CHAIRE INDUSTRIELLE EN EAU POTABLE

CREDEAU

POLYTECHNIQUE MONTRÉAL
UNIVERSITÉ D'INGÉNIERIE

Characterization of micropollutants and perfluoroalkylated substances in drinking water sources in the Greater Montreal Area

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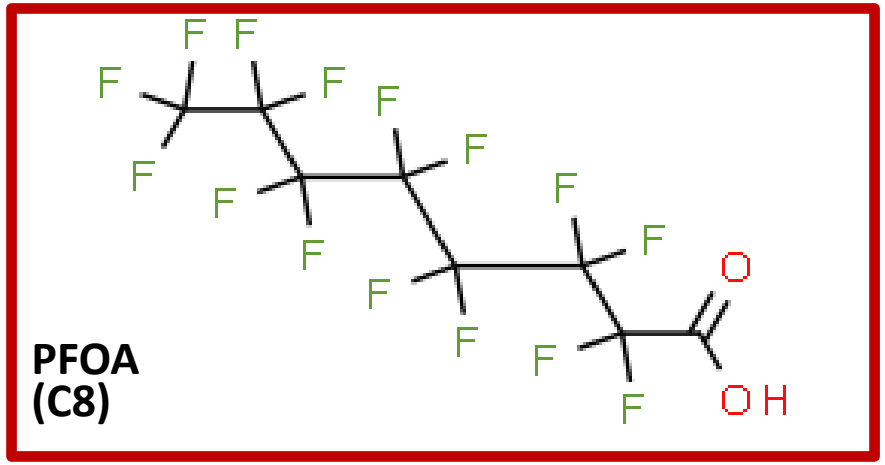
What are PFAS?

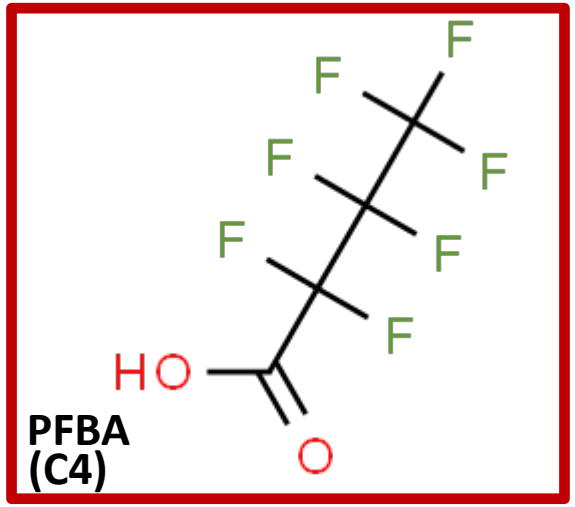
- Human-made and highly fluorinated substances
- Hydrogen atoms replaced by fluorine atoms (carbon-fluorine bonds)
- Compounds that are more stable and unlikely to react or degrade in the environment
- Removal from drinking water is difficult (high persistence and solubility)
- Bioaccumulation

LONG-CHAIN



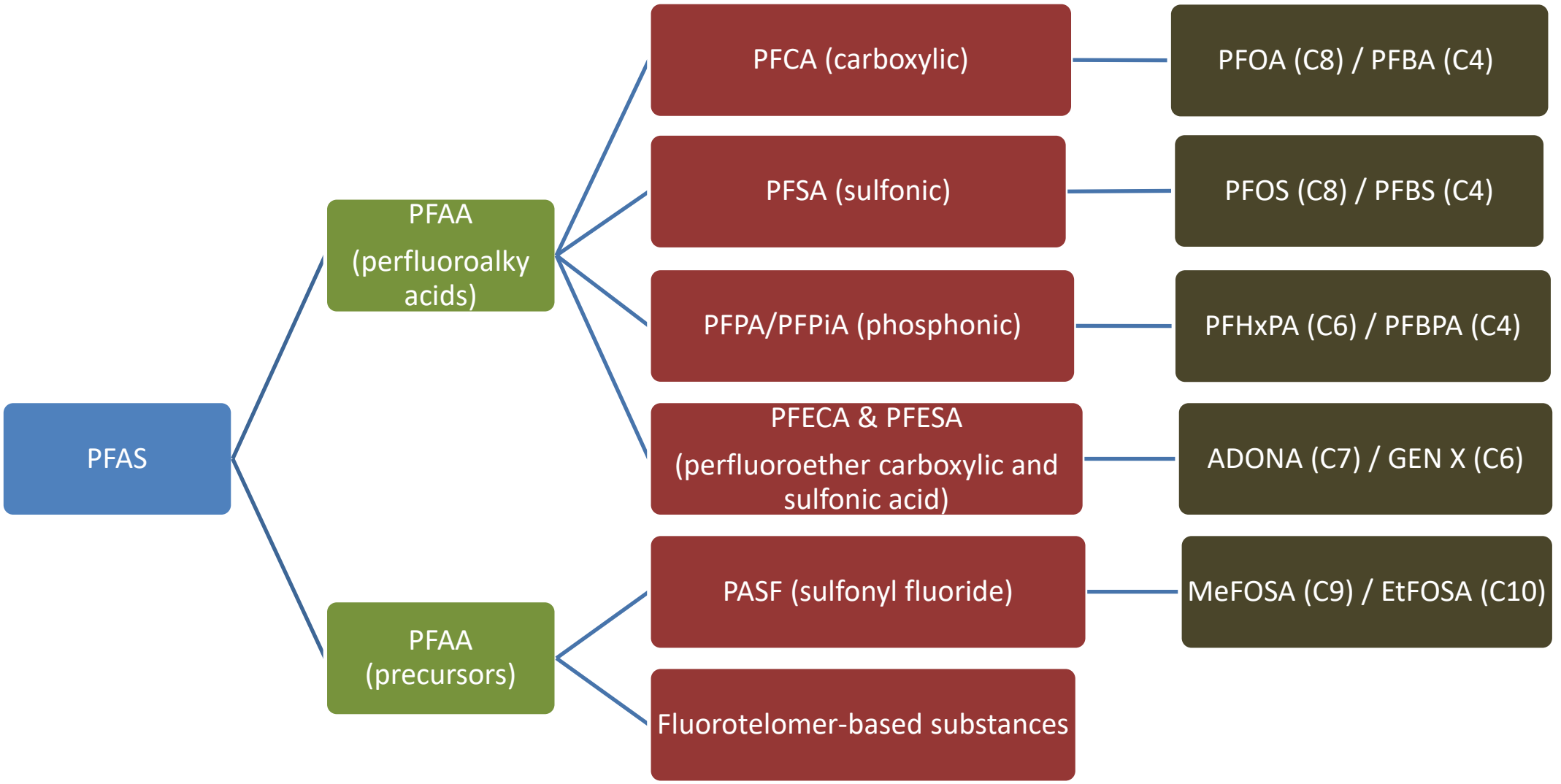
PFOA
(C8)

SHORT-CHAIN



PFBA
(C4)

PFAS family


CLASS
SUBCLASS
PFAS COMPOUND
PFAS
PFAA (perfluoroalky acids)
PFAA (precursors)
PFCA (carboxylic)
PFSA (sulfonic)
PFPA/PFPiA (phosphonic)
PFECA & PFESA (perfluoroether carboxylic and sulfonic acid)
PASF (sulfonyl fluoride)
Fluorotelomer-based substances
PFOA (C8) / PFBA (C4)
PFOS (C8) / PFBS (C4)
PFHxPA (C6) / PFBPA (C4)
ADONA (C7) / GEN X (C6)
MeFOSA (C9) / EtFOSA (C10)

Impact of PFAS substances in Quebec, Canada

- **Presence and occurrence**
- **Trends**

Water Research 233 (2023) 119750

Contents lists available at ScienceDirect

Water Research

journal homepage: www.elsevier.com/locate/watres

Target and nontarget screening of PFAS in drinking water for a large-scale survey of urban and rural communities in Québec, Canada

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Science of the Total Environment 777 (2021) 146073

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Longitudinal and vertical variations of waterborne emerging contaminants in the St. Lawrence Estuary and Gulf during winter conditions

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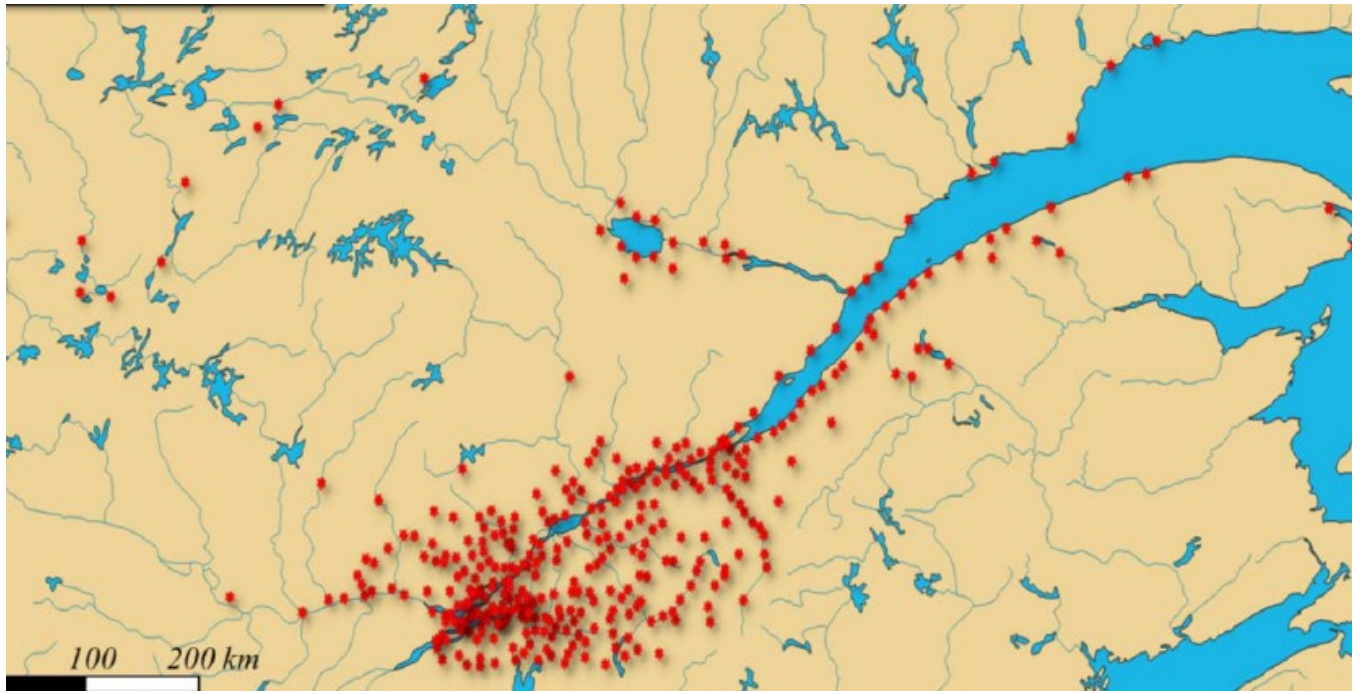


Source: "Target and nontarget screening of PFAS in drinking water for a large-scale survey of urban and rural communities in Quebec, Canada" by Muñoz et al. 2023, Water Research. Volume 233. https://doi.org/10.1016/j.watres.2023.119750 (Adapted figure)

Potential sources of PFAS in the Greater Montreal Area

- Domestic activities
- Wastewater
- Landfill leachate
- Aqueous fire-fighting foam (AFFF):

What about Canada?

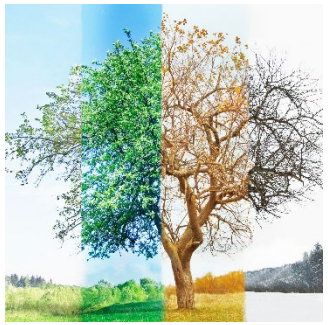
- Accidents: Lac-Mégantic, Quebec
- Airports: Contamination of sites close to the airports of Toronto and Hamilton, ON

Source: https://news.sundanceusa.com/news/what-you-need-to-know-about-pfas-in-packaging (Adapted figure)

Impacts of PFAS substances in source and treated water

Research objectives

- **Monitoring of PFAS substances and micropollutants in the Greater Montreal Area**
  - **Occurrence of different compounds**
  - **Characteristics**
  - **Trends**



- **Compare measured concentrations to the recommendations and objectives of Health Canada and USEPA**

Health Canada Santé Canada

Sampling sites and methods

- **Sampling of 15 water treatment plants in the Greater Montreal Area:**
  - **Saint-Lawrence river (n=8)**
  - **Ottawa river (Des Prairies and Mille-Îles rivers) (n=4)**
  - **L'Assomption river (n=3)**

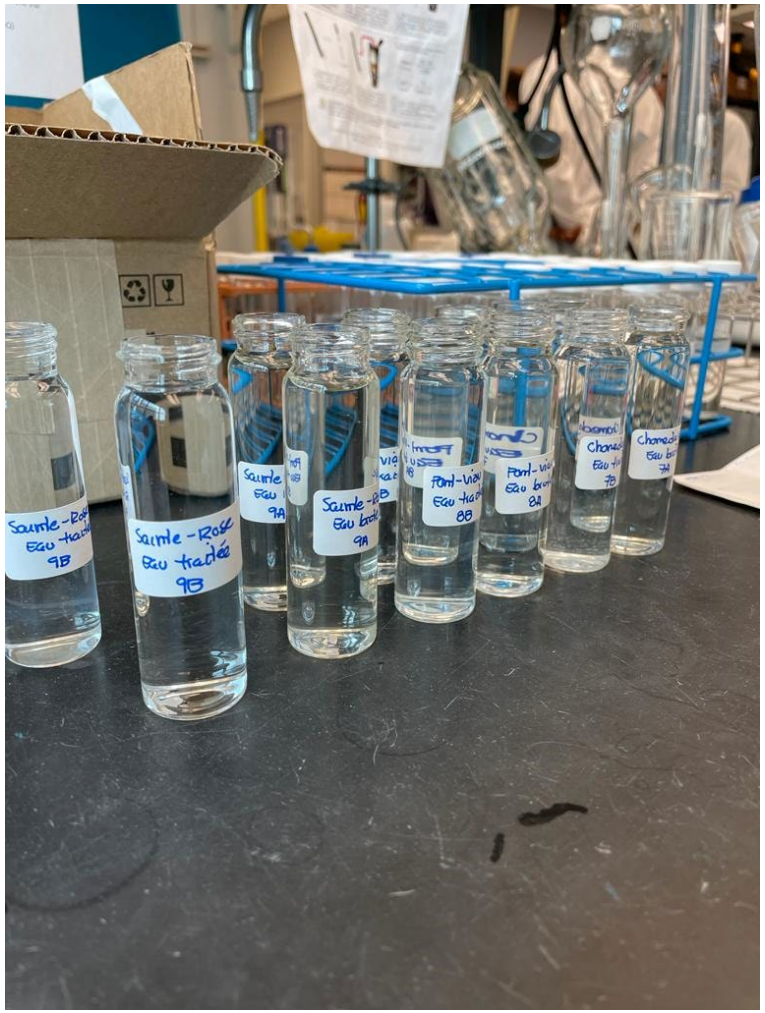
- **During the summer, 1 urban stream was sampled (may and august)**
  - **Objective = Monitoring PFAS concentrations at a site that is potentially impacted by airport runoff**

- **Samples per site:**

Water	Sample	Phase
Raw	Sample 1	PFAS (dissolved + particular)
Treated	Sample 2	PFAS (dissolved)

Method

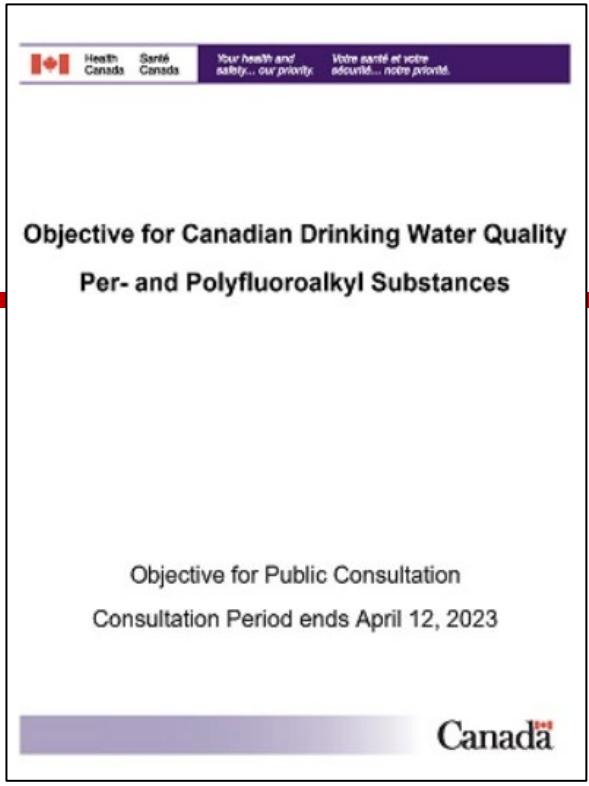
- Sampling : 1 week per season (winter and spring completed), awaiting summer results, autumn sampling next week
- Parameters measured during sampling :
  - pH
  - Temperature
  - Turbidity
  - UV Absorbance
- Parameters measured in the lab :
  - TOC
- Samples stored at 4 °C
- Avoid contact with Teflon®, waterproof clothing (GoreTex® or Tyvek®) and other products that might contain PFAS



Objectives and regulations

Verification of our preliminary data

- **Objective for Canadian Drinking Water Quality Per- and Polyfluoroalkyl Substances (Health Canada):**
  - **Sum of 29 PFAS compounds < 30 ng/L**
- **USEPA:**
  - **PFOS < 4 ng/L**
  - **PFOA < 4 ng/L**
  - **PFNA < 10 ng/L**
  - **PFHxS < 9 ng/L**
  - **PFBS < 2000 ng/L**
  - **GenX < 10 ng/L**


Health Canada Santé Canada

Your health and safety... our priority. Votre santé et votre sécurité... notre priorité.

Objective for Canadian Drinking Water Quality

Per- and Polyfluoroalkyl Substances

Objective for Public Consultation

Consultation Period ends April 12, 2023

Canada

ENVIRONMENTAL PROTECTION AGENCY

40 CFR Parts 141 and 142

[EPA–HQ–OW–2022–0114; FRL 8543–01–OW]

RIN 2040–AG18

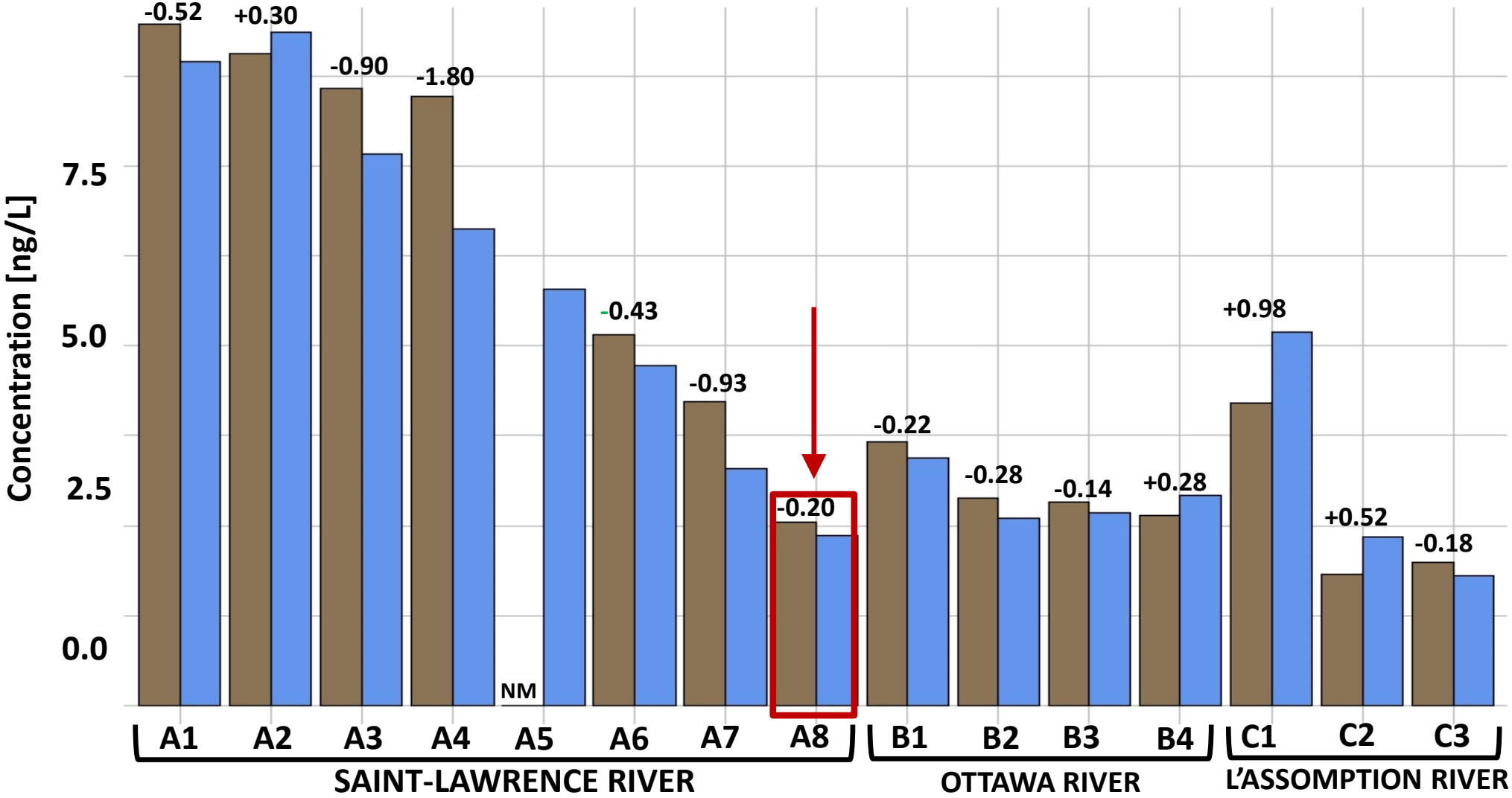
PFAS National Primary Drinking Water Regulation Rulemaking

AGENCY: Environmental Protection Agency (EPA).

ACTION: Preliminary regulatory determination and proposed rule; request for public comment; notice of public hearing.

Results

Average concentration (n=2) of PFAS for the 15 water treatment plants



Sum of 29 compounds (Health Canada) < 30 ng/L

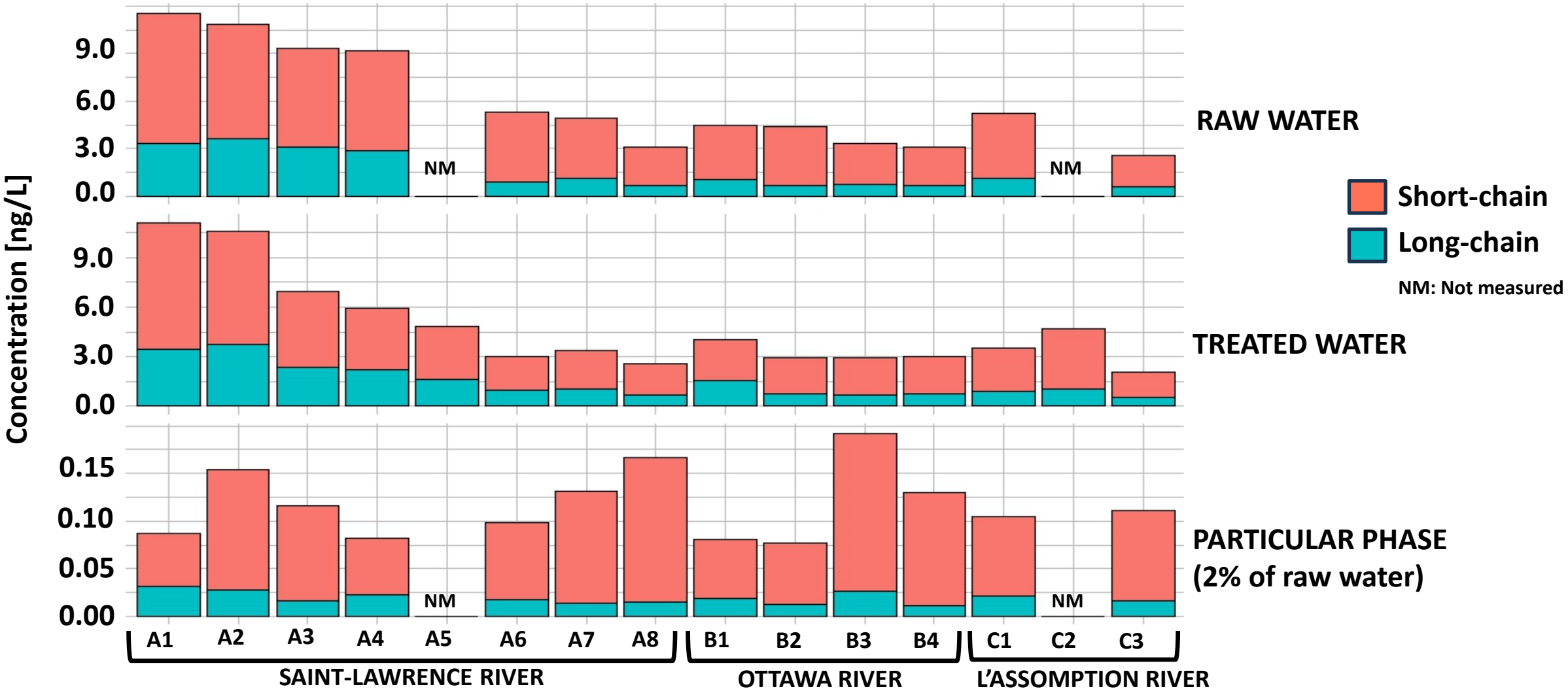
RAW WATER

TREATED WATER

NM: Not measured

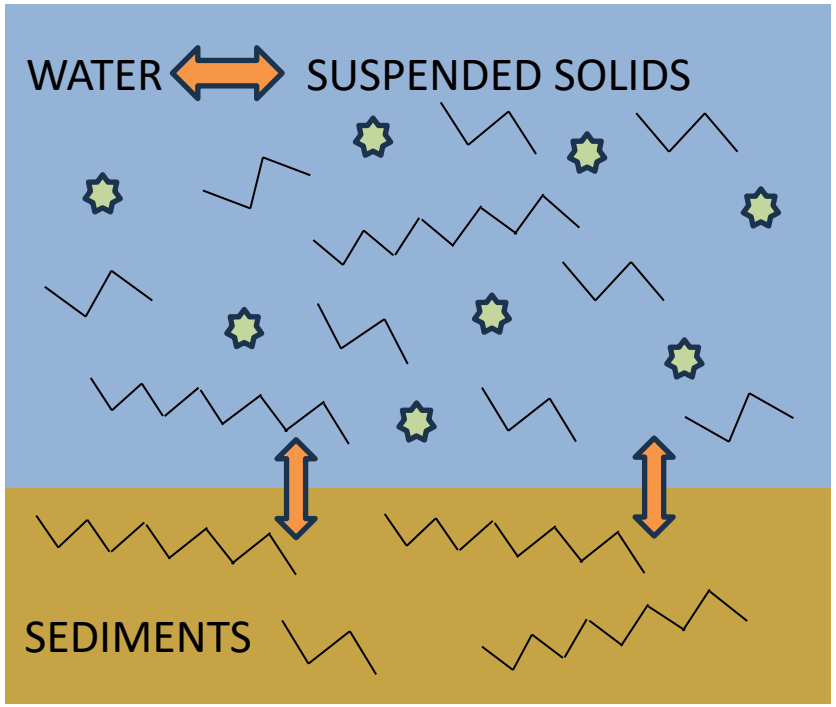
Results

Occurrence of all PFAS according to their type of carbon chain – Spring 2023



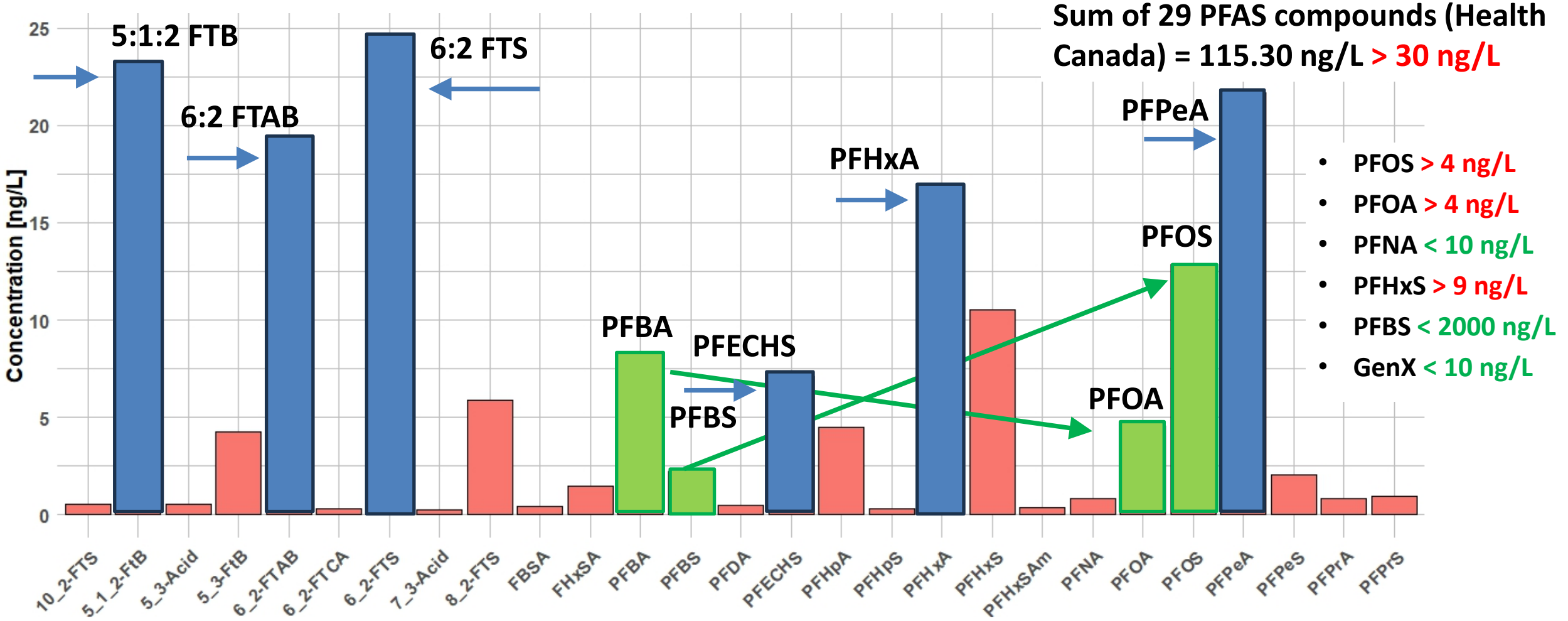
Results and trends

Short and long-chain PFAS



- **75% of the measured PFAS are short-chain, while 25% are long-chain**
- **Other studies (Zhao et al., 2016) follow this trend: 88% of PFAS in water are short-chain**
- **Short-chain PFAS are highly soluble**
- **Weak adsorption potential**

Results: Urban stream



Conclusions

- All water treatment plants meet the objectives proposed by Health Canada and the USEPA recommendations
- Among the drinking water sources monitored in this study, the highest concentrations are found in the St. Lawrence River
- There are "local" sources of PFAS contamination
- The significant PFAS concentrations measured in the water of the urban stream are probably the result of runoff from the airport
- Predominance of short-chain over long chain PFAS
- **Next steps**: Autumn sampling campaign, micropollutant results and analysis in all four seasons

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