



Institiúid Uisce DCU  
DCU Water Institute



# The Detection of Poly- and Perfluoroalkyl Substances (PFAS) in Transitional and Marine Water

A Dublin Bay study

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Acknowledgments: Dr. Belinda Huerta, Dr. Enrique Jacobo Diaz-Montaña, Prof. Fiona Regan



*Foras na Mara*  
*Marine Institute*



# Outline

**1. Introduction to PFAS**

**2. INVEST-pFASST – Project Objective**



**3. Initial Findings**



**4. Method Development**

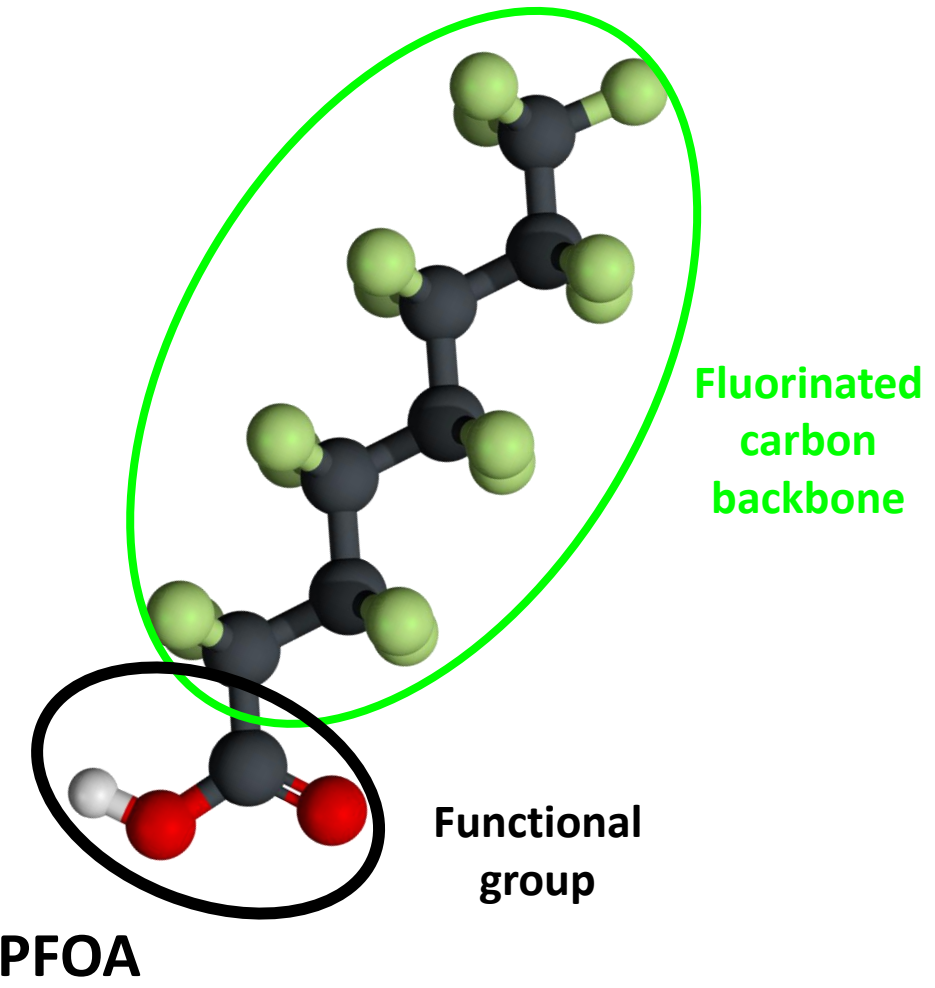


# Introduction

- Per- and polyfluoroalkyl substances → PFAS
- 2021 OECD Definition: -CF<sub>3</sub> or -CF<sub>2</sub>- moiety

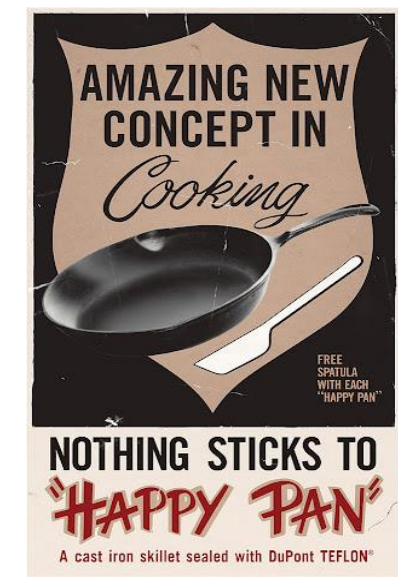
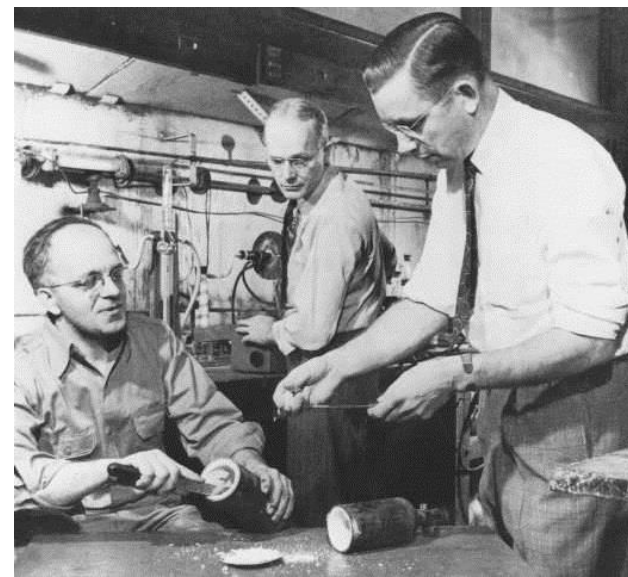


10,000 → >1,000,000



# Introduction

- Man-made compounds
- Widespread use:
  - Industrial applications
  - Firefighting foams
  - Textiles
  - Personal care products

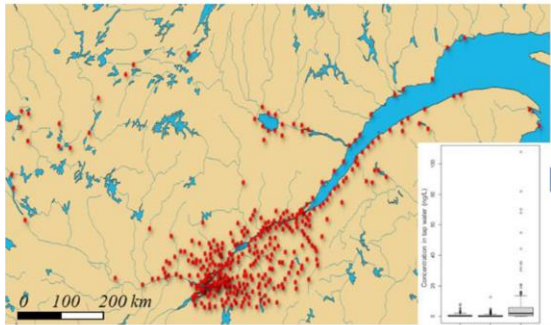


# Introduction

- Ubiquitous in the environment

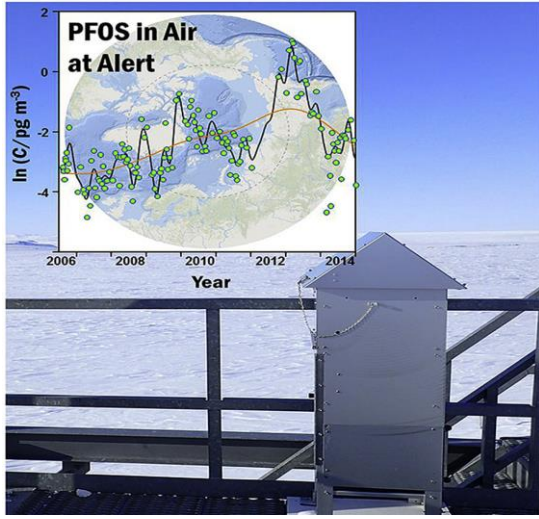
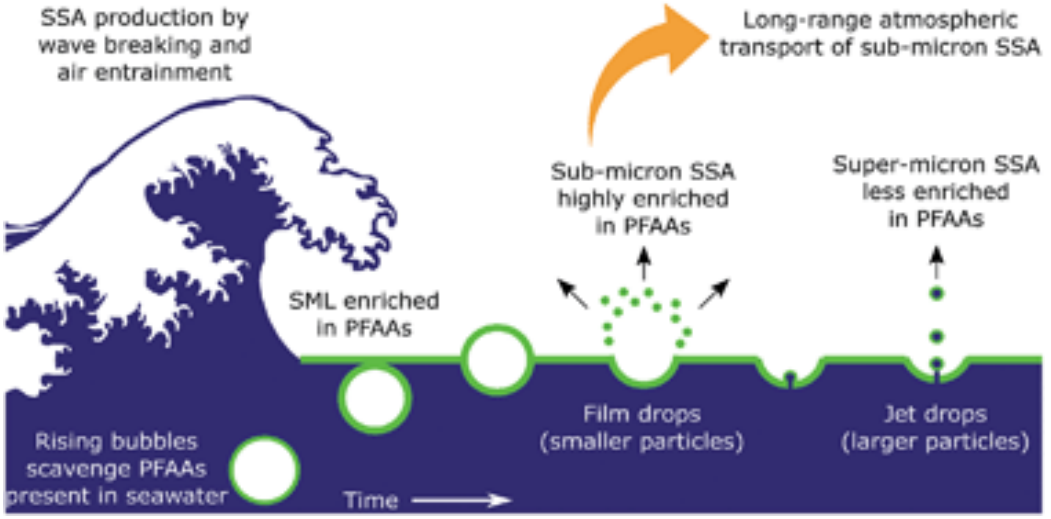
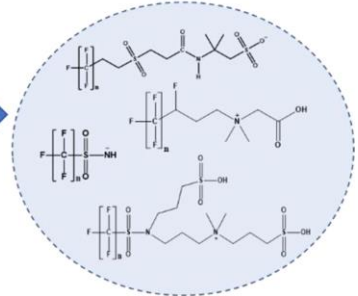


## Health concerns



Tap water samples collected at 376 locations in Québec, Canada

PFAS nontarget screening  
 24 classes detected



Munoz, G., Liu, M., Vo Duy, S., Liu, J., Sauvé, S., 2023. Target and nontarget screening of PFAS in drinking water for a large-scale survey of urban and rural communities in Québec, Canada. *Water Research* 233, 119750.

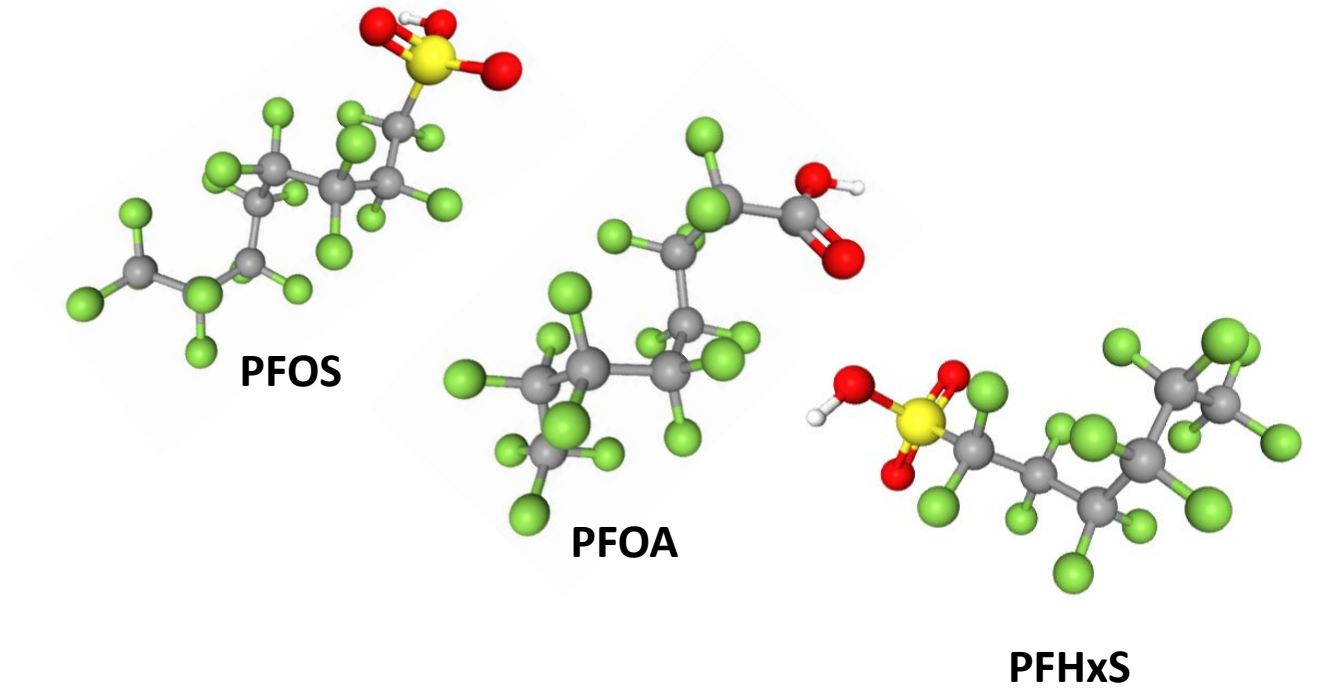
Johansson, J.H., Salter, M.E., Navarro, J.C.A., Leck, C., Nilsson, E.D., Cousins, I.T., 2019. Global transport of perfluoroalkyl acids via sea spray aerosol. *Environ. Sci.: Processes Impacts* 21, 635–649.

Wong, F., Shoeib, M., Katsoyiannis, A., Eckhardt, S., Stohl, A., Bohlin-Nizzetto, P., Li, H., Fellin, P., Su, Y., Hung, H., 2018. Assessing temporal trends and source regions of per- and polyfluoroalkyl substances (PFASs) in air under the Arctic Monitoring and Assessment Programme (AMAP). *Atmospheric Environment* 172, 65–73.

# Introduction

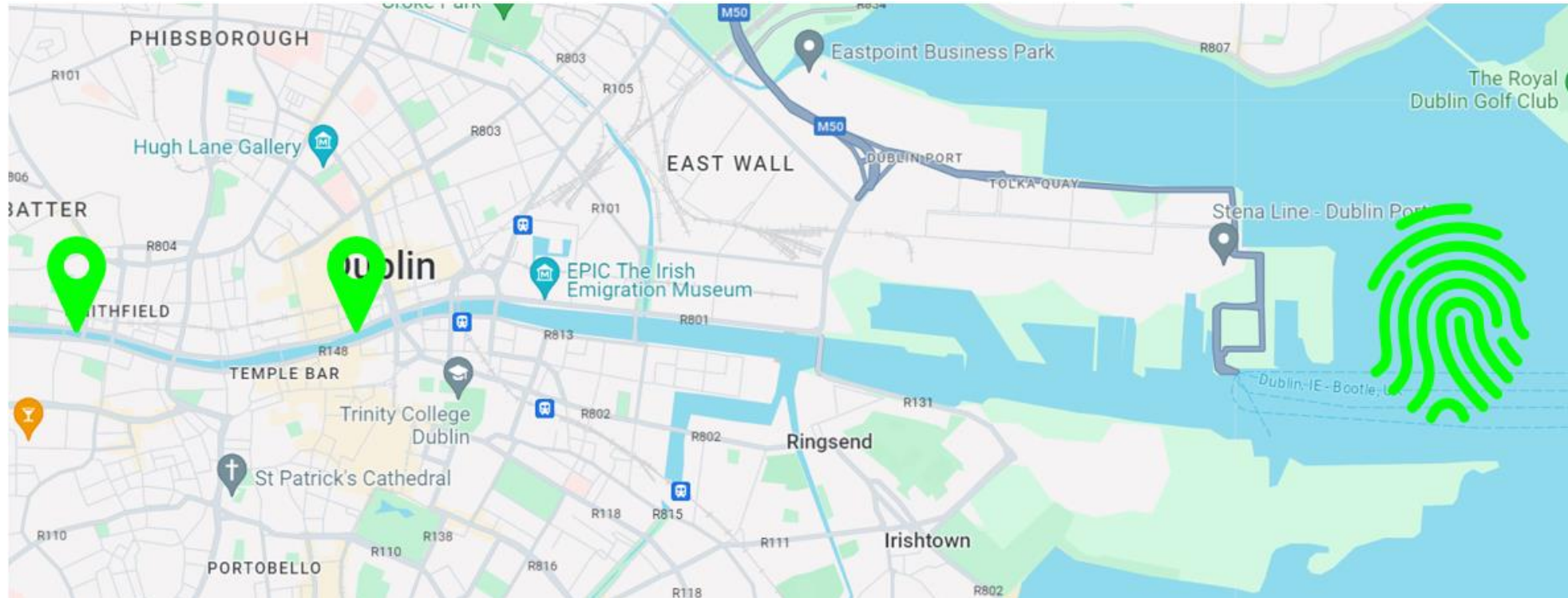
## Legislation

- POPs Regulation
  - PFOS, PFOA, PFHxS restricted
  - C9 – C21 PFCAs
- EU Commission
  - Proposed 24 PFAS substances for surface and ground water
- Drinking water directive (EU 2020/2184)
  - Total PFAS (0.5 µg/l)
  - Sum of PFAS (0.1 µg/l)



# Objective

- An **INVEST**igation of PFAS - to inform **PFAS S**Tategy in Ireland
- Analyse PFAS pollution in transitional and marine waters



# QQQ Method

## Equipment

### Avoid

- ✗ PTFE (Teflon)
- ✗ FEP (Teflon FEP, Hostafion FEP, Neoflon)
- ✗ PFPE
- ✗ Latex gloves

### Instead use

- ★ HDPE
- ★ PP
- ★ LDPE (Ziploc)
- ★ Powderless nitrile gloves

## Clothing

### Avoid

- ✗ Water/stain/grease resistant coatings



### Instead use

- ★ Natural fibres
- ★ PFAS free synthetic materials
- ★ Neoprene
- ★ PVC, wax coated materials

## Other

⚠ Food packaging

⚠ Aluminium foil

⚠ Insect repellent

⚠ Sunscreens



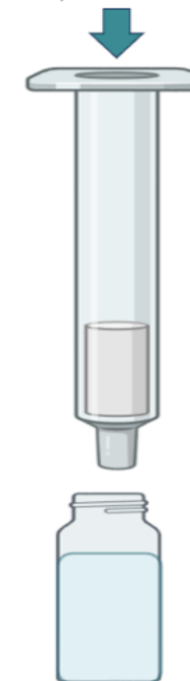
★ 250 – 1000 ml

★ Field Blanks



## Condition

- 1) 5 ml 0.5% ammonia/MeOH
- 2) 5 ml MeOH
- 3) 5 ml Ultrapure water



## Load

### Sample



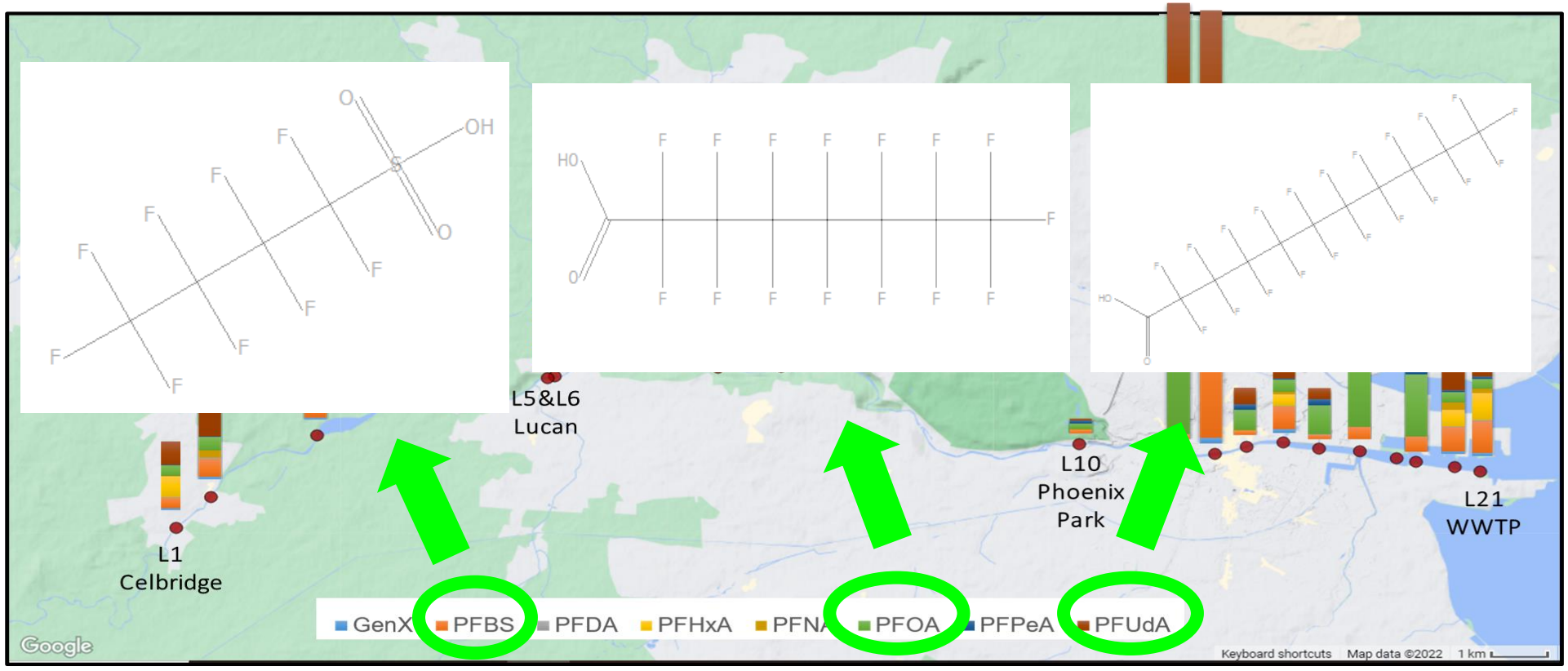
Michigan Department of Environment, Great Lakes and Energy. General PFAS Sampling Guidance, January 2024.

Glüge, J., Scheringer, M., Cousins, I.T., DeWitt, J.C., Goldenman, G., Herzke, D., Lohmann, R., Ng, C.A., Trier, X., Wang, Z., 2020. An overview of the uses of per- and polyfluoroalkyl substances (PFAS). Environ. Sci.: Processes Impacts 22, 2345–2373.

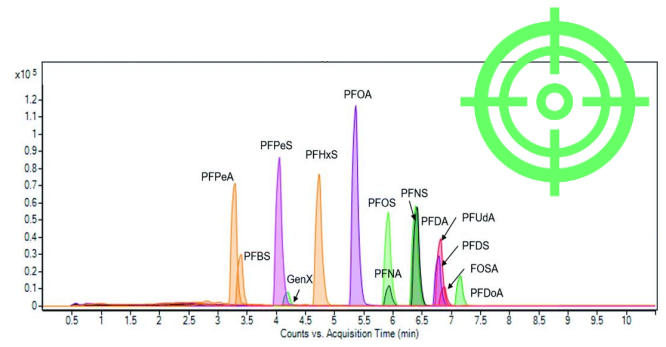


# Initial Findings

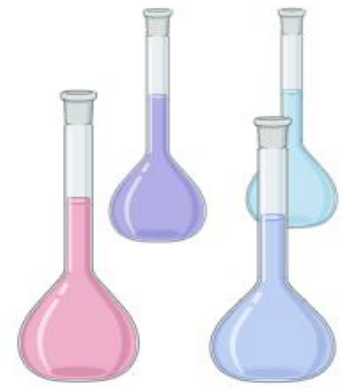
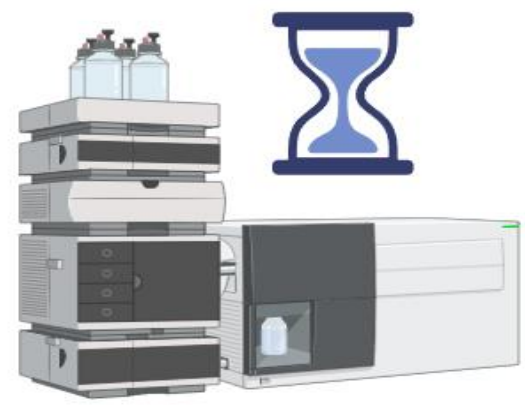
Targeted method LC-QQQ-MS – 15 compounds



# Initial Findings



Target Analysis



# Method Development – QQQ vs QTOF

◆ Low resolution MS → PFOA m/z = 413

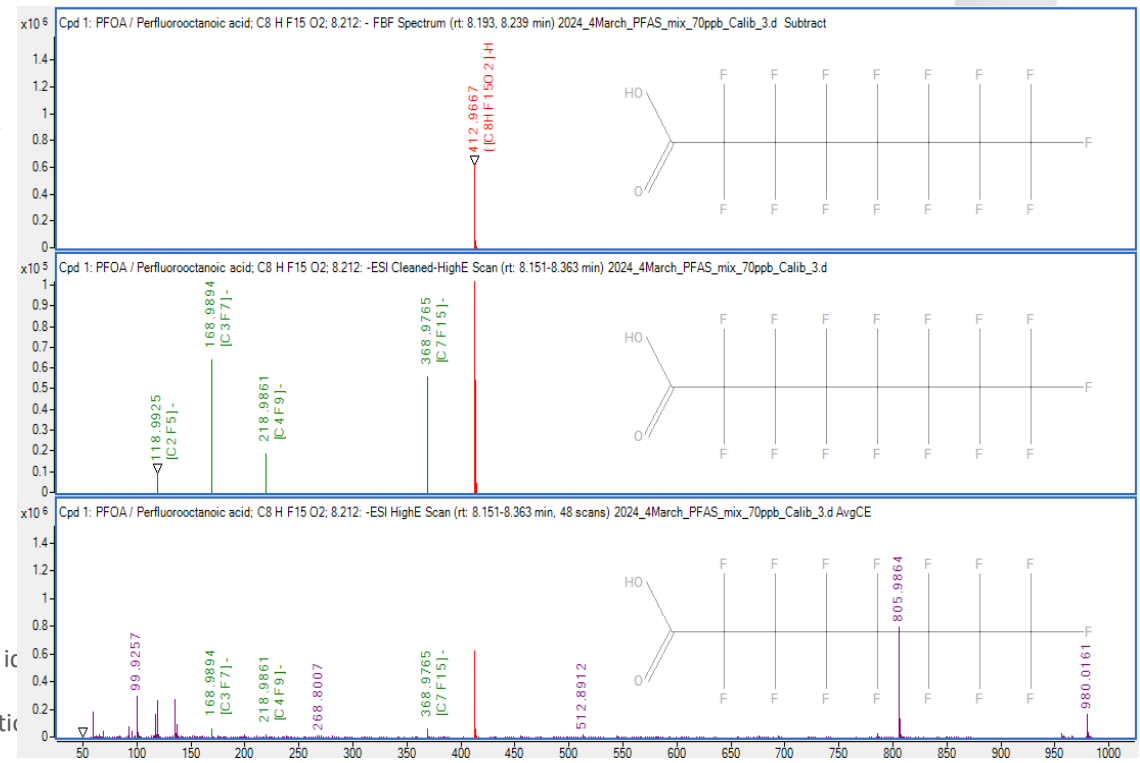
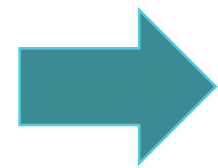
◆ MRM mode

Specific product mass selected

◆ High resolution MS → PFOA m/z = 412.9667

◆ Full scan mode

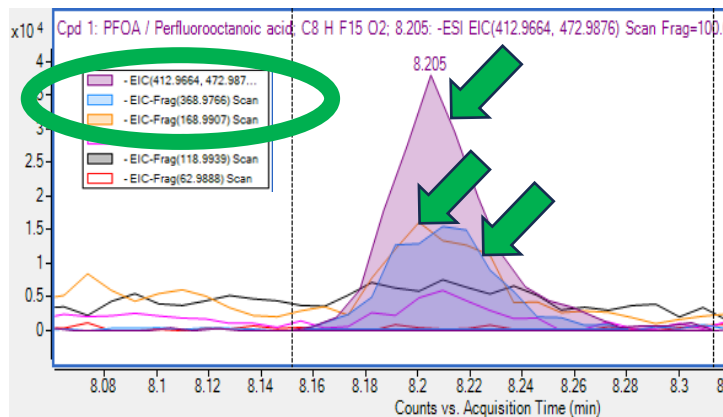
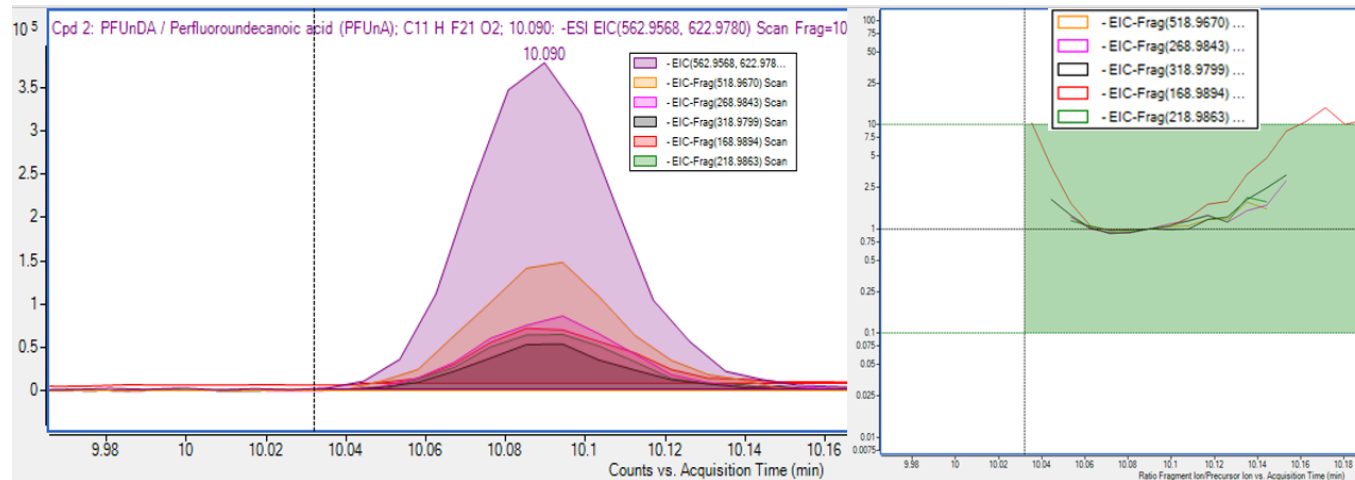
Scans for a range of ions



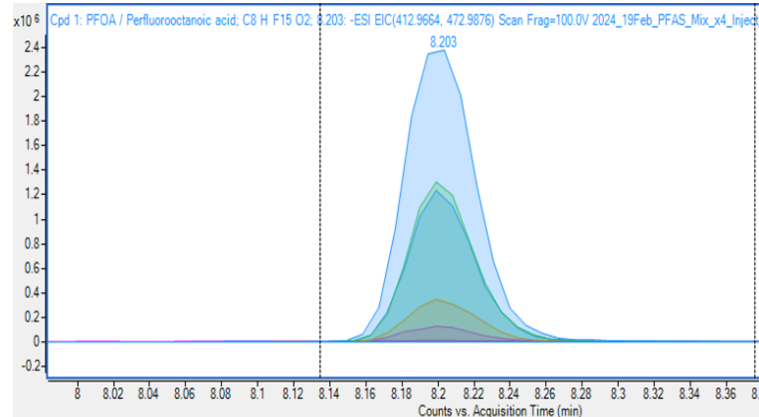
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# All ions workflow optimisation

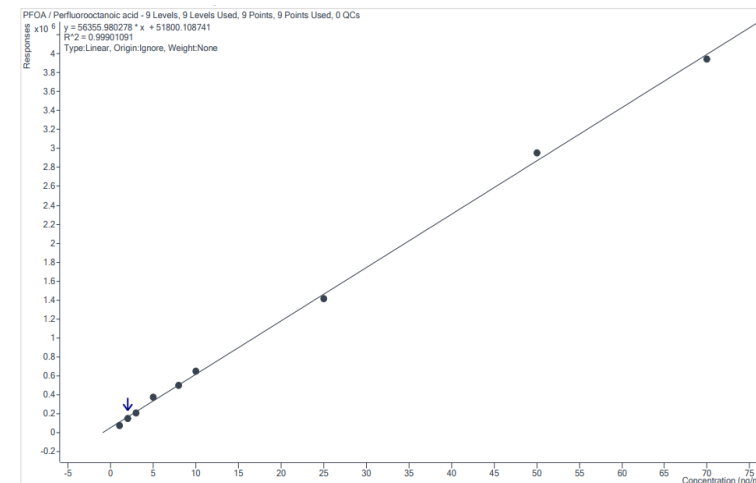
- Cycling collision energies
- Injection volume
- Quantification



5 µL injection of 1ppb standard



5 µL injection of 100ppb standard



# Conclusion

- **PFAS exist in the Irish environment**
- **Targeted methods are suitable for legislation purposes**
- **Shift towards untargeted analysis is necessary to gain full understanding of PFAS pollution in Ireland**
- **Marine waters are representative of the city's PFAS use**

# Acknowledgements

Dr. Belinda Huerta

Dr. Enrique Jacobo Diaz-Montaña

Leila Bowe

Prof. Fiona Regan

