Chemicals in Water

Alan Stephens

15th June 2023 Water Conference Galway

Man-Made Chemicals

Great advances since 1950s in food production, medicines, cosmetics, paints, textiles, ..

Unintended impacts –DDT, Mercury, CFCs, asbestos, PCBs

- Control of chemicals
  - Legislation - REACH, POPs, PPP, DW, WFD EQSs
  - Regulators - FSAI, Dept. of Ag, EPA
- Persistent, Bioaccumulated & Toxic (PBTs)

Chemicals in Water

Monitoring of Irish waters

- Uisce Eireann, NFGWS – Drinking water supplies & sources –Pesticides - MCPA, 2,4-D, Glyphosate, Metals – Lead
- Water Framework Directive Priority Substances Monitoring Programme
  - EPA with LAs, MI, IFI and State Lab
  - 20% of surface waters monitored (rivers, lakes, estuaries & coastal waters)
  - Analysis of water and fish (biota) samples
  - 48 PSs with Environmental Quality Standards (EQSs) & other substances
  - Chemical Status (Good/failing to achieve good)

5.4 Chemical Status of Surface Waters

Of the 349 water bodies that were assessed for chemical status, 173 (50%) failed to achieve good chemical status due to one or more EQS failure (Figure 5.1). If the failures for ubiquitous substances are removed, then a total of 41(12%) of water bodies failed to achieve good chemical status (Figure 5.2).

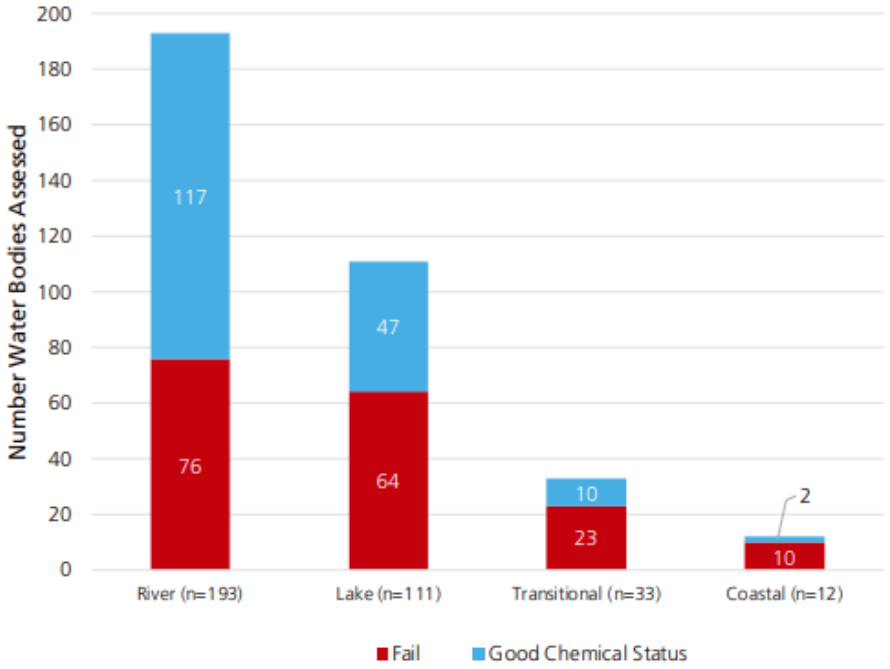


Figure 5.1 Chemical status of assessed water bodies in each water category (includes ubiquitous substances)

Legacy Chemicals

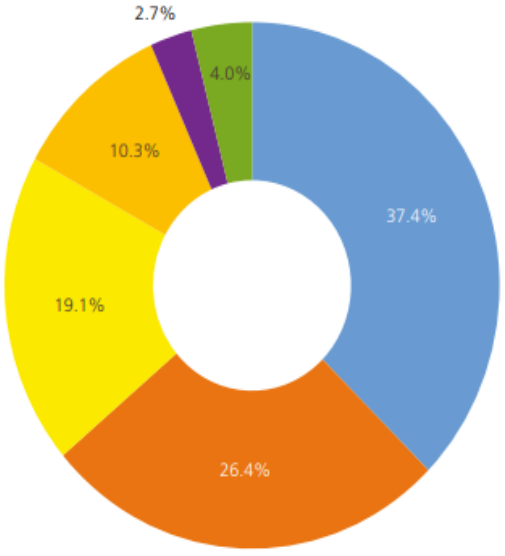


Figure 5.3 Percentage of EQS failures by priority substance

Poly Aromatic Hydrocarbons (PAHs)

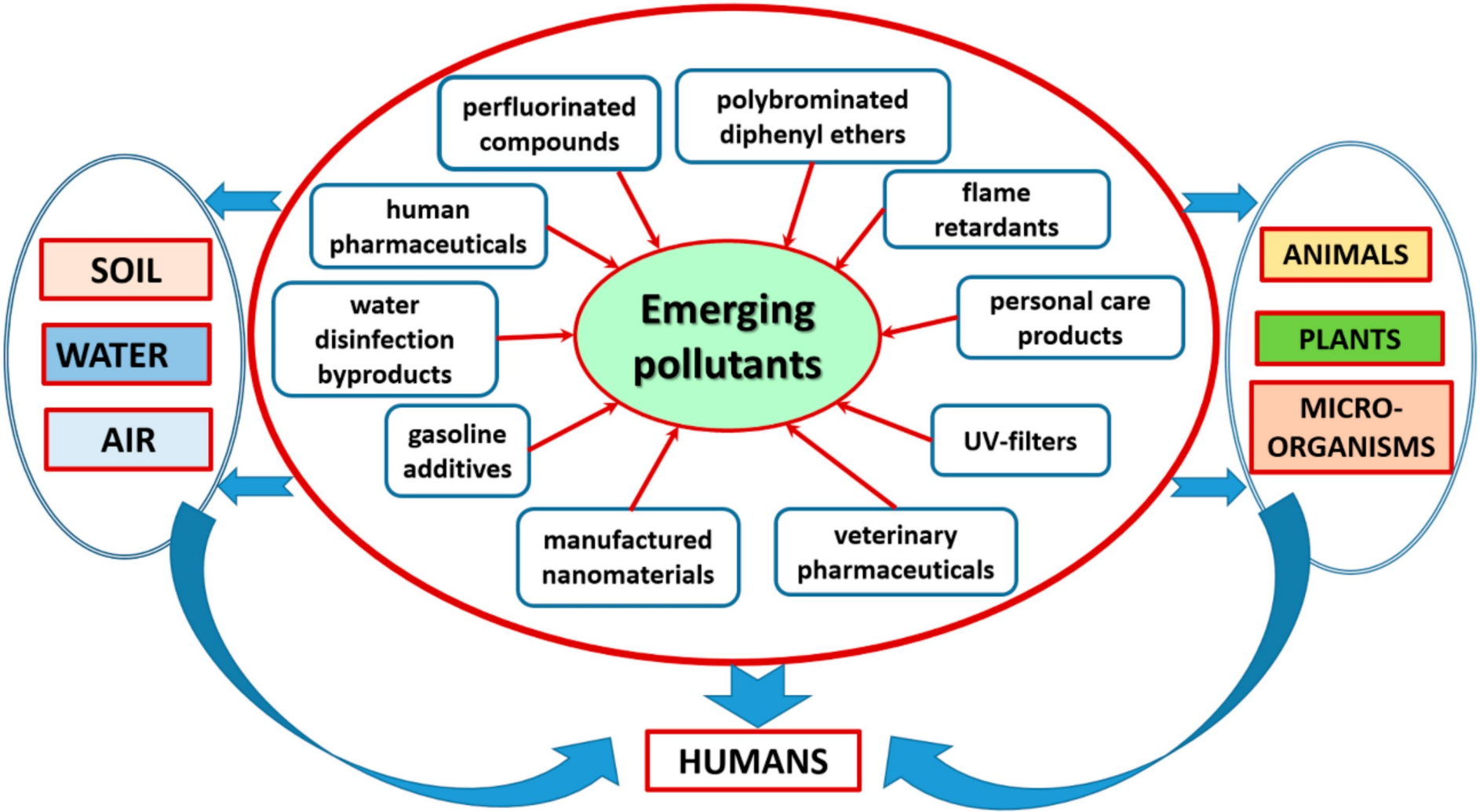
– 37% of Chemical Status failures

Metals – Mercury, Cadmium & Lead

– 26% of failures

Poly Brominated Di-phenyl Ethers (PBDEs)

– 19% of failures

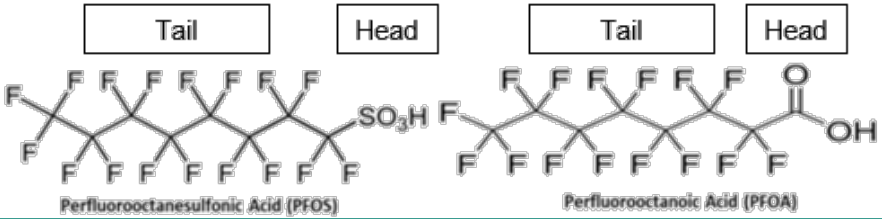

perfluorinated compounds
polybrominated diphenyl ethers
human pharmaceuticals
flame retardants
water disinfection byproducts
Emerging pollutants
personal care products
gasoline additives
UV-filters
manufactured nanomaterials
veterinary pharmaceuticals
SOIL
WATER
AIR
ANIMALS
PLANTS
MICRO-ORGANISMS
HUMANS

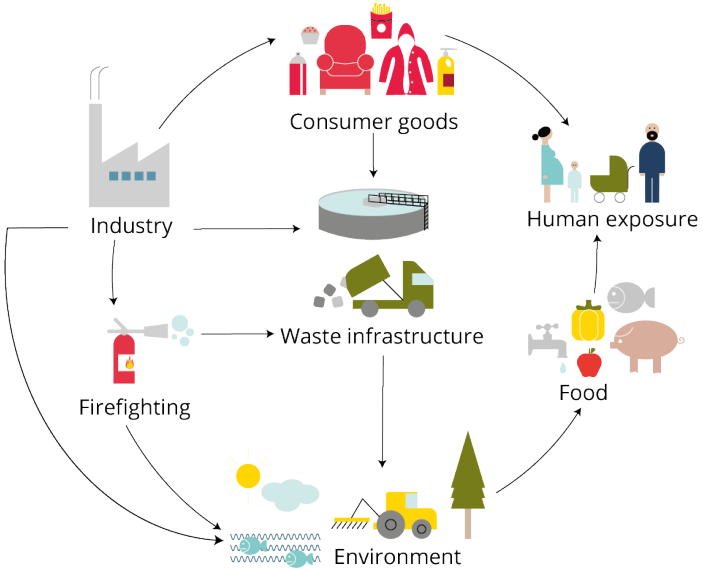
PFAS

3% of EQS failures due to PFAS

Per- and Poly-fluoroalkyl substances (PFAS)

- large group of man-made chemicals
- Used in industrial and consumer products since the 1950s
- Uses include repelling water and oil, thermal and chemical stability, and surfactant properties



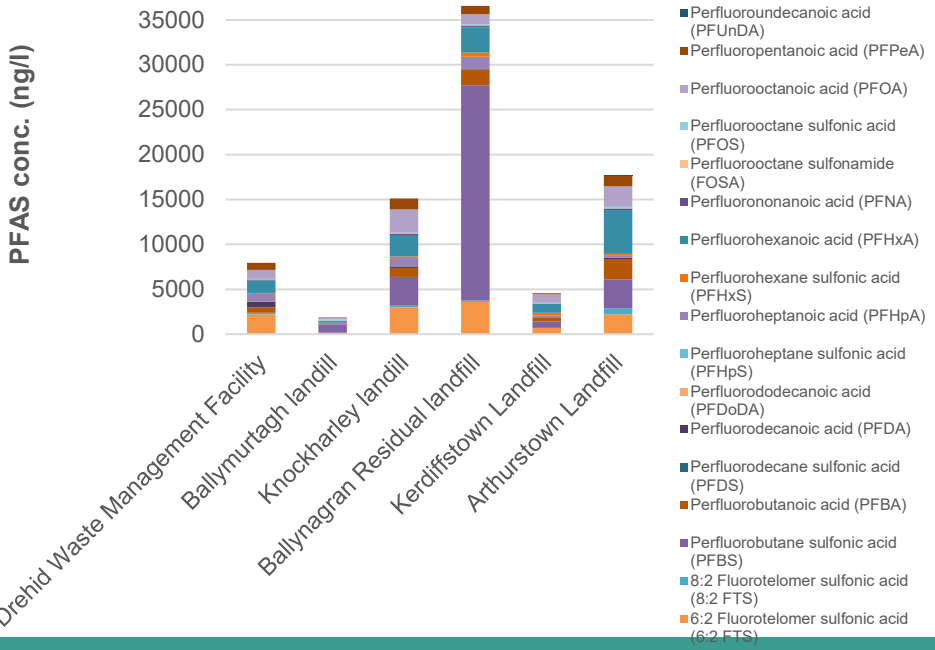


PFAS Monitoring

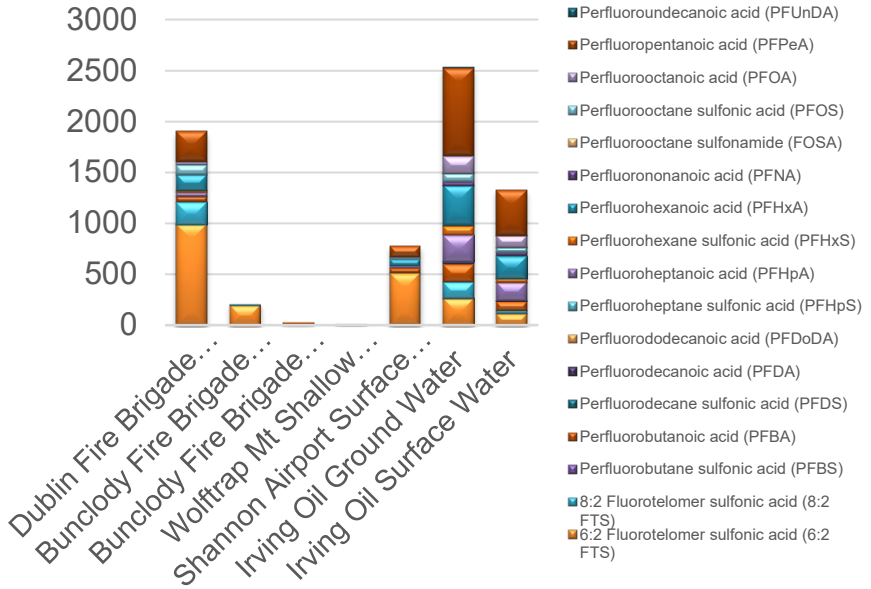
- 2021/2022 POPs ‘hotspot’ campaign monitored River Shannon and River Brosna
- PFOA ranging from 0.010 – 0.045 µg/l detected in River Brosna
- Investigation on going by Westmeath County Council in coordination with EPA.
- Uisce Eireann also made aware of these detects

PFAS Studies – Landfill and Fire Stations

PFAS conc. (ng/l) detected in leachate samples (Fuel Research Project 2020)



PFAS conc. (ng/l) detected in water samples (POPs Hotspot Study 2020)



Cypermethrin

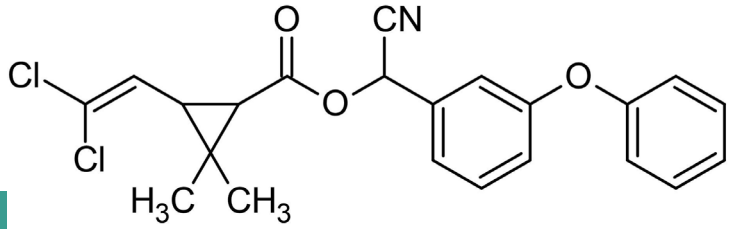
3% of EQS failures due to Cypermethrin

Cypermethrin was commonly used insecticide used in agriculture (sheep dip) and forestry (pine weevil control).

Low toxicity for mammals and birds

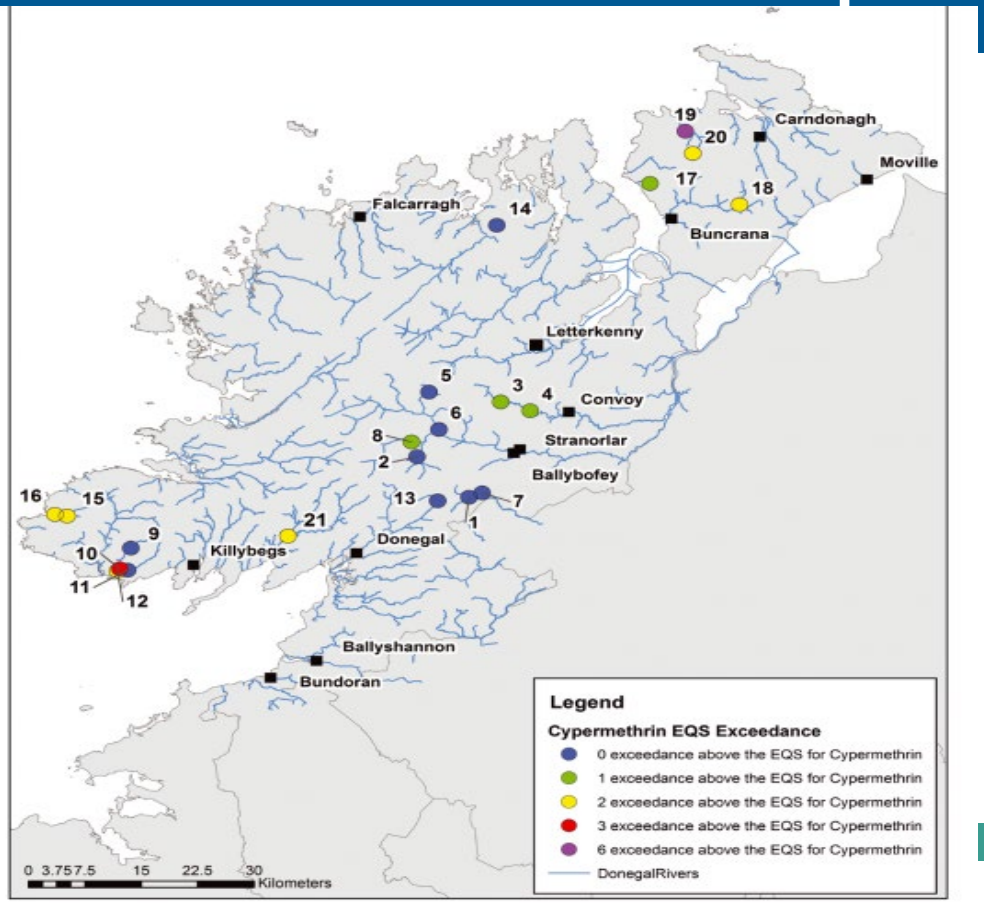
Invertebrates and fish are highly sensitive to cypermethrin

Very damaging to aquatic ecosystems



Cypermethrin Monitoring in Donegal 2020

- The number of macroinvertebrate species being recorded in some rivers in Donegal was so greatly reduced that a toxic chemical effect was suspected.
- The results showed widespread detection of cypermethrin, with 26% of results showing levels above the surface water annual average EQS (0.00008ug/l).



What's next?

- EU Green deal & Zero Pollution Action Plan
- Stop use of some chemicals
- Better design and mngt. of new chemicals
- New PSs with EQSs
- Programme of Measures to eliminate EQS failures
- More screening for & targeted monitoring of PSs

24 New candidate PS for the proposal WFD

PPPs and biocides (12)	Pharmaceuticals (9)	Industrial chemicals (2)	Metals (1)
Acetamiprid	Estrone (E1)	Per- and polyfluoroalkyl substances (PFAS) (24)	Silver
Clothianidin	17-beta-estradiol (E2)		
Imidacloprid	Ethylestradiol (EE2)	Bisphenol A	
Thiacloprid	Azithromycin		
Thiamethoxam	Clarithromycin		
Bifenthrin	Erythromycin		
Deltamethrin	Carbamazepine		
Esfenvalerate	Ibuprofen		
Permethrin	Diclofenac		
Nicosulfuron			
Glyphosate			
Triclosan			

5 Neonicotinoids 5 Pyrethroids 3 Hormones 3 Antibiotics Group of 24 PFAS

European Commission