

PFAS

What is next for
this “emerged”
contaminant?

Oct 2025



Outline

1

Introduction and PFAS basics

2

Where are we now – sites, regulations, analytical, remediation

3

Where are we going ?

4

Practical solution and toolkit for evaluation



ELEMENT IN ENVIRONMENTAL

AIR QUALITY

WATER QUALITY – FRESH AND SEA WATER

Tissue

SOILS AND SEDIMENTS

ENVIRONMENTAL COMPLIANCE

Making tomorrow safer than today!

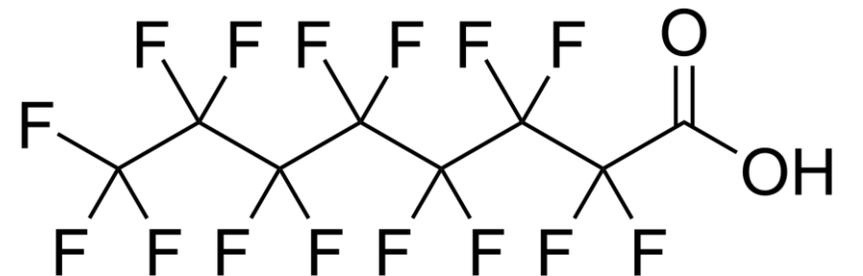
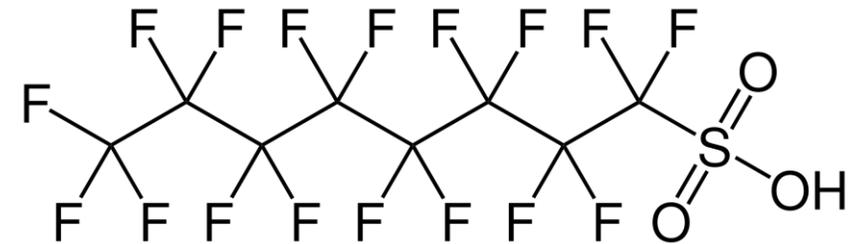
Quick background

- Professional Chemist in BC
- Worked in a few labs = food, supplement, pharma, environmental
- Contract manufacturing supplements and pharmaceuticals
 - Sourced chemicals to fix issues and make runs more efficient
- Chemical ingredient distribution
 - Sold chemicals locally from Dupont, 3M, BASF etc and got to see how they work



PFAS introduction

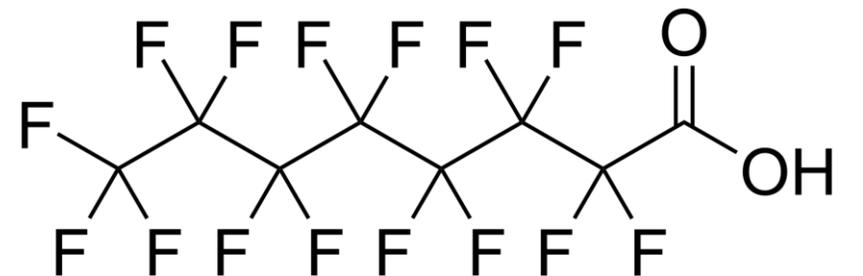
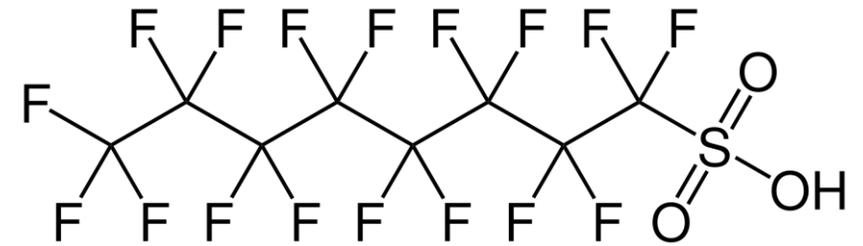
- Per and PolyFluoroAlkylated Substances = Synthetic chemicals
- ~14000+ (depending on the definition)
 - Only 250 are industrially relevant
- Incredibly useful chemicals:
 - Water, oil, grease repellent
 - Chemical and thermal stability (C-F bond)
 - Surfactant
- PFOA (Teflon) and PFOS (scotchguard) the most known
 - Health issues directly correlated to these two PFAS
 - C8!



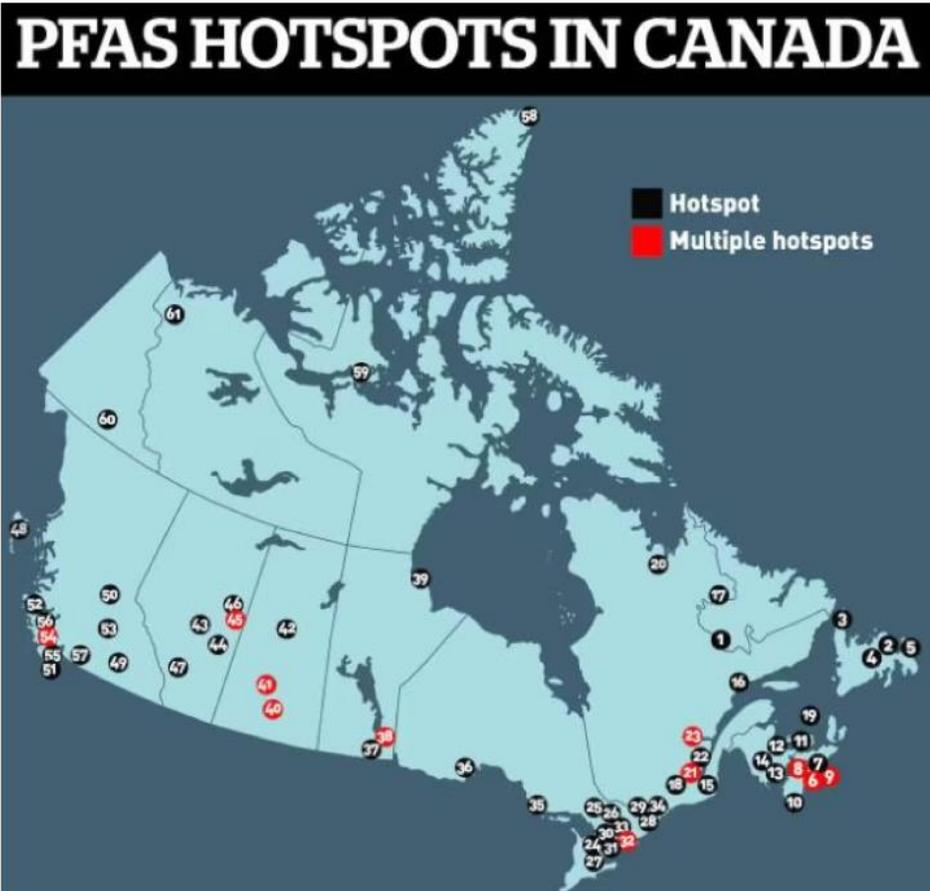
Dark Waters is a good movie to watch too!

PFAS issues

- 1970s health issues emerged (at LOW levels)
 - Dupont in 1980s said 1 ppb was safe!
 - Today we don't think there is a "safe" level and limits largely based on analytical limits
- Cancer, endocrine disruption, immunity, fertility, development, pregnancy etc
- Bioaccumulate
- Mobile in waters and soils
 - Abnormally large plumes from sites when compared to any other contaminant
 - We find them everywhere and in everyone
- **PERSISTENT ORGANIC POLLUTANT** (Stockholm convention)



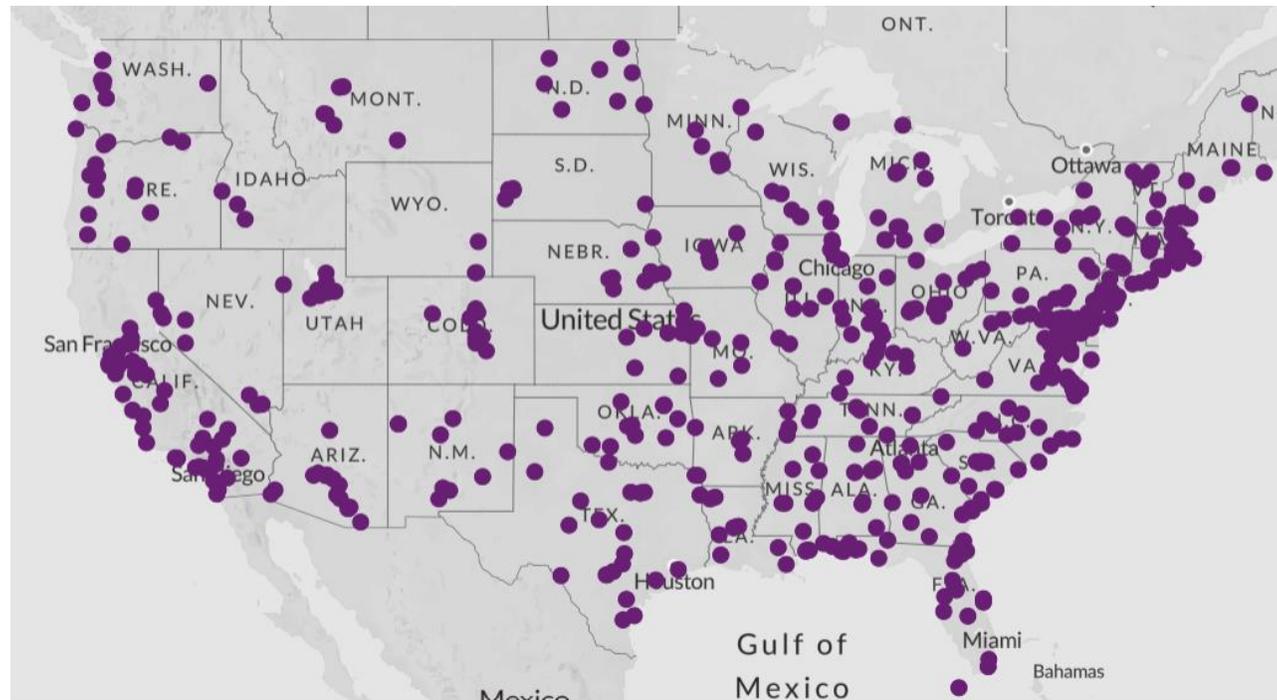
Where are we now Sites - Canada



- Sites using AFFFs are the primary areas being treated right now = military bases and airports
- ~2-5% of AFFF mix is PFAS
- Water treatment facilities and landfills/waste streams are starting initial evaluation

Where are we now

Sites - US



Where are we now

Regulations



Long chain PFAS are toxic under CEPA (switch to short chain)

PFAS drinking water guidelines = 30 ng/L
US regulation 4 ng/L for PFOA PFOS (others gone)

Some provinces/ states have their own regulations

Class based elimination of PFAS proposed by Health Canada

Where are now Analytical



EPA 537.1

Drinking Water

- Testing for 18 compounds
- Older method and still a part of some regulatory requirements

EPA 533

Drinking Water

- Testing for 25 compounds
- Preferred and “better” method

EPA 1633A

All other environmental matrices

Waste water, soils, tissues, biosolids

- Testing for 40 compounds
- Robust with room for modification

Where are we now Remediation

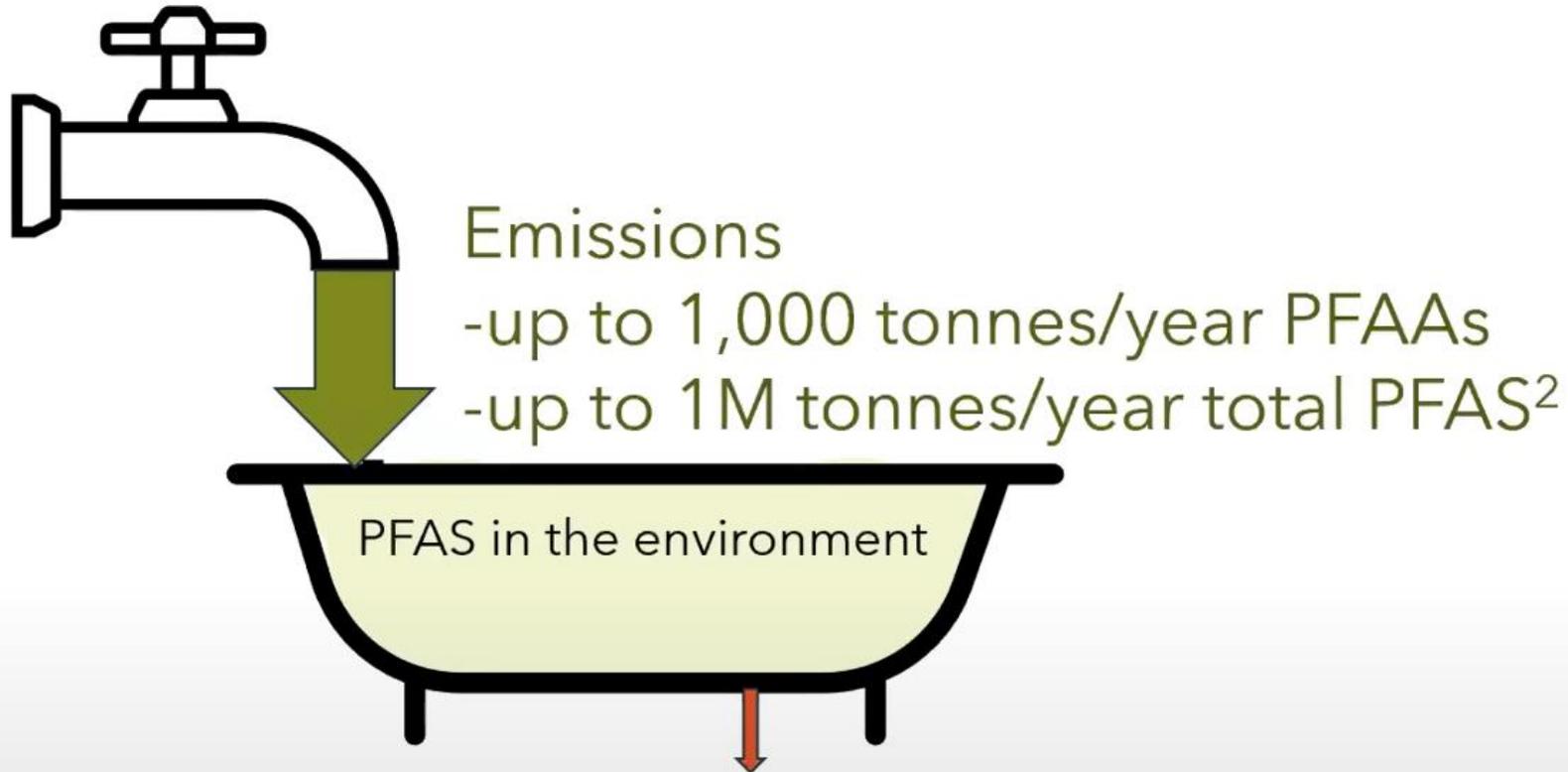


- Key is to **separate, concentrate and destroy**
 - Foam fractionation of waters (separation and concentration)
 - Granular Activated Carbon (absorb but have to replace)
 - Soil washing
 - Ion exchange resins
- Incineration is the primary method of PFAS destruction
 - C-F bond is very strong so requires almost 1000C and sufficient residence time
 - Short chain PFAS released around destruction site
- ALL OF THESE ARE COSTLY

Where do
we go from
here?



The issue of persistence

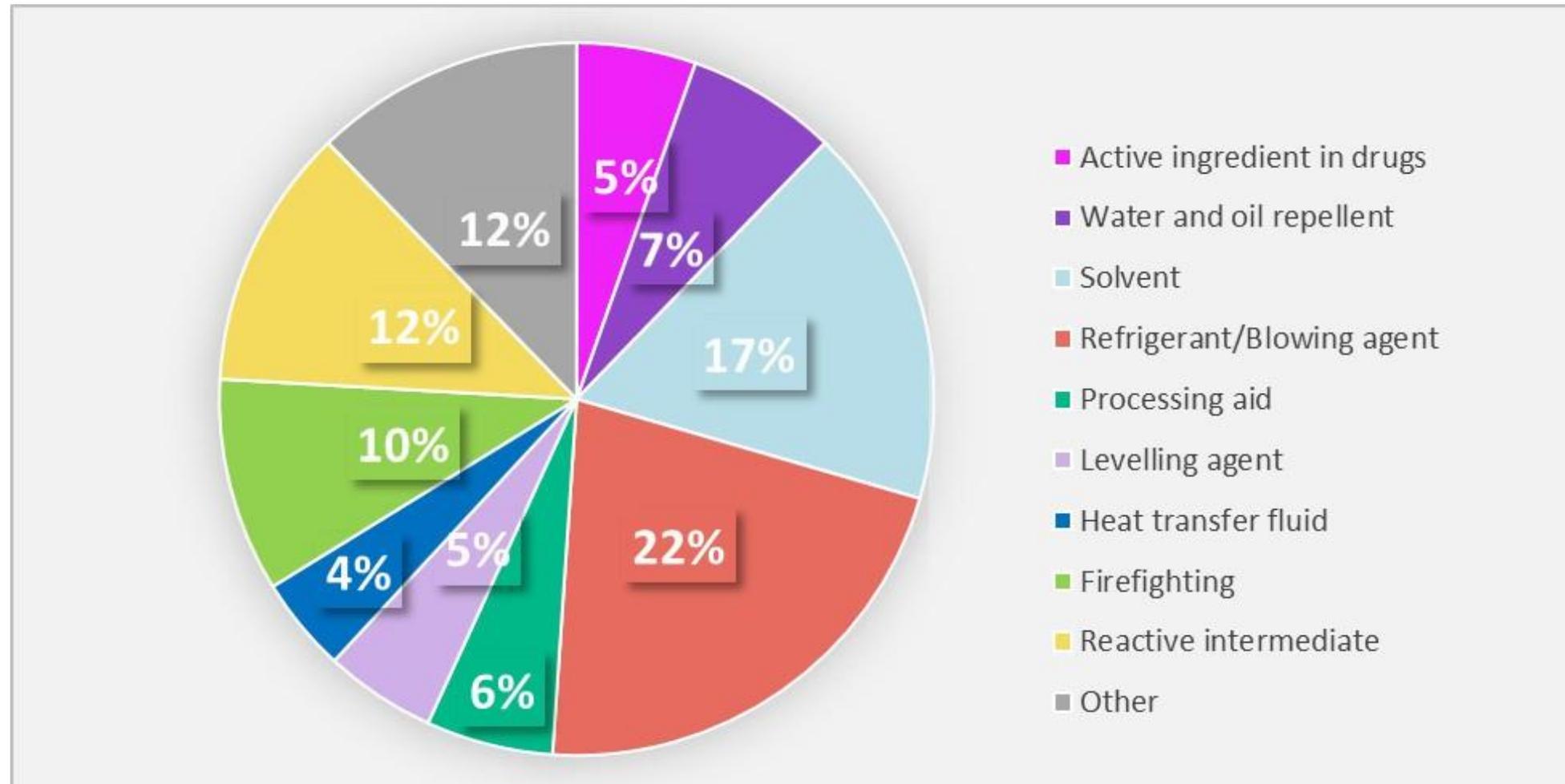


Increasing
remediation rates to
match current PFAS
emission rates would
cost

**more than the
global GDP**

Active Treatment and Destruction
\$1-65M USD per kg PFAA removed and destroyed

Where else do we find PFAS outside of AFFFs?



Where do we find PFAS

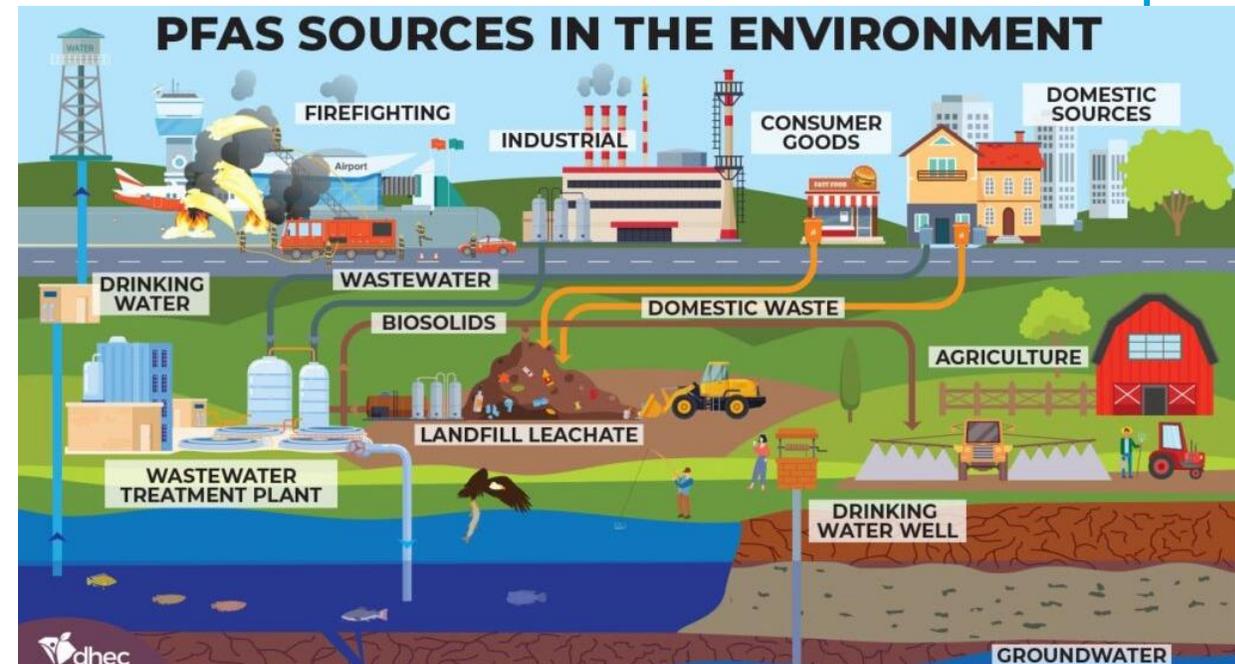


- PFAS in consumer products = food, textiles, plastics, paper, diapers, cookware, paints, etc etc
- PFAS in manufacturing = chemicals, fertilizers, pharmaceuticals and medical devices, mining and refining, plastics and resins, coating
 - Many companies do not know they were using PFAS, “trademark” chemical mix
- **Concentrate in landfills and wastewater treatment plants**

Landfills and WWTP

- **Landfill:** Leachate as well as air emissions
- **WWTP:**
 - Key site where treatment is needed to effectively manage PFAS
 - **Biosolid by-products of WWTP beneficially used as fertilizer → PFAS!!**
 - Realistically treatment is too expensive to do so at WWTP

Upstream evaluation is key to limit PFAS at these sites – stop or slow it at source



PFAS in oil and gas industry Extraction



- Drilling and production chemicals
 - Surfactants create foams to minimize fluid loss, and act as anti-foaming agents for water-oil separation
- Stimulation Chemicals
 - Stable, low surface tension wetting agents to promote displacement and recovery
- Tracers
 - Mapping and movement
- Storage and Containment
 - Prevent evaporation and contain spills on water, PTFE, PFA, PVDF etc

PFAS in oil and gas industry

Safety



- The most effective control for hydrocarbon fires are still PFAS containing AFFF systems
- Most facilities have not removed and replaced these with modern AFFF foams
- Military bases, firehalls and airports have gone through phaseouts – Lessons learned:
 - PFAS residue persists within system
 - Historic fires or tests likely created contaminated sites

PFAS in Pulp and Paper



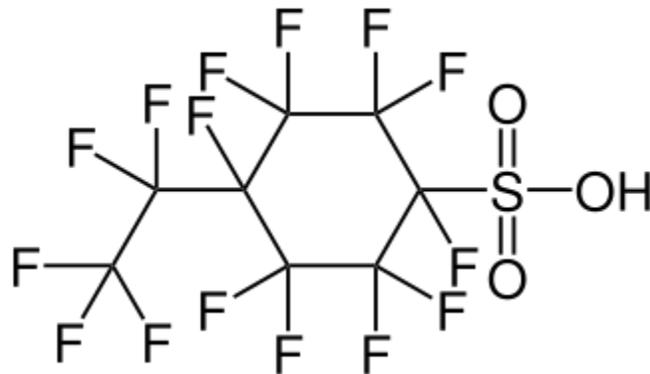
- Coating to prevent water and grease from sticking. ~40% of food contact paper contains PFAS
- Several sites in BC produce or produced food contact paper, or used PFAS as part of their processes as well



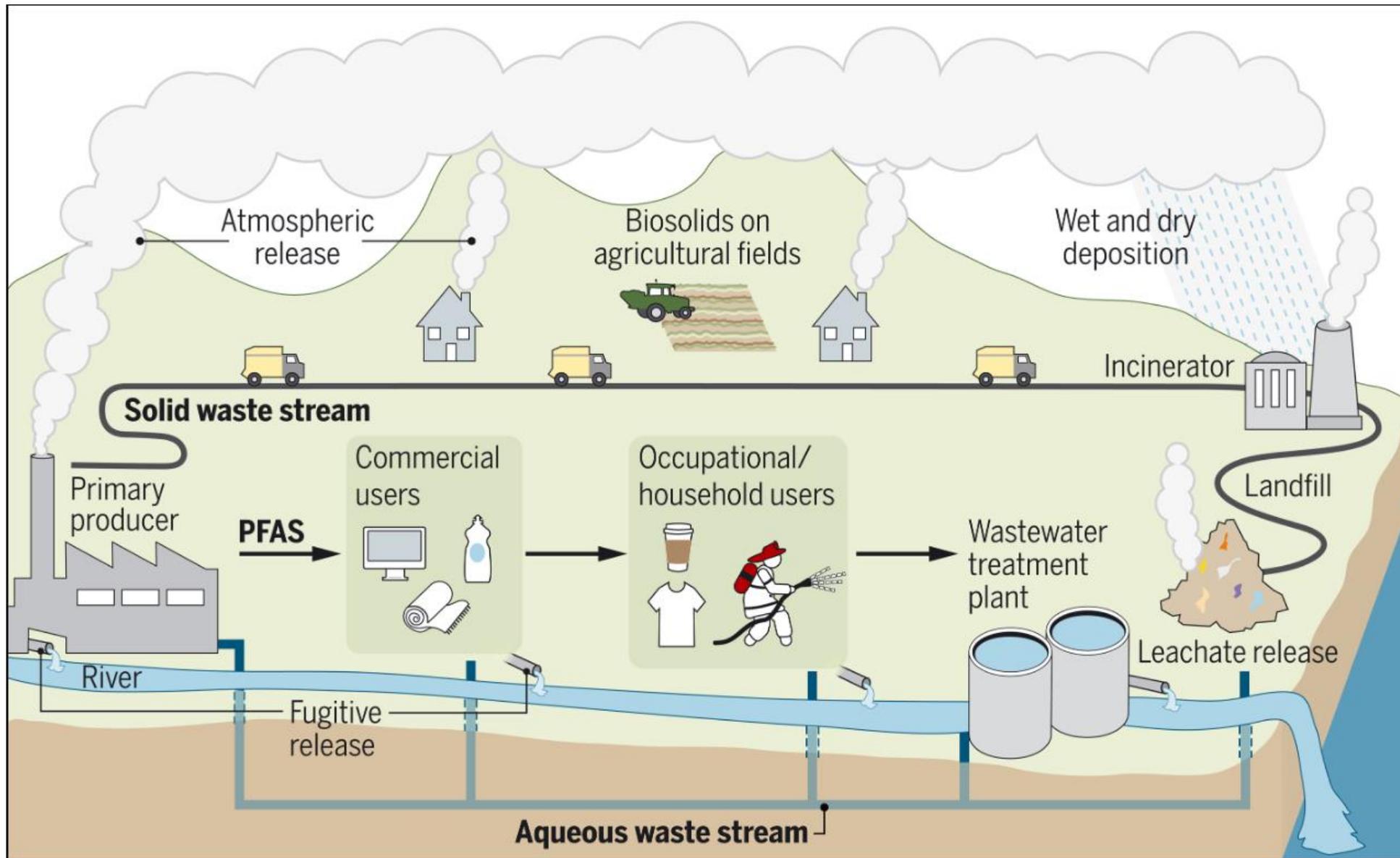
| Application | Type of Paper | PFAS Used |
|------------------------|------------------------------|--------------------------------------|
| Food wrappers | Burger wrappers, deli papers | FTOHs, diPAPs |
| Microwave popcorn bags | Grease-resistant paper | PFOS (historically), 6:2 diPAP (now) |
| Baking paper | Parchment, liners | FTOHs, fluorinated polymers |
| Take-out containers | Boxboard, molded fiber | PFAS surface coatings |
| Fast food cups | Liquid-resistant paperboard | PFAS-based barriers |

PFAS in metal plating and finishing

- PFAS regularly used in metal plating and finishing baths to suppress mists – surfactants
- Major industry with a range of small and medium sized facilities serving the automotive, aerospace and parts industries
- PFOS, PFOA used initially, but those have phased out
- These have been found in numerous states and traced back to discharge from these facilities
- Not part of any discharge permits, and not monitored
- Not all compounds part of screens
- Persistent even when stop usage

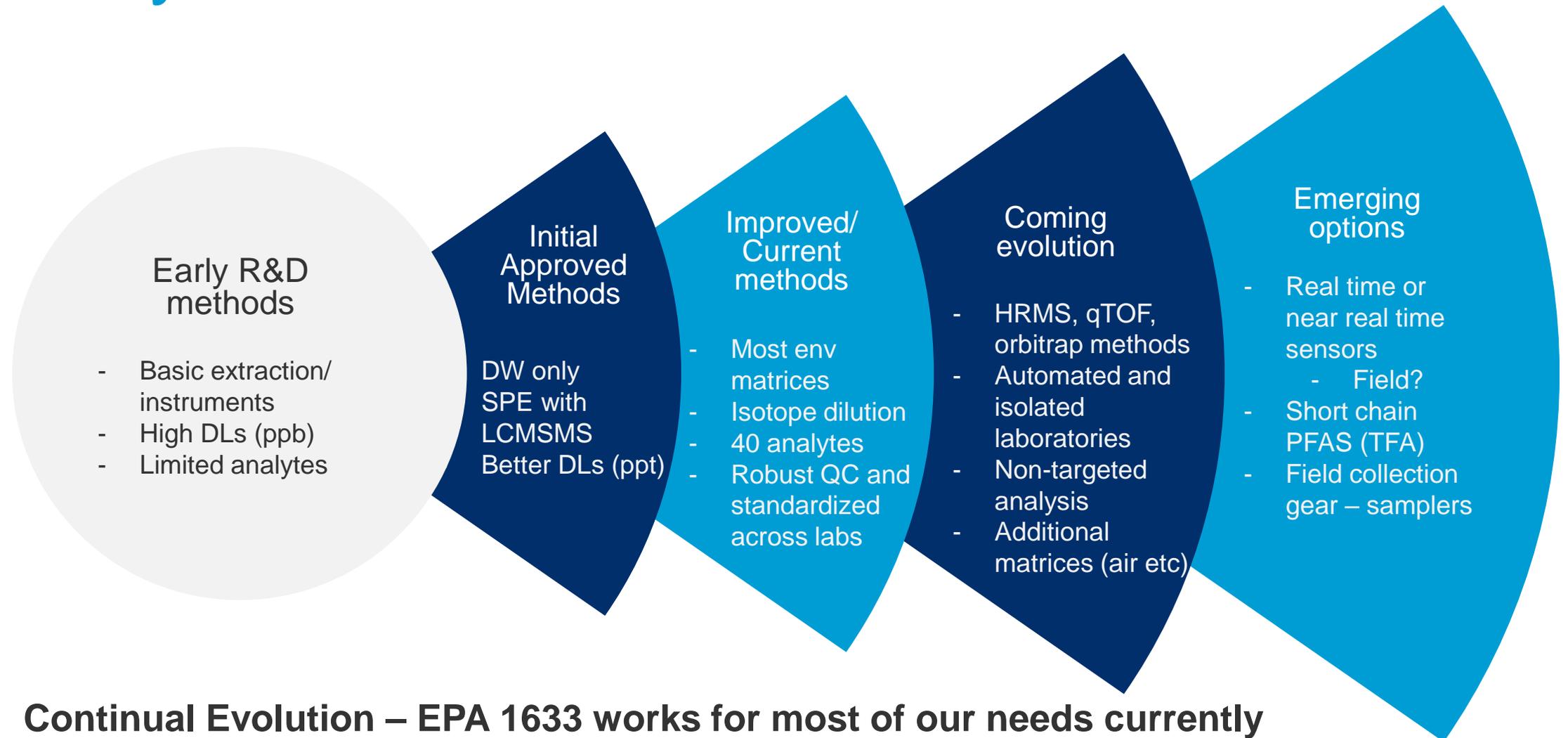


UPSTREAM EVALUATION



Where are we going

Analytical Evolution



Continual Evolution – EPA 1633 works for most of our needs currently

Where are we going

Regulations

- Canadian water regulations finalized and enforced
 - **Water treatment focus**
- **Biosolid** regulations in Canada (and the US)
- PFOA and PFOS added to CERCLA (superfund)
 - **Polluters Pay**
- PFAS ban in consumer products in some states
- Canada and US data collection around PFAS usage → regulation of larger groups of chemicals easier than individual



**PFAS Strategic Roadmap:
EPA's Commitments to Action
2021–2024**

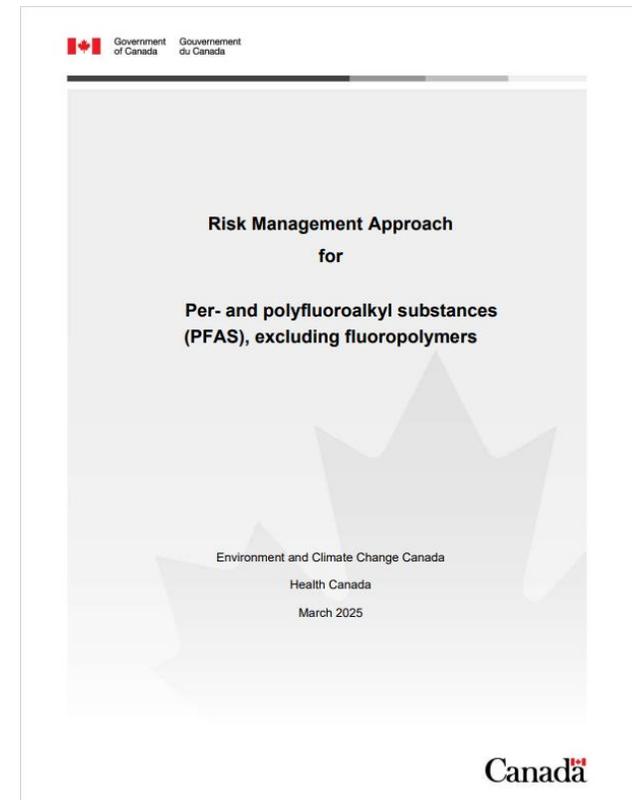


Where are we going Regulations - UPDATE

Phase 1: prohibition of the use of PFAS, excluding fluoropolymers, in firefighting foams

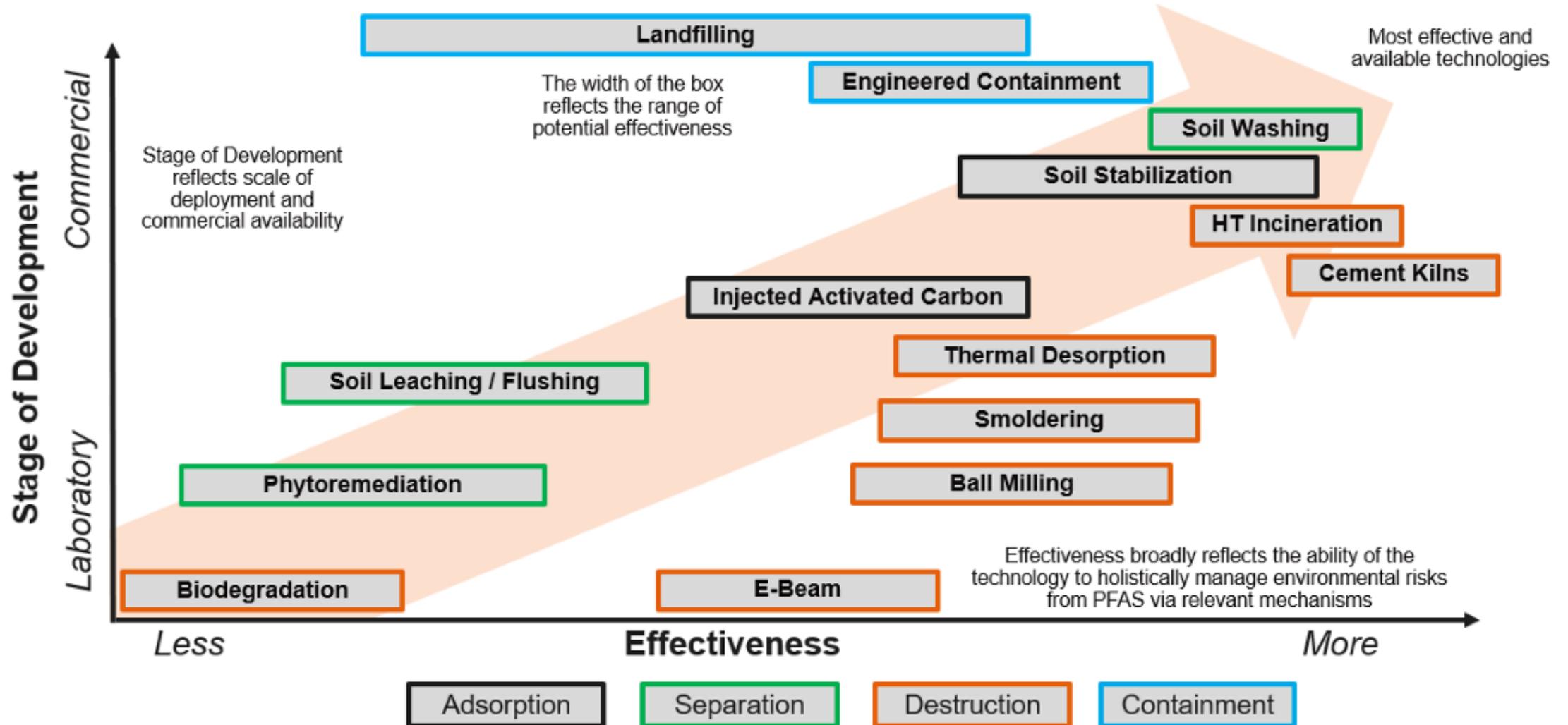
Phase 2: prohibition of the uses of PFAS, excluding fluoropolymers, not needed for the protection of health, safety or the environment, which includes consumer applications. Examples are cosmetics, NHPs, food packaging and products, paint and sealant, textiles, waxes

Phase 3: prohibition of the uses of PFAS in areas such as fluorinated gas, prescription drugs, med device, industrial materials, industrial sectors such as mining and petroleum, transport and military applications

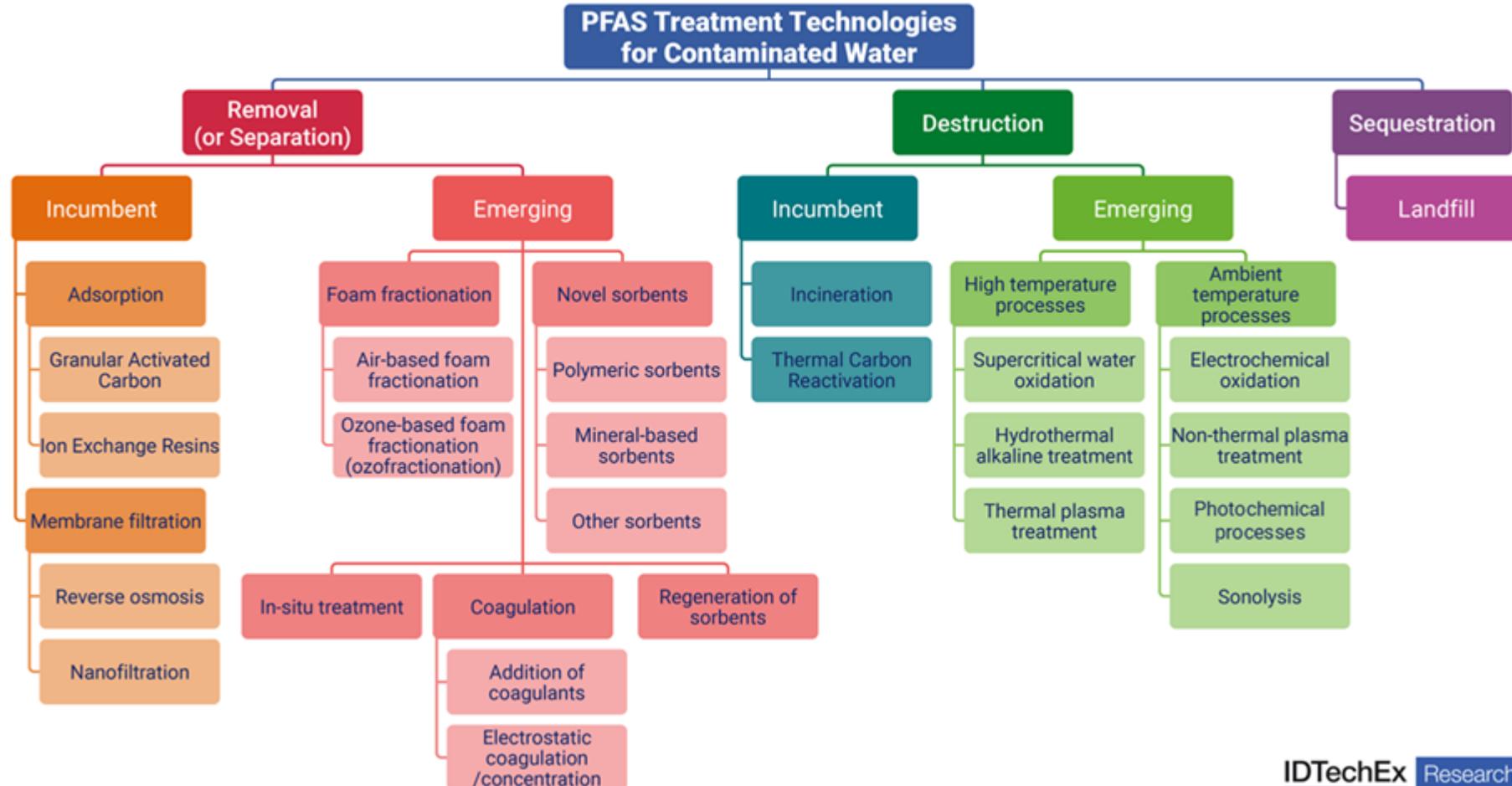


Where are we going

Soil treatment



Where are going Water treatment



Practical solutions



1. Restrict PFAS **USAGE**

- Being considered and added in EU, Canada, states
- Auditing of supply chain and due diligence
- **THIS WORKS!!!** PFOA and PFOS going down!

2. Evaluate sites where **PFAS concentrate**

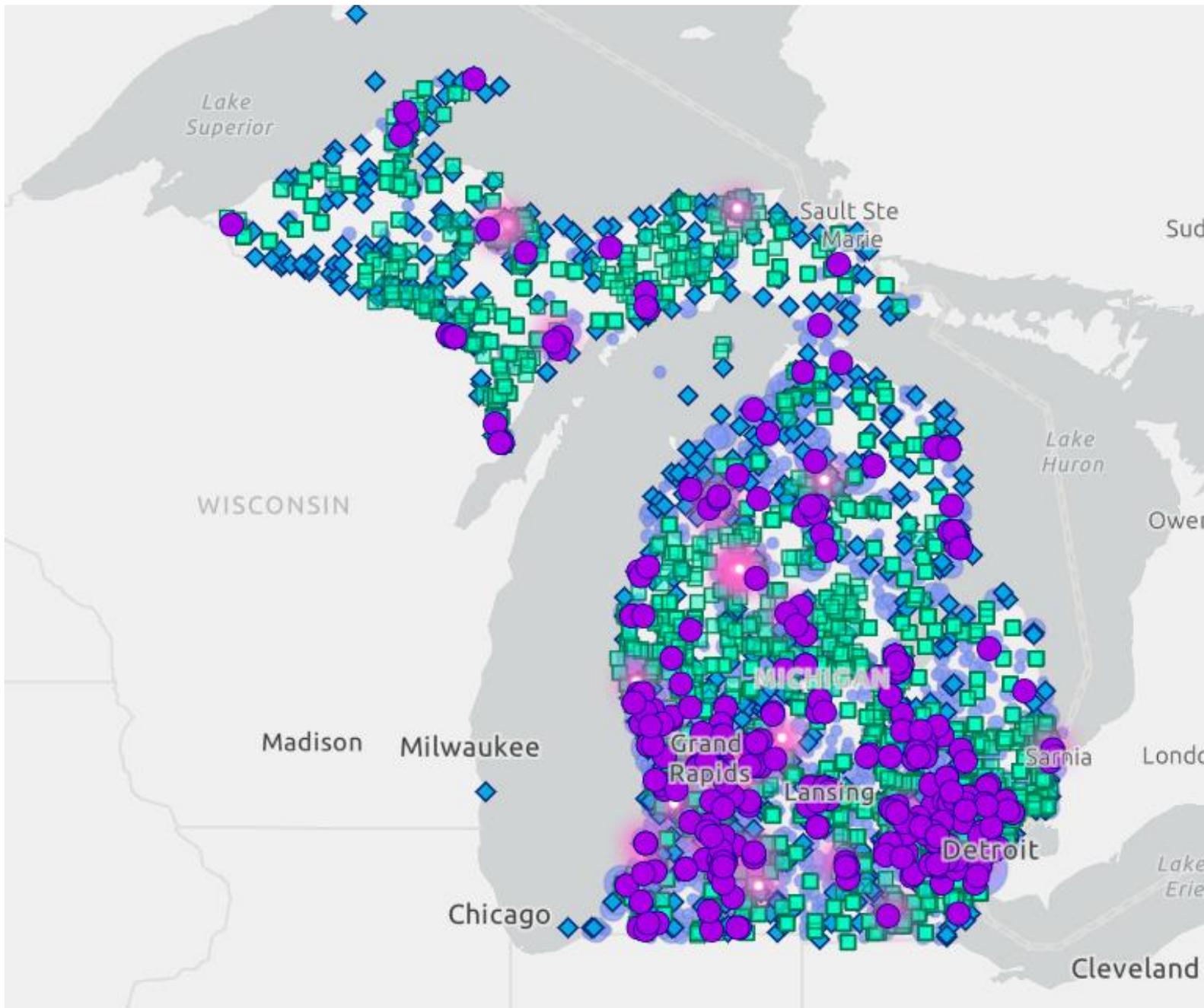
- Landfills and WWTP → Upstream evaluation
- Industry treat or remove
- Testing with 1633 works in most cases!

3. Targeted **treatment**

- Where it is most effective



Michigan PFAS sites



What can you do now Industry

Audit of supply chain for PFAS, ask suppliers to stop using

Find alternatives and switch where viable

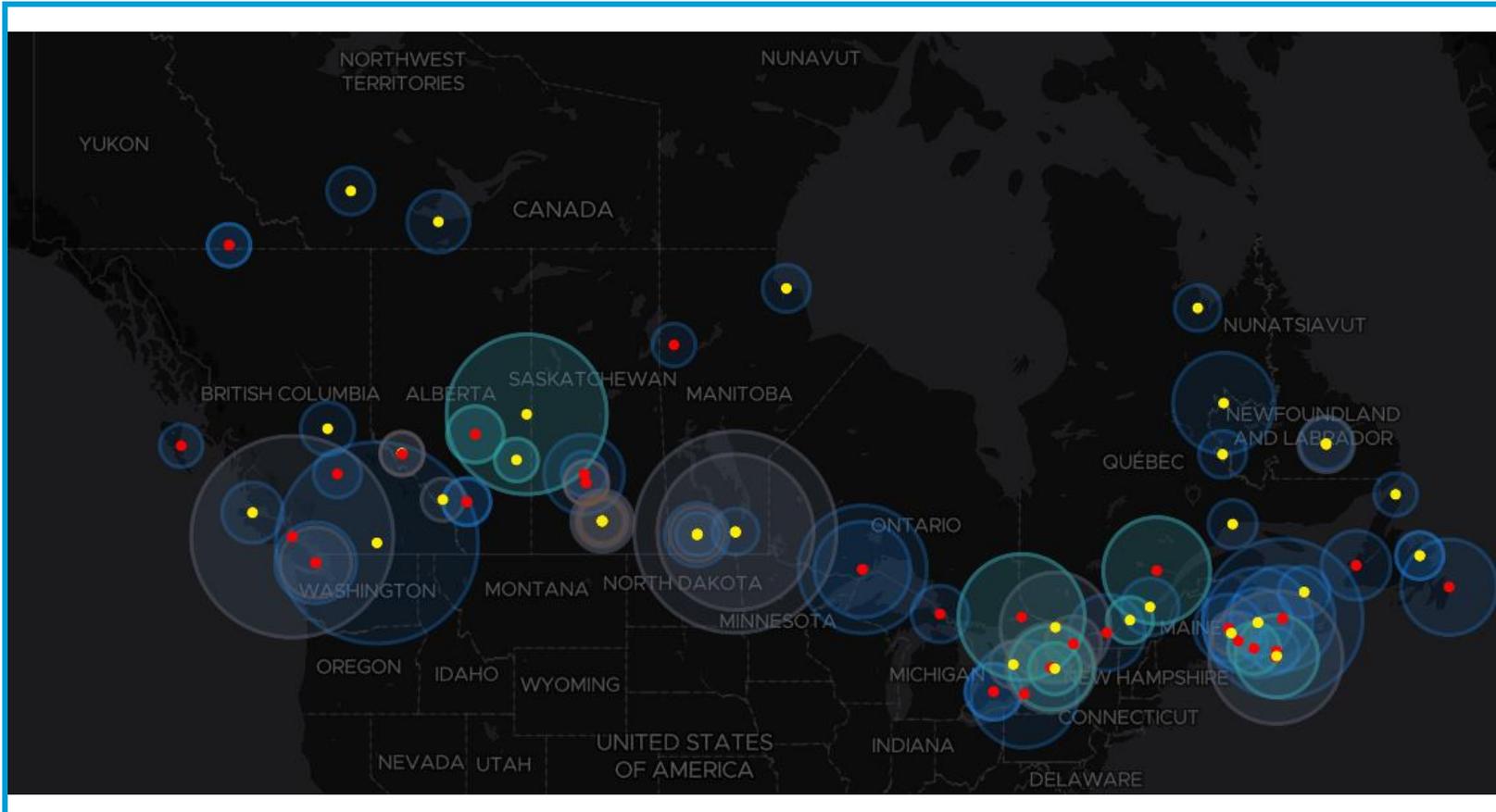
Baseline testing of areas where recent or historic PFAS use suspected

Control areas where PFAS found (barriers and other plume reduction options)

Evaluate → Screen (high level) → Test Regulated PFAS compounds



Where are we going Site extra



<https://newsinteractives.cbc.ca/features/2025/pfas-canada-map/>

THANK
YOU

PERMVEER BAINS (PERM)
permveer.bains@element.com
604-726-5892