REGIONAL EXPOSURE ASSESSMENT OF METALS IN THE AQUATIC FRESHWATER ENVIRONMENT – SEDIMENT COMPARTMENT

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Setting the scene

The **update of regional metal concentration levels in the aquatic environment - sediment compartment** is part of Eurometaux's currently ongoing comprehensive **"Metals environmental exposure gathering program" (MEED-program).** This program accounts for both current and anticipated future requirements to comply with the Zero Pollution Ambition and biodiversity objectives. The Green Deal will likely increase the volumes of certain metals significantly for uses related to digitalisation and decarbonisation while at the same time more stringent legislation and the improvement in emission abatement techniques will mitigate the expected higher emissions. Measured regional metal concentrations are used to derive exposure scenarios under the REACH umbrella. **As environmental release rates of metals are expected to vary over time due to new applications and changing volumes, previously collected regional ambient concentration levels** (data 2000-2004) **may no longer be relevant** for the current situation. As sediments are quite often a sink for metals, the main aim of the current study was to derive more recent relevant metal concentrations for this compartment that can be used to update the REACH dossiers.

Methodology

Data sources

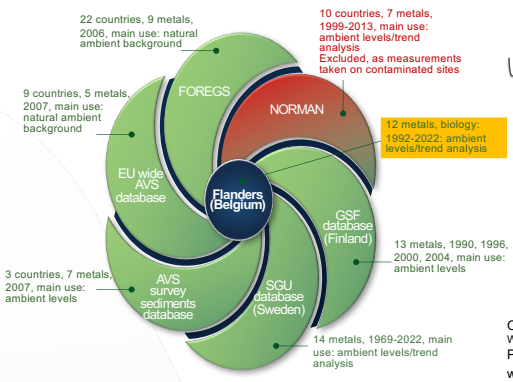
The challenge – data collection

- **Biased concentrations**: Measurements are often taken locally at contaminated sites
- **No** centralized European Union (**EU**) **database**
- Metals in sediment are **not part of most countries' regulatory-based monitoring programs**

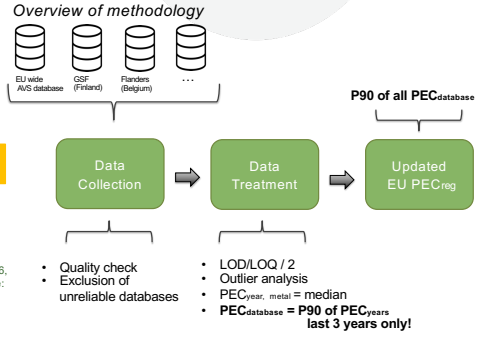
Tailor-made approach was needed

Personal communication, national websites, publications

Overview of databases



Overview of methodology

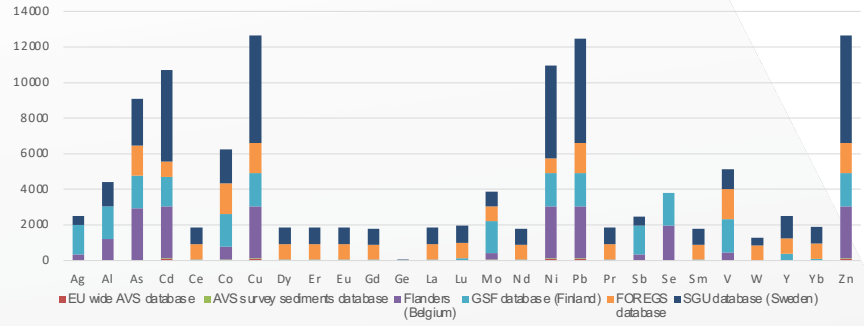


Outlier analysis according to: log(Xi) > log (P75) + K(log(P75) – log(P25)
With *Xi = measured concentration and K = 1,5 (scaling factor)*
Pragmatic approach: removal of outliers > cut-off value is only considered when P75 percentile > relevant reported LOQ/2.

Results

Frequency of metal measurements in the investigated databases

As expected, the usual suspects — As, Cd, Cu, Ni, Pb, and Zn — were most often studied.

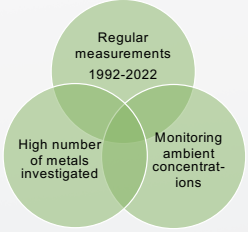


Metal	Range PEC$_{databases}$ mg/kg dw	Derived PEC$_{reg,sed}$ mg/kg dw
Ag	0.1 - 0.7	**0.62**
Al	10633 - 21285	**19510**
As	5.8 – 9.7	**9.61**
Cd	0.1 - 1.5	**1.16**
Ce	43.6 - 62.21	**62.21**
Co	5.6 – 34.2	**28.04**
Cu	0.43 – 50.25	**40.20**
Dy	3.95 - 4.53	**4.53**
Er	1.85 - 2.7	**2.70**
Eu	0.71 - 0.96	**0.96**
Gd	4.51 - 5.0	**5.00**
Ge	3.16	**3.16**
La	26.39 - 30.44	**30.44**
Lu	0.41 - 0.49	**0.49**
Mo	0.5 – 3.4	**3.24**
Nd	26.32 - 27.11	**27.11**
Ni	6.4 – 32.9	**28.25**
Pb	6.0 – 61.6	**48.95**
Pr	5.89 - 6.87	**6.87**
Sb	0 .03 – 1.9	**1.76**
Se	1.0 – 1.8	**1.79**
Sm	4.84 - 5.27	**5.27**
V	28.4 – 71.4	**65.71**
W	1.3 – 9.3	**9.30**
Y	24.64 - 25.2	**25.20**
Yb	1.98 - 2.64	**2.64**
Zn	28.1 – 141.3	**129.73**

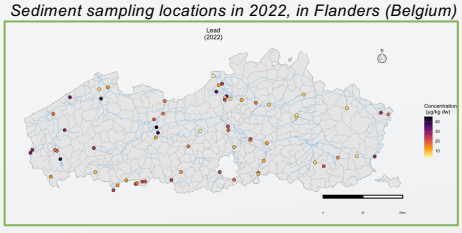
Outcome of the data treatment: Ranges of metal concentations in the different databases and newly derived PEC$_{reg,sed}$ values

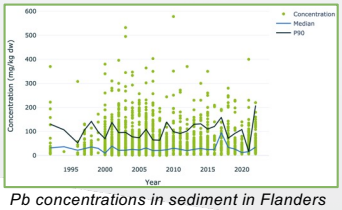
Case study: temporal trend analysis of metal concentrations

Flanders (Belgium)



Sediment sampling locations in 2022, in Flanders (Belgium)





Pb concentrations in sediment in Flanders (Belgium), 1992-2022

- **The Flemish (Belgian) database was chosen for temporal trend analysis** due to its extensive historical record of high-quality data on various metals.
- An example is provided for Pb.
- Sampling locations are depicted on the map of Flanders.
- Concentrations were analysed over the years.
- No temporal variability is observed for Pb.
- Similar findings were noted for all other metals; **no trends were identified.**

Conclusion

- **The span in concentration ranges** found in the different databases **are relatively small** for all metals, confirming high level of accuracy.
- **No down/upward temporal changes** of metal concentration levels were noted for a 30-year period (1992-2022) based on case study on the Flemish (Belgian) database.
- **The updated ambient PEC$_{reg,sed}$** will **improve the quality** of the **regional exposure assessment** and **exposure scenarios** in which they are applied.