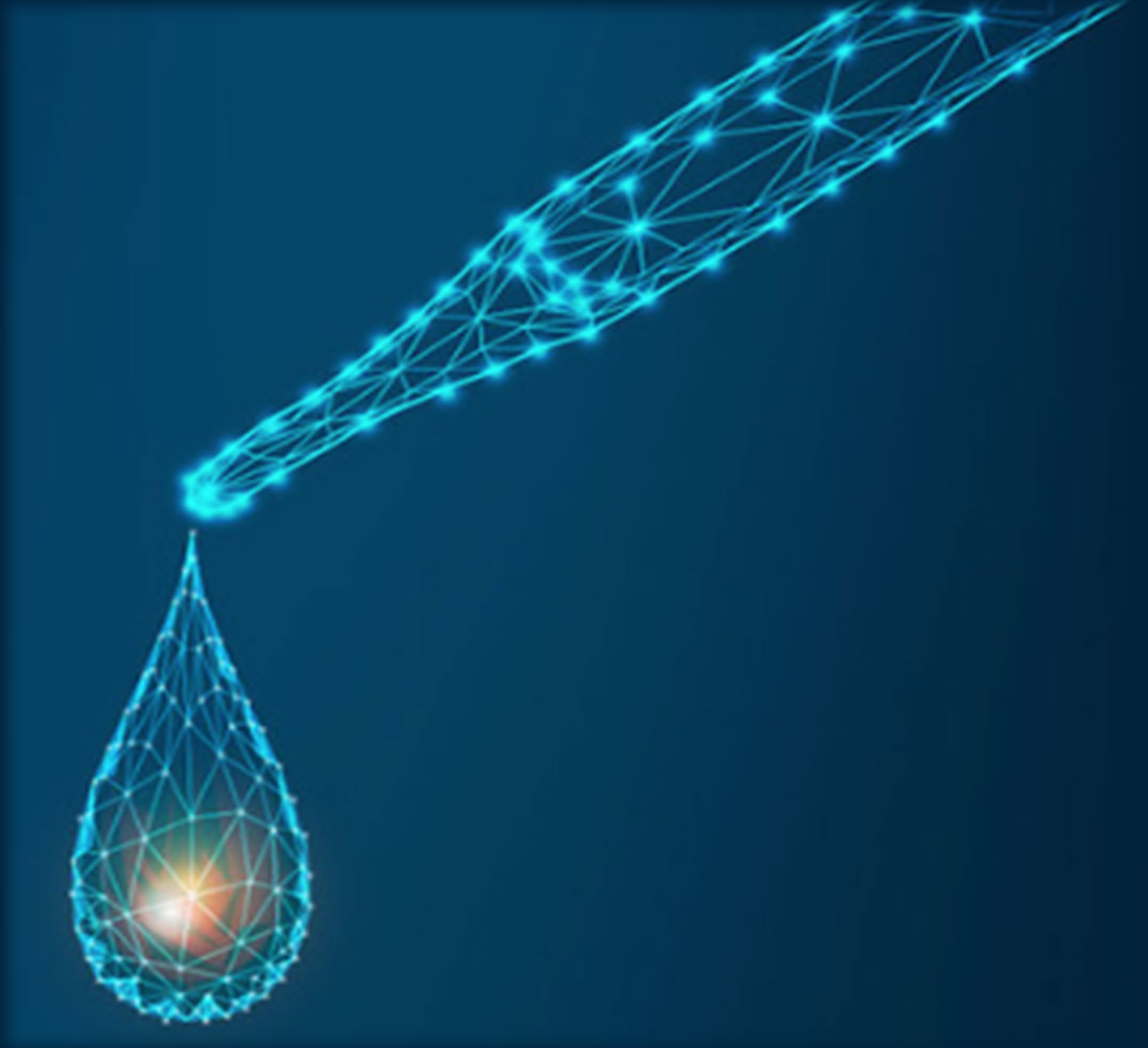
Collective Strategies for Water Research – From Planning to Action



THE Water Research FOUNDATION®

advancing the science of water®

AGENDA

Opening/ Background on The Water Research Foundation (WRF)	Insights for Research Success Within WRF Projects Case Study from Eugene, OR, USA	Research Communities, Partnerships in Canada and the US and Effective Collaboration with Utility Partners	Panel Cases for Regional to Global Insights and Impact from Research Partnerships - Regulatory, Utility, and Stakeholder Collaboration	Closing/ Impacts on the Global Community of PFAS as an Emerging Concern in Research and Practice
Peter Grevatt, PhD CEO, The Water Research Foundation	***Michael McKie*** CIMA+ Canada ***Robert C. Andrews*** University of Toronto ***Ray Leipold*** Eugene Water & Electric Board (EWEB)	***Monica Emelko*** University of Waterloo	***Adriano Mena*** The Regional Municipality of York (ON) ***Antoine Rempp*** Regional Municipality of Wood Buffalo (AB) ***Aziz Ahmed*** Ontario Ministry of Environment, Conservation and Parks	***Peter Grevatt, PhD*** CEO, The Water Research Foundation

THE Water Research FOUNDATION®

BY THE NUMBERS

AS OF 8/31/2023

SUBSCRIBERS

963 UTILITIES

67 MANUFACTURERS

62 CONSULTANTS

FUNDED RESEARCH

$81 MILLION

$49 MILLION CASH
Contractually Funded Research

$32 MILLION COST SHARE

RESEARCH PORTFOLIO

264 ACTIVE PROJECTS

66 CO-FUNDED PROJECTS
***137** CO-FUNDERS*

9 FEDERAL/STATE GRANTS

3 FEDERAL CONTRACTS

2 PRIVATE GRANTS

$.78 OF EVERY DOLLAR SUPPORTS PROGRAM SERVICES

49 WRF STAFF

RESEARCH PRIORITY | TAILORED COLLABORATION | EMERGING OPPORTUNITIES | GRANTS/AWARDS | PAUL L. BUSCH AWARD | FACILITATED & UNSOLICITED RESEARCH

Canadian Subscribers

- 54 Utilities
- 24 Consulting Offices
- 5 Manufacturers

Insights for Research Success Within WRF Projects Case Study from Eugene, OR, USA

Michael McKie – CIMA+ Canada

Robert C. Andrews – University of Toronto

Ray Leipold – Eugene Water & Electric Board (EWEB)

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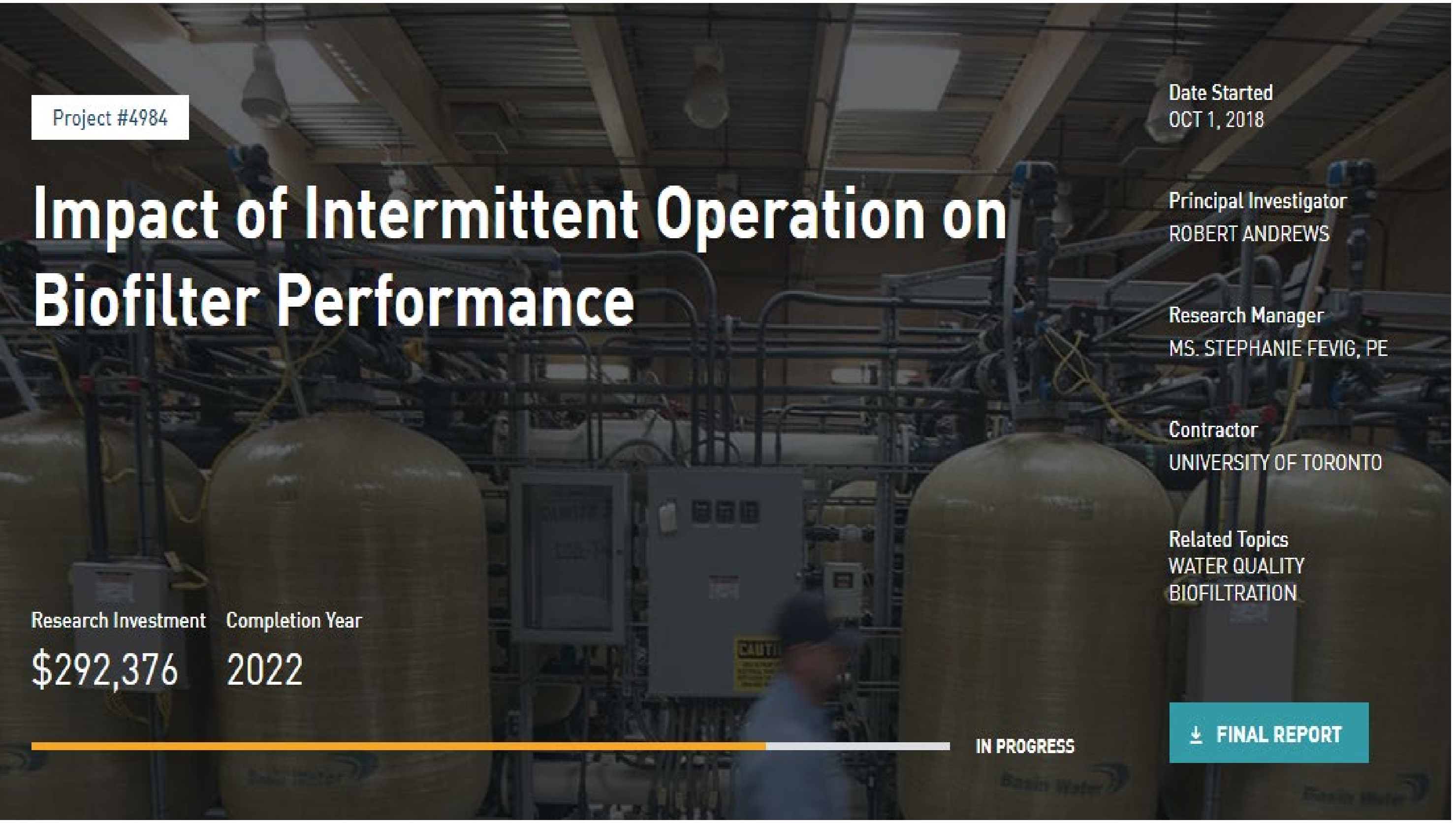

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PROJECT NO.
4984

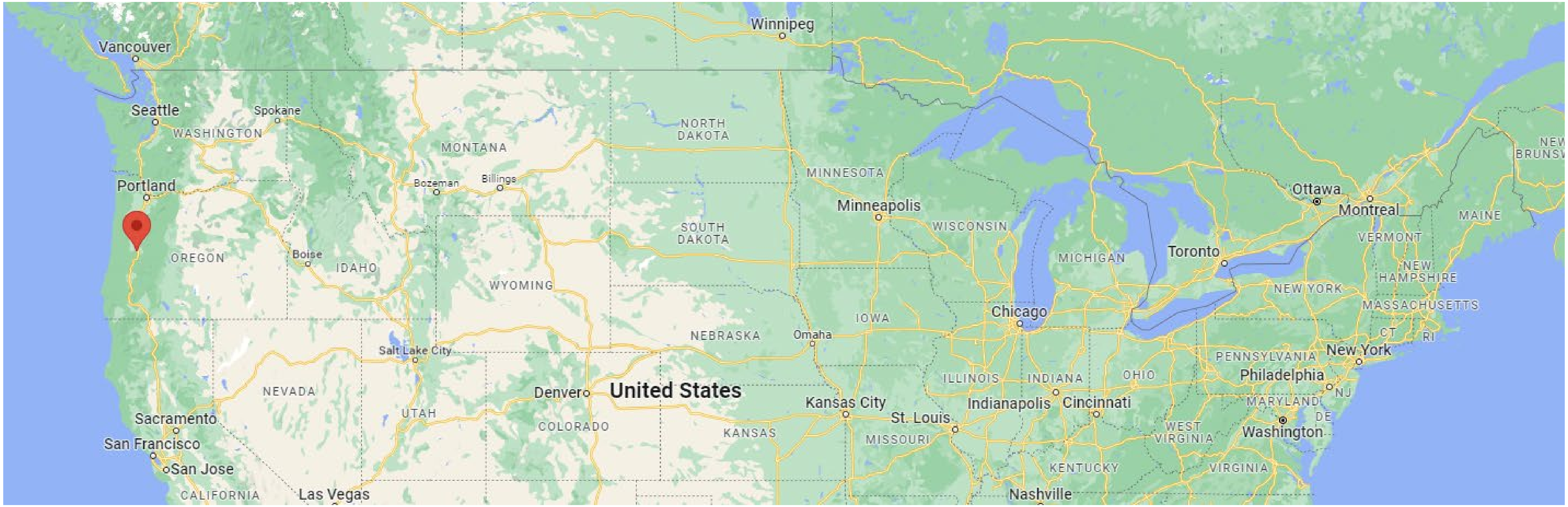
Impact of Intermittent Operation on Biofilter Performance

EWEB

How We Got There

- Networking
- Collaboration
- Coordination
- WRF Support

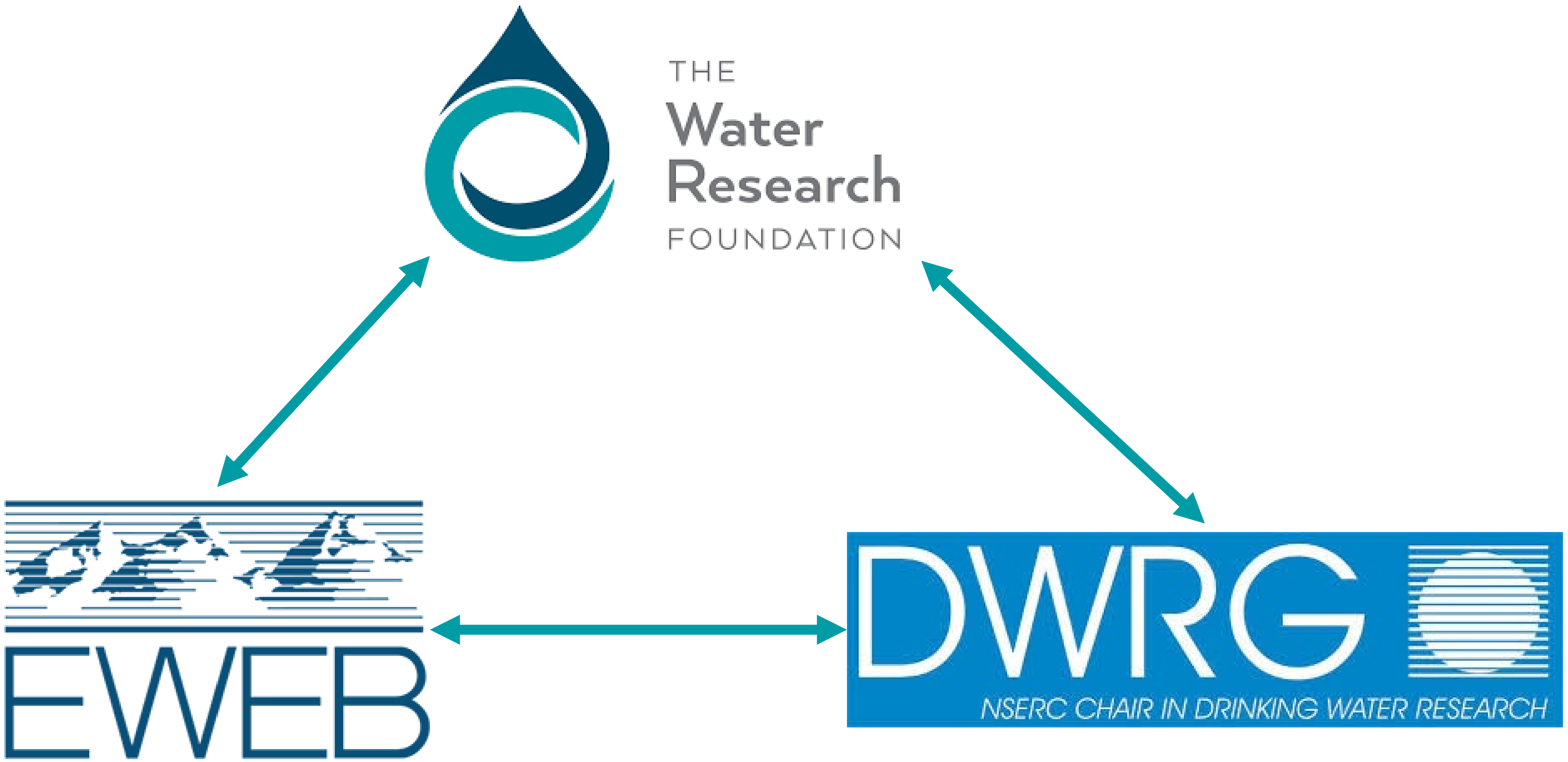
An Unexpected Partnership



A Desire for Innovation

- Chlorine system changes driver for evaluation of biofiltration
- Understanding of potential opportunities
- Concern about potential impacts
- Wanted a collaborative, site-specific investigation

Role of WRF


THE
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FOUNDATION
EWEB
DWRG
NSERC CHAIR IN DRINKING WATER RESEARCH

Benefits of WRF

- Project management
- On-going review by industry experts
- Opportunity to learn
- Access to cutting-edge research
- Platform to learn and share
- Applicable, actionable outcomes

Research Communities, Partnerships in Canada and the US, and Effective Collaboration with Utility Partners

Monica Emelko, University of Waterloo

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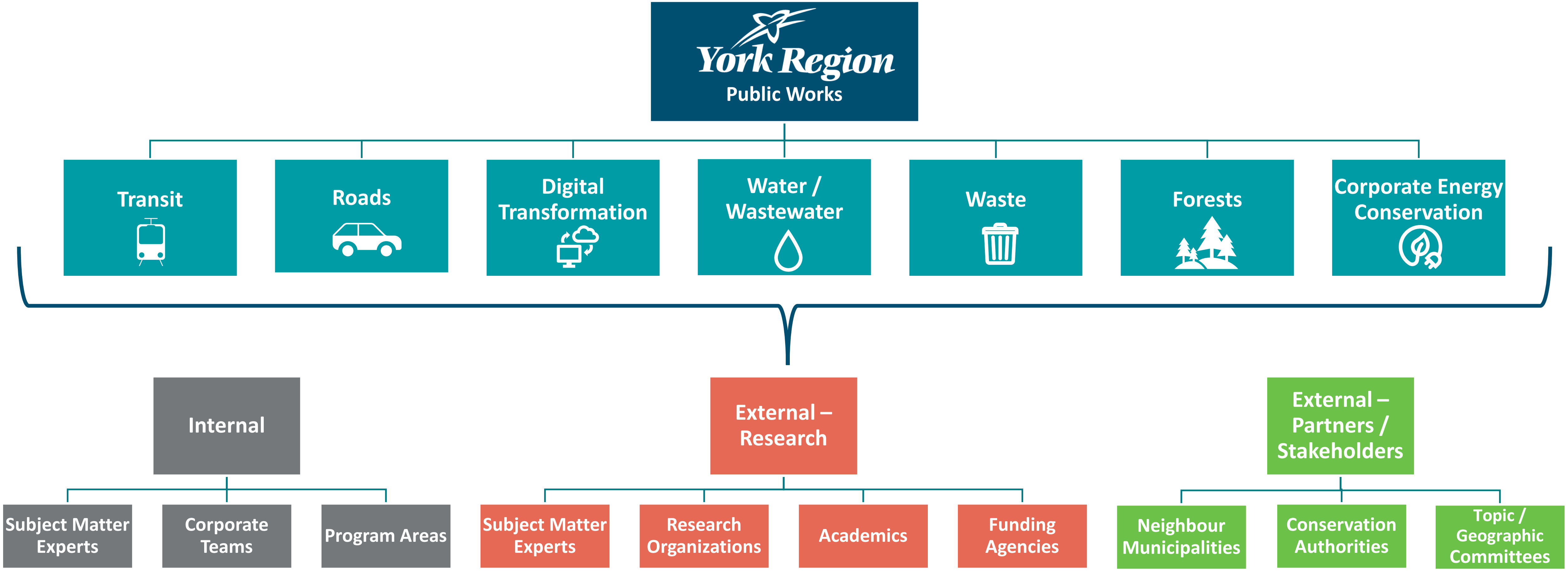
Panel

Cases for Regional to Global Insights and Impact from Research Partnerships

Case #1

Adriano Mena, York Region Public Works

Research Partnerships



Panel
Cases for Regional to Global Insights and Impact from Research Partnerships
Case #2

Antoine Rempp

Regional Municipality of Wood Buffalo (AB)

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Panel

Cases for Regional to Global Insights and Impact from Research Partnerships

Case #3

Aziz Ahmed

Ontario Ministry of Environment, Conservation and Parks

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Impacts on the Global Community of PFAS as an Emerging Concern in Research and Practice

Peter Grevatt, PhD

CEO, The Water Research Foundation

advancing the science of water®

Per- and Polyfluoroalkyl Substances

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Topic Hub:

[Per- and Polyfluoroalkyl Substances (PFAS)]

In this topic

- 21 Projects
- 4 Webcasts

Related Topics

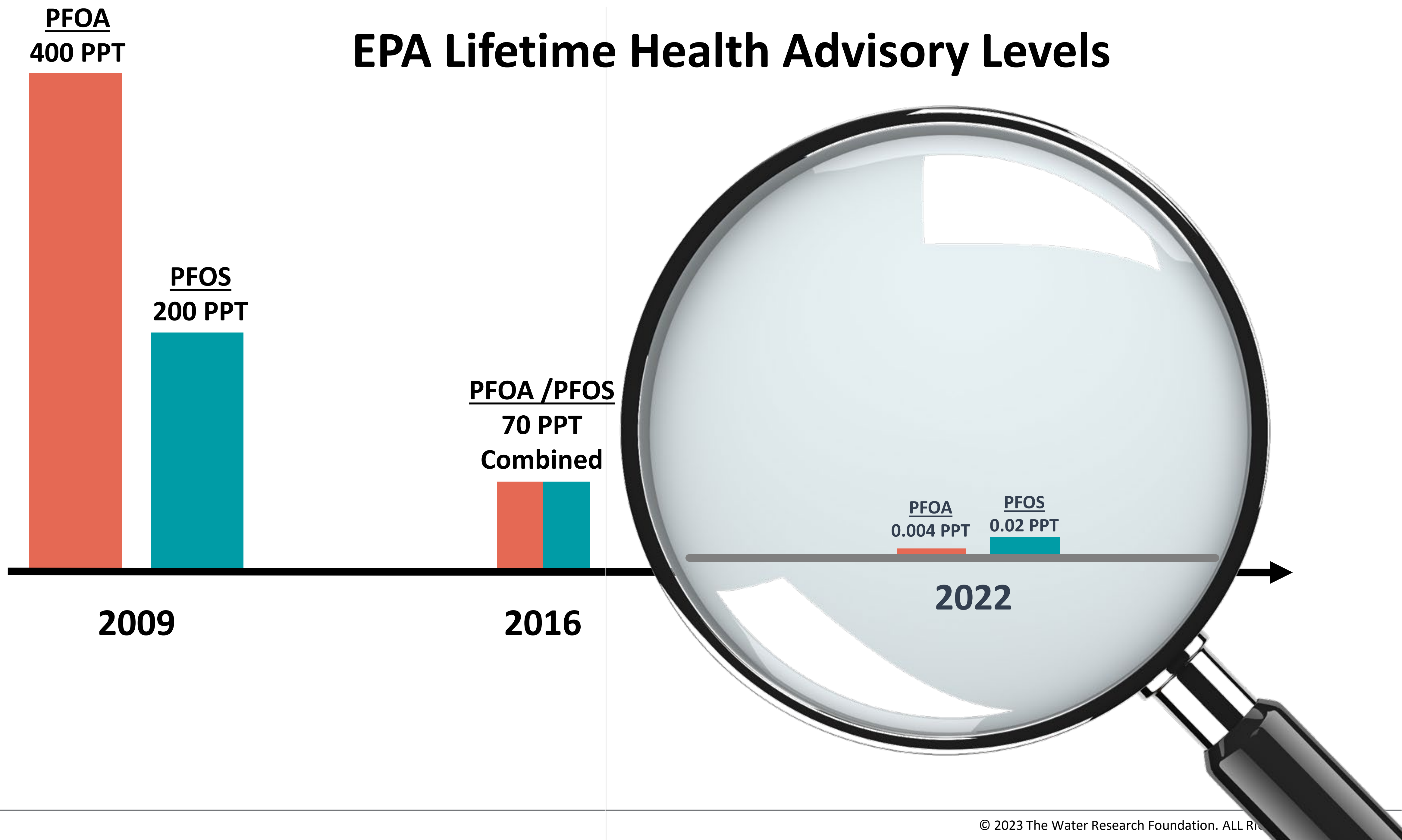
- Constituents of Emerging Concern (CECs)
- Advanced Treatment
- Endocrine Disrupting Compounds, Pharmaceuticals & Personal Care Products (EDCs & PPCPs)
- Microplastics

Range of the perfluorooctanoate (PFOA) safe dose for human health: An international collaboration

Table 1
Safe doses of PFOA and PFOS from international authorities.

Authority	Safe Dose ug/kg-day	Point of Departure (POD_{HED})	Uncertainty Factors
Alliance for Risk Assessment (this paper)	0.01–0.07	Various (see text): 4.35 to 23 μg/ml of serum	Animal-human kinetic factor = 1 [a] Animal-human dynamic factor = 3 [b] Human toxicodynamic factor = 3[c] Human toxicokinetic factor = 8.4[d] Database uncertainty factor = 1[e] Human clearance = 0.23 ml/day-kg[f]
European Food Safety Authority (EFSA, 2020)	0.00063[g]	17.5 ng/mL ($BMDL_{10}$) Decreased anti-tetanus and anti-diphtheria antibody concentration	• None applied • BMD derived in sensitive population (infants) and response is risk factor for disease rather than a disease.
Food Standards Australia/ New Zealand (2017)	0.16	4.9 μg/kg-day	Within human variability = 10 Animal to human extrapolation = 3
Health Canada (2018)	0.02	0.52 μg/kg-day	Within human variability = 10 Animal to human extrapolation = 2.5
US Environmental Protection Agency (2022)	0.0000015	0.0000149 μg/kg-day decreased anti-tetanus antibody concentration	Within human variability = 10
US Environmental Protection Agency (2023 DRAFT)	0.00003[h]	Various (human): 0.000305 μg/kg-day (decreased anti-tetanus and anti-diphtheria antibody concentration), 0.000275 μg/kg-day (increased serum cholesterol) 0.000292 μg/kg-day (decreased birth weight)	Within human variability = 10
World Health Organization (2022)	0.02	Estimated based on PFOA water level of 100 ng/L	• WHO made a risk management call of 100 ng/L • This value can be used to estimate the comparable safe dose of 0.02 μg/kg-day using 2 L of water consumption per day, a 60 kg body weight and a 20% relative source contribution.

EPA Lifetime Health Advisory Levels



1: All Participants - PFOA Levels by Drinking Water Source

The first table **(Table 1a)** provides PFOA results for all 2,903 participants -- people using Village water, people using private wells, people who work in the area, and former residents. The table also compares the PFOA results between people who were using Village water at the time of testing and people who were not.

Table 1a PFOA blood test results by drinking water source Participants tested February 2016 through November 2016				
	Number of participants	PFOA in micrograms per liter		
		Geometric mean	50th percentile	90th percentile
All participants	2903	21.6	26.1	123.0
By drinking water source at time of blood collection				
Currently on Village water	1640	43.5	48.5	156.5
Not currently on Village water	1263	8.7	8.1	44.3

NYSDOH, 2018

Table 6 PFOA blood test results for adults reporting occupational exposures to PFAS From employment in the Hoosick Falls area, by water source, gender, age group, and length of residence: tested from February through November 2016				
	Number of participants	PFOA level in micrograms per liter		
		Geometric mean	50th percentile	90th percentile
All adults reporting occupational exposures	123	57.6	60.3	253
Adults not currently served by public water	56	33.3	34.3	106
Adults with occupational exposures currently served by Hoosick Falls public water				
Adults currently served by public water	67	91.1	84.9	334
By gender				
Females	16	79.8	96.4	*
Males	51	94.9	84.2	334
By age group				
18-39 years	15	41.2	32.2	*
40-59 years	35	121.3	119.0	*
60 years and older	17	101.6	135.0	*
By length of residence				
Less than 10 years	10	70.3	65.9	*
10 to 24 years	21	84.4	71.9	*
25 – 40 years	15	84.0	84.2	*
More than 40 years	21	117.7	121.0	*

* Number of people in each grouping is too small to show 90th percentile

NYSDOH, 2018

Table 7 PFOA Levels in Blood from Other Studies: Other communities with PFOA contamination in drinking water, people who worked with PFOA, and the general U.S. population		
	Results in micrograms per liter	
Other communities with PFOA in drinking water:	**Average level**	**High level**
Little Hocking, Ohio	228	N.A.
Lubeck, West Virginia	92	N.A.
Tuppers Plains, Ohio	42	N.A.
Mason County, West Virginia	16	N.A.
People who worked with PFOA:	**Average level**	**High level**
3M workers, Decatur, Alabama	1125	N.A.
DuPont workers, Parkersburg, West Virginia	410	N.A.
General U.S. population:	**Middle level (50th percentile)**	**High level (95th percentile)**
Age 12 and up: 1999-2000*	5.20	11.90
Age 12 and up: 2013-2014	2.07	5.57
Males only	2.37	5.67
Females only	1.67	5.07
Young people age 12-19	1.67	3.47
Children age 6-11	1.94	3.84
Children age 3-5	1.80	5.58

NYSDOH, 2018

PFAS One Water Risk Communication Messaging for Water Sector Professionals

PROJECT 5124

PFAS One Water Risk Communications (5124): One Water Toolkit

One Water Toolkit Contents:

- 2-page and 4-page brochures on sources, PFAS cycle, potential consumer actions
- Suggested content and language for
  - Web pages
  - Emails
  - Bill inserts
  - Social media
- Sample graphics

What are PFAS?

Per- and polyfluoroalkyl substances (PFAS) are a large group of chemicals used since the 1940s in common household and commercial products. PFAS chemicals are often used to keep food from sticking to cookware. They also make clothes, carpets, and furniture resistant to water and stains. The manufacturing and consumption of these products delivers PFAS into our natural environment and into our drinking water supplies.

Because they are used in so many everyday products, most people in the United States and other industrialized countries now have PFAS in their blood. Studies of PFOA and PFOS (two common PFAS) found that most people's exposure to PFAS comes from their diet. Drinking water and inhaling dust with PFAS are two other common PFAS exposures. Understanding how PFAS can enter our environment, our homes, and our bodies can help us manage our exposure.

Stay Informed

Look to official sources of information to stay up-to-date on the latest news. Reliable sources include:

- The U.S. Centers for Disease Control
- The U.S. Environmental Protection Agency

THE Water Research FOUNDATION

PFOS and PFOA are two of the most well-known and studied PFAS. Though production stopped in 2000, they are still found in our environment. Newer PFAS, like "GenX," are now used in their place.

We swallow, inhale, or rub PFAS into our skin by using certain products, eating or drinking impacted food and water, and breathing in the dust in our homes.

PFAS enter the environment when companies make products with PFAS.

PFAS can enter the environment as we throw away products that have PFAS, and through our own bodily waste.

Resources we use from the environment - drinking water, food, air - are more likely to have higher levels of PFAS over time.

PFAS build up in the human body over time. Scientists are still studying the health effects of higher PFAS blood levels, which may include certain types of cancer, high cholesterol, or decreased vaccine response in children.

PFAS do not break down naturally and build up in the environment over time.

How We Can Reduce Our Exposure

PFAS exposure can vary depending on your local environment, but you can take steps to reduce the PFAS around you. You can identify PFAS in products by looking for "fluoro" or "perfluoro" in an ingredients list. Choosing products that do not have PFAS can require some research, but it is an effective way to reduce your exposure. It can also mean giving up some product features such as "non-stick," or "water- or stain-resistant." Consider replacing older and worn-out products that have these features. Studies have also found that cooking more of your meals at home can lower PFAS blood levels.

Avoid buying non-stick cookware that has PFAS and stain-resistant furniture and carpeting. Look for "fluoro" or "perfluoro" in an ingredients list or ask the manufacturer.

Limit eating foods packed in materials that use PFAS. Common food packaging that may have PFAS includes microwave popcorn bags, fast food boxes (like french fry containers and pizza boxes), and bakery bags.

Minimize the dust in your home to limit PFAS particles in the air. Change your home's air filter on a regular basis and leave your shoes at the door to avoid tracking in dirt and pollutants.

Avoid personal care products that have PFAS. These include certain types of dental floss, nail polish, facial moisturizers, and cosmetics.

Learn about the PFAS levels in your local drinking water. If you want an at-home treatment option, look at the NSF International list of products certified to remove PFAS from drinking water in the home.

PFASCentral.org maintains a list of manufacturers and retailers that have PFAS-free policies.

How Does PFAS Affect Your Water?

Water quality is regulated to protect public health and drinking water quality is public information. Thus, water often provides the first clues about health-related trends we need to pay attention to.

Water also connects all of us. Vast as it may seem, our world is a closed system. There is no such thing as "new" water. All water is shared, and it flows in and out of streams, rivers, oceans, and each of us. Along the way, it often carries the things that we put in it, including chemicals like PFAS.

Water utilities are responsible for maintaining water quality according to regulations while also keeping drinking water affordable. Treatment to remove PFAS from water can happen at utilities and in our homes – using technologies like activated carbon and reverse osmosis – but this treatment can be expensive. Our country's regulatory process helps make sure we are delivering the safest water at the lowest cost. Your water utility's website is the best place to find reliable information about relevant regulations and our local drinking water quality.

Appendix

Topic Resources: PFAS

- PFAS One Water Risk Communication Messaging for Water Sector Professionals (5124)
- Assessing Per- and Polyfluoroalkyl Substance Release from Finished Biosolids (5042)
- PFAS in Biosolids: Trends, Technologies, and Its Link to the Circular Economy Webcast
- Advances in Water Research Magazine – PFAS Issue
- PFAS Topic Hub (waterrf.org)
- PFAS Topic Overview (1-Pager)
- Full list of WRF's PFAS Resources
- Video coming soon!

WRF PFAS Projects

Updated 06/05/2023

1693 **Formation of Nitrosamines and Perfluoroalkyl Acids During Ozonation in Water Reuse Applications**

4322 **Treatment Mitigation Strategies of Poly & Perfluorinated Chemicals, Final Report plus webcast**

4344 **Removal of Perfluoroalkyl Substances by PAC Adsorption & Ion Exchange**

4877 **Concept Development of Chemical Treatment Strategy for PFOS-Contaminated Water**

4913 **Investigation of Treatment Alternatives for Short-Chain Per- Polyfluoroalkyl Substances**

5002 **Determining the Role of Organic Matter Quality on PFAS Leaching from Sewage Sludge and Biosolids (NSF grant)**
Webcast: Relating PFAS Leaching from Sewage Sludge and Biosolids to Water and Sludge Quality (WEF, February 2020)

5011 **Evaluation and Life Cycle Comparison of Ex-Situ Treatment Technologies for Per-and Polyfluoroalkyl Substances (PFASs) in Groundwater (DOD grant)**

5031 **Occurrence of PFAS Compounds in US Wastewater Treatment Plants**

5042 **Assessing Poly- and Perfluoroalkyl Substance Release from Finished Biosolids**

5082 **Investigation of Alternative Management Strategies to Prevent PFAS from Entering Drinking Water Supplies and Wastewater**

WRF PFAS Projects

5102 Application of Novel Method to Estimate Total PFAS Content in Water

5103 Microwave Regeneration of PFAS-Exhausted Granular Activated Carbons

5107 Understanding Pyrolysis for PFAS Removal

5111 Studying the Fate of PFAS through Sewage Sludge Incinerators

5124 PFAS One Water Risk Communication Messaging for Water Sector Professionals

5153 Evaluation of Bench-Scale Methods to Predict Drinking Water PFAS Removal Performance of Ion Exchange and Novel Adsorbents at Pilot- and Full-Scale

5170 State of the Science and Regulatory Acceptability for PFAS Residual Management Options (recently awarded)

5172 Cost-effective PFAS Mitigation Strategies for Communities (RFP)

5211 Understanding the Value Proposition for Thermal Processes to Mitigate PFAS in Biosolids (recently awarded)

5212 Enhanced Aeration and Scum Recovery for Physical Removal of PFAS from Wastewater (recently awarded)

5214 Direct In-Situ Measurement of PFAS Transformation & Leaching from Land-Applied Biosolids (recently awarded)