
  - *Regional* research/monitoring efforts
  - Partnered with *State Agencies*
  - Collaborate and engage with *underserved communities*

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Project Objectives

1. Conduct scoping activities to identify social and economic research gaps associated with PFAS risk, exposure, and remediation in GL
2. Conduct a GL regional research competition on social and economic issues associated with PFAS risk, exposure, and remediation.
3. Support and monitor funded research activities.
4. Ensure research results are shared across the GL and beyond.

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Project Team

Advisory Committee	
Member	**Organization**
Ankley, Gerald	US EPA Great Lakes Toxicology and Ecology Division
Dehnert, Gavin	Wisconsin Sea Grant
Hadad-Hurst, Pamela	New York State Department of Environmental Conservation
Hendershott, Abigail	Michigan PFAS Action Response Team
Koch, Brian	Illinois Department of Public Health, Division of Environmental Health
Loken, Luke	USGS Upper Midwest Water Science Center
Saperstein, Noah	Red Cliff Band of Lake Superior Chippewa
Streets, Summer	Minnesota Pollution Control Agency

Scoping Session Format

- Three 3-hour virtual sessions in March 2023
- >70 participants from >45 different federal and state agencies, tribal nations, academic institutions, and consulting firms
- Presentations, facilitated discussions (breakout rooms), interactive ways to share information
- Follow-up survey

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Scoping Session Format

Session	Topic	Question of the day
1	Risk & Exposure	Which communities are at risk and what are their sources & routes of exposure?
2	Mitigation & Remediation	What are the socioeconomic barriers to the adoption and implementation of some of the current/proposed solutions and what are their alternatives?
3	Governance & Prevention	What information is needed to ensure all who live, work, and recreate in the Great Lakes region are treated in a just and equitable way with respect to governance and prevention of PFAS contamination and exposure?

Key Outcomes & Information Gathered

- Main PFAS sources and exposure routes
- Human health and ecological risks associated with PFAS
- Risk communication
- Mitigation and remediation of PFAS contamination
- PFAS governance at the state level
- Challenges to adopting regional consensus
- Research and knowledge needs

Sources and Exposure Routes of PFAS

1) Ingestion through food and water

2) Inhalation through air and dust

3) Dermal exposure with consumer products

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Health Risks from PFAS

Human

- Decreased infant birth weights
- Increased risks for cancers
- Effects on pulmonary function
- Thyroid issues
- Other diseases due to suppression of immune response (decreased vaccine response)

Ecological

- Growth and developmental effects
- Diminished survival and reproductive success
- Immune system suppression
- Other physiological or behavioral impacts

*Dose varies with exposure route and total dose is key

* Type of PFAS would affect associated risks

*PFAS health risks unknown

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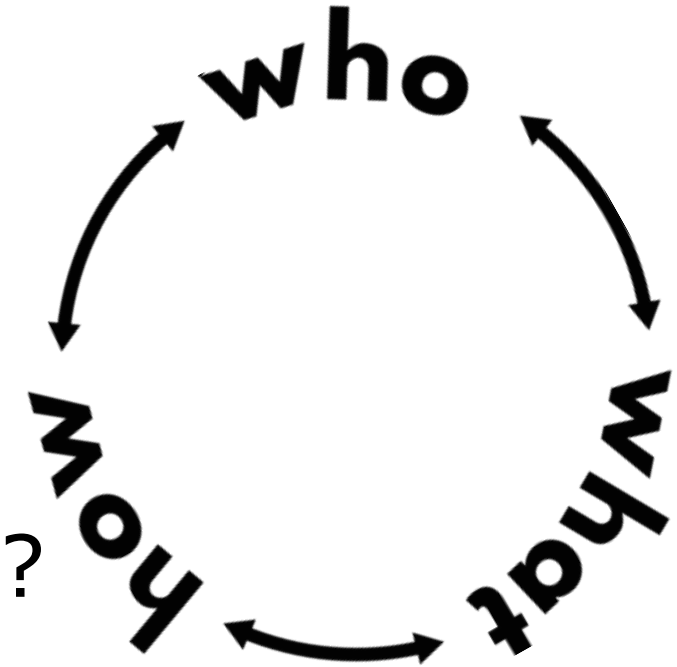
An Effective Risk Communication Strategy

Who to communicate to?



How to communicate?

What to communicate?

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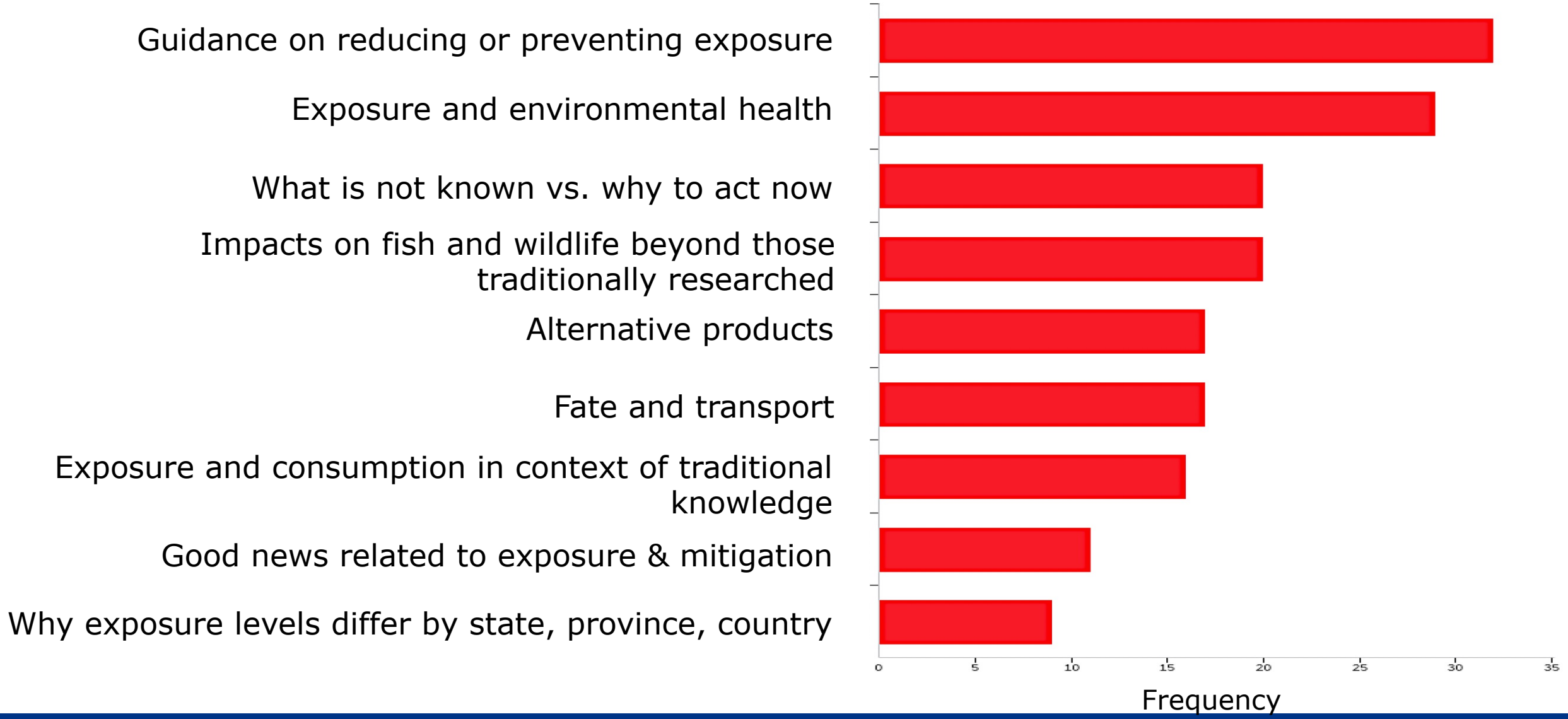
Who is at risk?

Group	Number of times placed in the category 'MOST aware'	Number of times placed in the category 'MEDIUM aware'	Number of times placed in the category 'LEAST aware'	Number of times placed in the category 'Unsure where this group fits'
Manufacturers of PFAS and related materials	29	4	1	1
Workers exposed via use of PFAS products (e.g., military personnel, firefighters)	23	9	1	1
People who live near major sources of PFAS (e.g., airports, manufacturing facilities)	18	10	5	1
Health care providers	7	20	4	3
People served by municipal water suppliers	2	19	10	3
Residents of large cities	2	14	14	5*
People who are pregnant or lactating	2	12	15	5*
Anglers and hunters	0	13	16	4
Adults over 50 years old	0	11	16	7
Tribal community members	1	10	19	4
Consumers of commercially caught fish	0	10	21	3
Students and workers at schools	1	5	23*	5*
People who use well-water	0	7	23*	4
Subsistence communities	1	3	24	6
Residents of rural communities	0	2	28	4

What to Communicate?



How to Communicate?

Factsheets

Trifold brochures

Evening virtual meetings

Focus groups

Incentivized outreach events

Citizen advisory groups

Environmental health clinics

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Mitigation and Remediation

- Military bases
- Airports
- Industrial facilities (metal plating, electronics, automotive, etc.)
- Oil refineries and bulk fuel terminals
- Agricultural lands with historical application of PFAS (biosolids, etc.)
- Aqueous film forming foam (AFFF) sources (firefighting use & training)
- Publicly owned treatment works
- Landfills
- Municipal water supplies (drinking and wastewater)
- Surface waterbodies, including sediments, due to direct and indirect discharges

Mitigation and Remediation

- Military bases
- Airports
- Industrial facilities (metal plating, electronics, automotive, etc.)

Solutions are available but differ in their technical effectiveness, accessibility, scalability, cost-effectiveness, sustainability, creation of harmful by-products, and meeting regulatory guidelines

Shift treatment costs from municipalities to responsible parties

- Municipal water supplies (drinking and wastewater)
- Surface waterbodies, including sediments, due to direct and indirect discharges

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Governance and Prevention at the State Level

Environmental Guidelines and Regulations, Compliance Promotion and Enforcement	Monitoring and Surveillance	Pollution Prevention	Public Engagement	Research and Other Efforts
• Groundwater Cleanup Criteria • Surface Water Quality Values • Drinking water MCLs • Fish consumption advisories • Biosolids Interim Strategy • NPDES permits with PFOS & PFOA • Requirements to report to EGLE when PFAS AFFF is used for emergencies	• Stormwater Characterization • NPDES Monitoring • Site investigations monitoring • Property transactions (Baseline Environmental Assessments) • Statewide surface water sampling	• AFFF Pick-up & Disposal of 60,000 gallons • AFFF no longer allowed for training purposes	• Local official calls with legislators • Town hall meetings • Comprehensive website w/all PFAS sites listed • Citizens Advisory Workgroup	• EGLE/DHHS labs: 537.1, 533, Fish, beef, blood, deer & crop analysis • Pending budget proposal includes funding designated for site cleanups in EJ communities

An overview of PFAS strategies in Michigan (Credit: Abigail Hendershott, MPART, EGLE)

Challenges to Adopting Regional Consensus

Identifying sources and financial responsibility

Setting regulations

Political boundaries

Geographical boundaries

Knowledge gaps and data sharing

Involving end users of the information

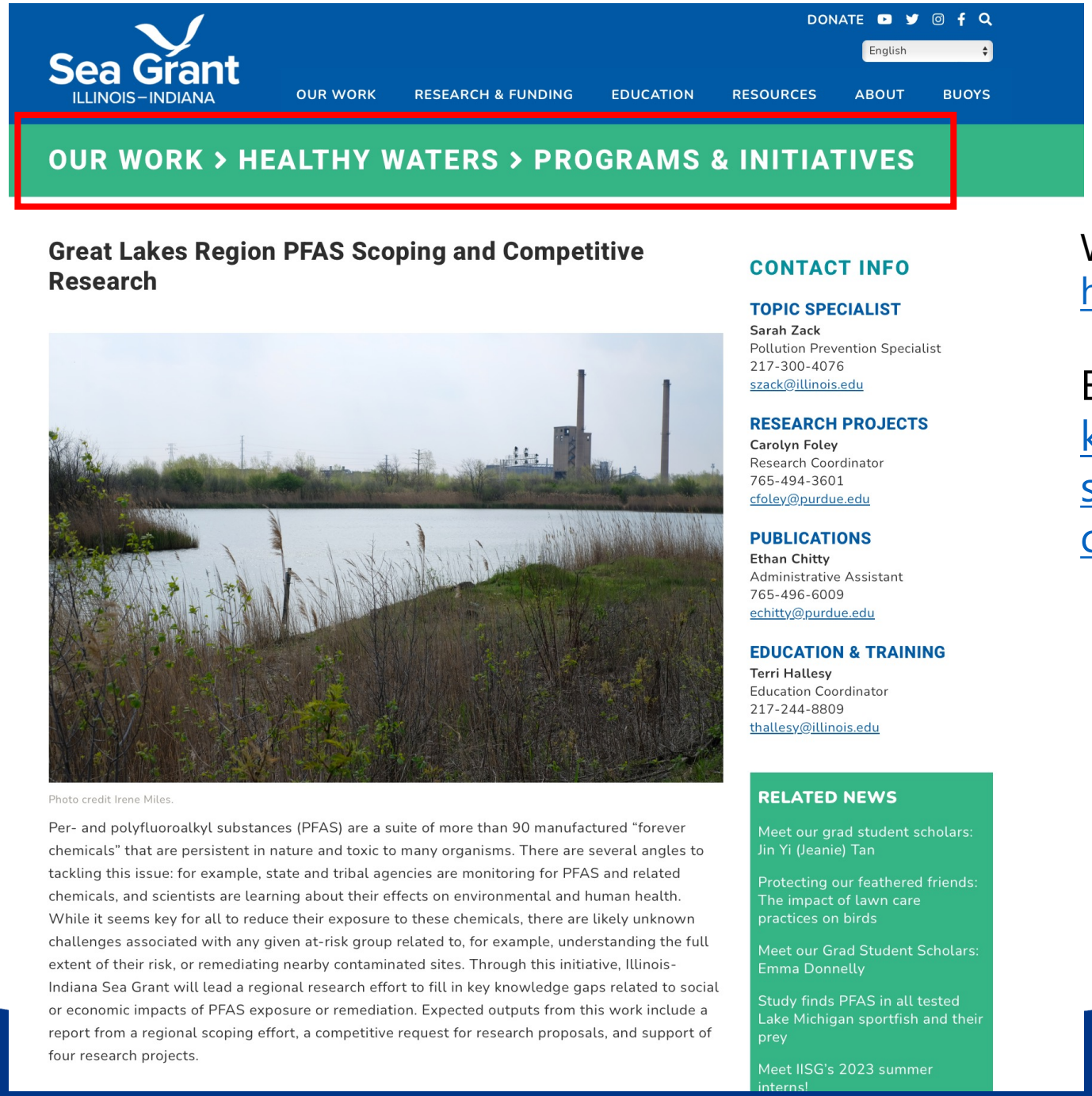
Research and Knowledge Needs

1. Sources of PFAS
2. Fate and transport of PFAS
3. Human health impacts of PFAS
4. Ecological impacts of PFAS
5. Spatio-temporal variability of PFAS
6. Drivers of PFAS toxicity
7. Quantification methods for PFAS
8. Alternatives to PFAS
9. PFAS and traditional practices
10. PFAS exposure prevention actions
11. PFAS mitigation & remediation methods
12. Land application of PFAS
13. PFAS and private well contamination
14. Wastewater treatment plants and PFAS
15. Effective policy for PFAS
16. Public perception of PFAS

RFP & Funded Research

Four projects recommended for funding:

1. UIC (Susan Buchanan)
   Survey on fish consumption habits of anglers of color in Chicago
2. UW Madison (Lyn van Swol)
   Message testing with the public
3. PSU (Ruohao Zhang)
   Online risk assessment tool for PFAS exposure
4. National Sea Grant Law Center (Catherine Janasie)
   Comparative analysis of PFAS laws in GL Region



Accessing the scoping report

Weblink:
https://go.illinois.edu/PFAS_ScopingReport

Email:
kohli19@purdue.edu
szack@Illinois.edu
cfoley@purdue.edu

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Thank you for participating in today's *The Current*!

Visit our website, northcentralwater.org, to access the recording and our webinar archive!

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