

Framework for Environmental Risk Assessment of Water-Resource-Based Bio-composite material



Arianna Nativio
dr. Oriana Jovanovic
Prof. dr. Zoran Kapelan
Prof. dr. ir. Jan Peter van der Hoek

Introduction

Materials & Methods

- Environmental Risk Assessment
- Laboratory leaching tests
- Simulation of real case scenarios

Results & Conclusion



Introduction: Wider Uptake of Water-Smart Solutions

MISSION: Facilitation of the industrial symbiosis to increase resource efficiency, limit emissions and develop a sustainable business based on water-smart solutions, by overcoming barriers that are not only technological but also organizational, regulatory, social and economic.

Partners:

- **11 Water Utilities and Industries**
- **7 Research Institutions:** SINTEF, NTNU, TU Delft, CVUT, VSCHT, UNIPA, CSIR-GH
- **5 Countries:** Netherlands, Norway, Czechia, Italy, Ghana
- **Dutch case study:** Production of new type of bio-composite materials made from water-recovered-resources

www.wider-uptake.eu

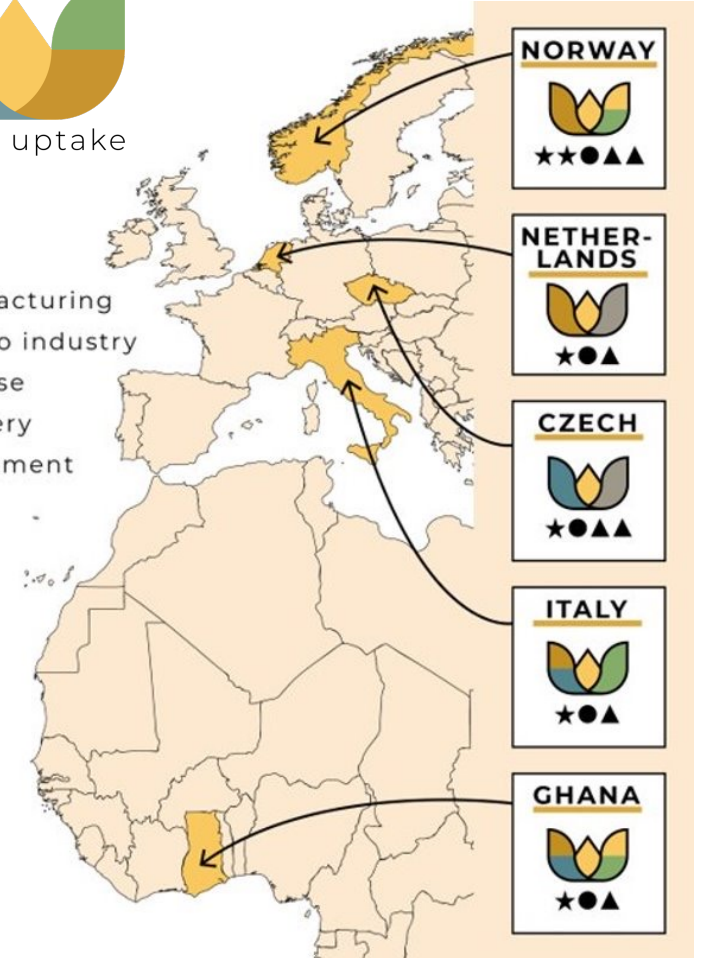


[linkedin.com/company/wideruptakeeu](https://www.linkedin.com/company/wideruptakeeu)



wider uptake

- Agriculture
- Building/manufacturing
- Energy supply to industry
- Wastewater reuse
- Resource recovery
- Industry involvement
- ★ Water utilities
- ▲ R&D Partners



Introduction: Bio-Composite Materials

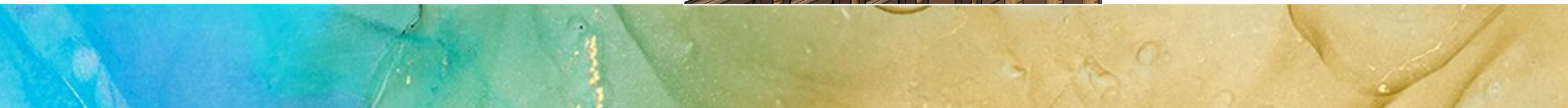
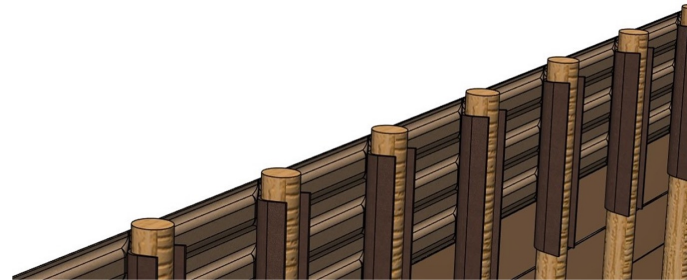
Bio-composite materials made from water resources

M1	M2	M3	M4
Water Reed	Water Reed	Wastewater cellulose	Water Grass
Mined calcite	Calcite mix (Mined and DW Calcite)	Calcite mix (Mined and DW Calcite)	Bio-filler from agri-waste
Unsaturated polyester resin (100% synthetic)	Unsaturated polyester resin (50% bio-based content)	Unsaturated polyester resin (50% bio-based content)	Furan resin
Additives	Additives	Additives	Additives



Introduction: Applications of Bio-Composites

Application in surface water: canal bank protection and water level scale



Introduction: Objective of the Study



New risk assessment framework for the production and application of a new type of bio-composite materials

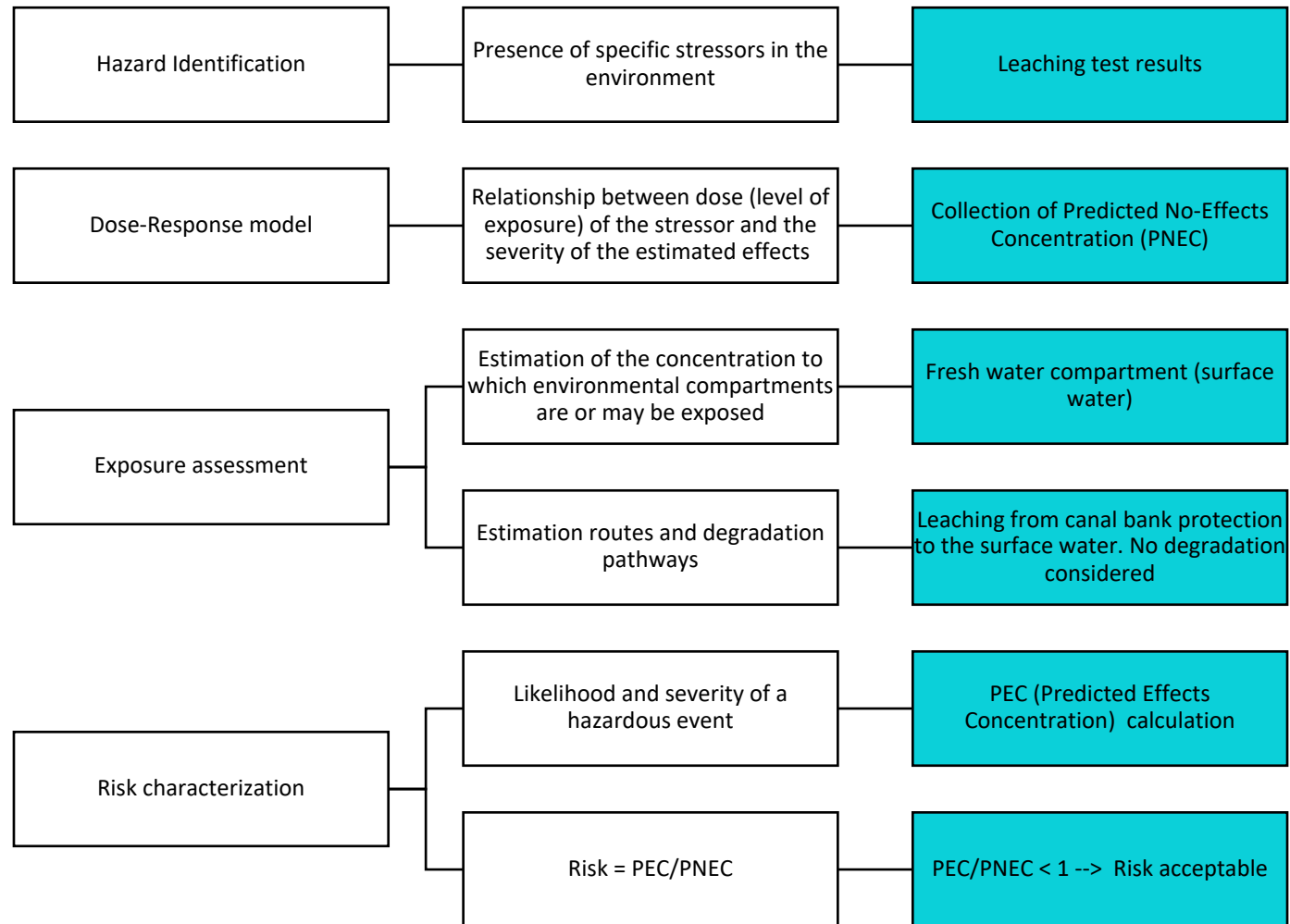


Human Health risks
Environmental risks

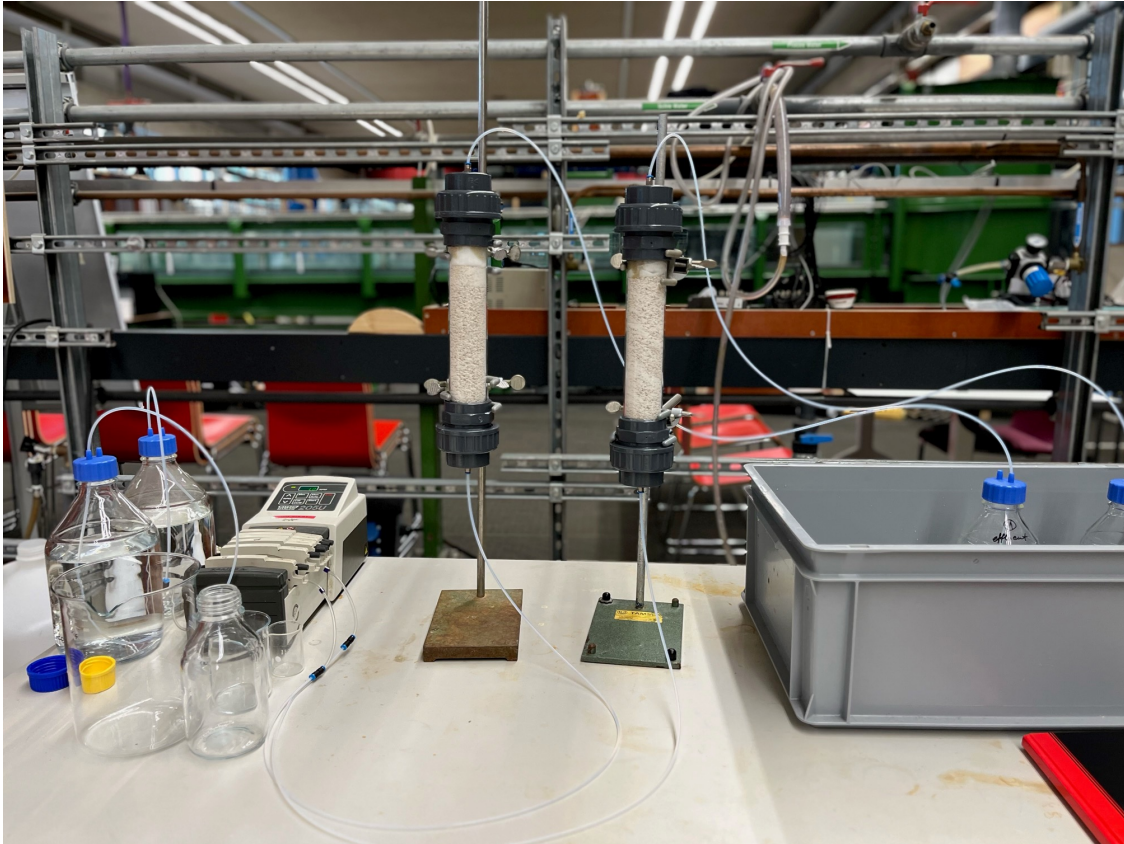


Bio-composites used as canal bank protection on surface water

Materials & Methods: Environmental Risk Assessment Framework



Materials & Methods: Laboratory Leaching Tests



Column percolation test (USEPA 1314)

Scope: potential leaching in surface water of toxic substances

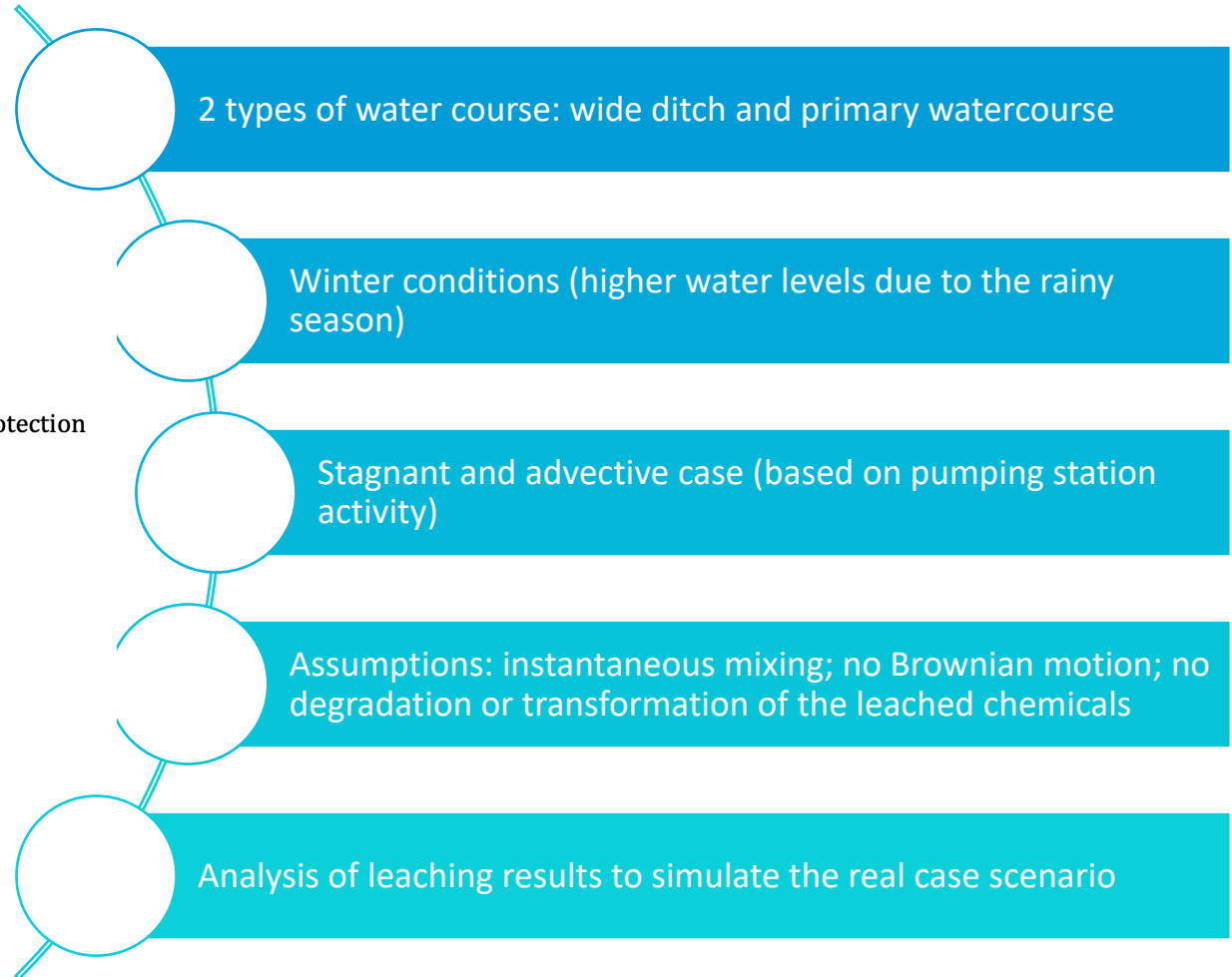
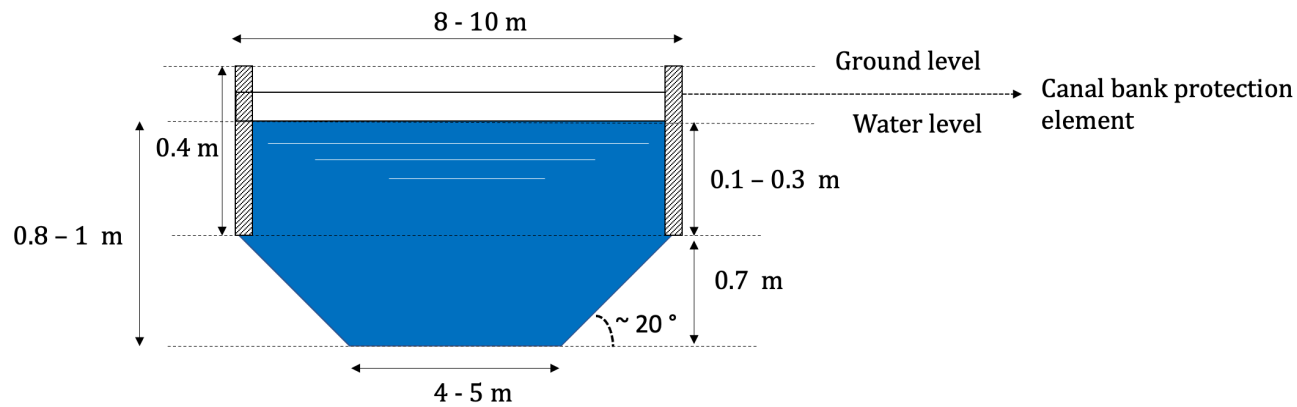
Absence of field data: Leaching test results used to simulate the real case scenario

300 gr grinded materials of size up to 4 mm; $Q = 9 \text{ ml/h}$;
Buffered influent $\text{pH} = 7.00$

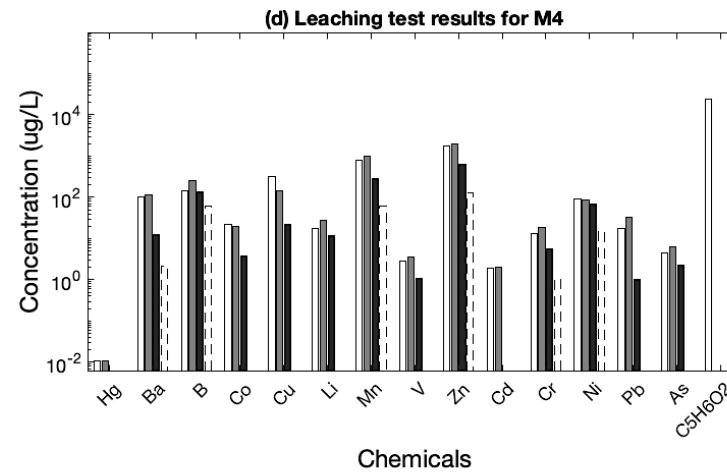
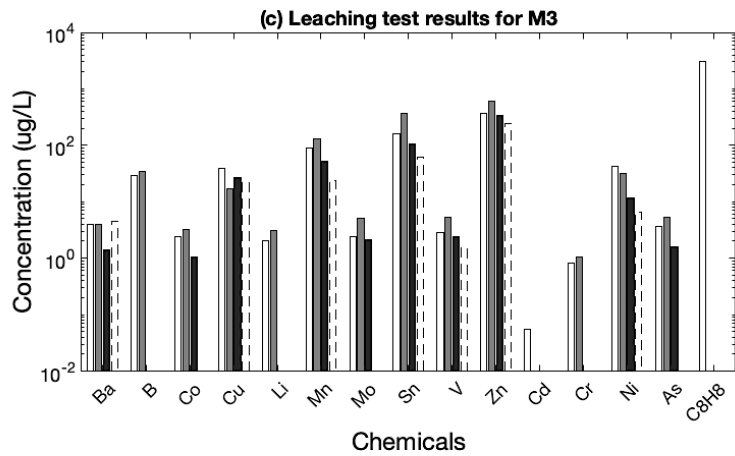
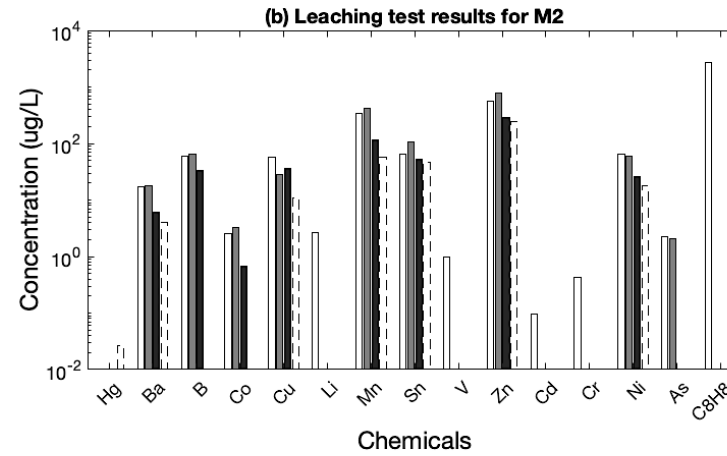
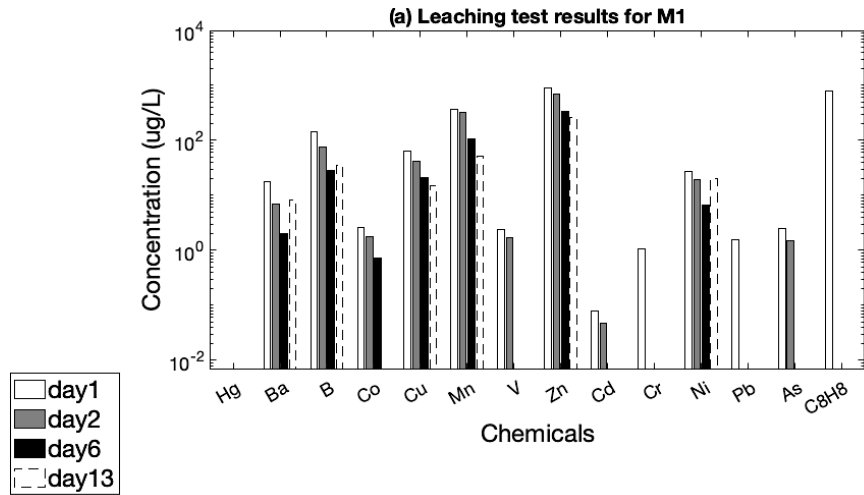
ICP-MS analysis for heavy metals: Hg, Ba, B, Co, Cu, Li, Mn, Mo, Sn, V, Zn, Cd, Cr, Ni, Pb, As [$\mu\text{g/L}$]

GS-MS analysis for Styrene [$\mu\text{g/L}$]; HPLC for Furfuryl Alcohol [mg/kg]

Materials & Methods: Simulation of a Real Case Scenario



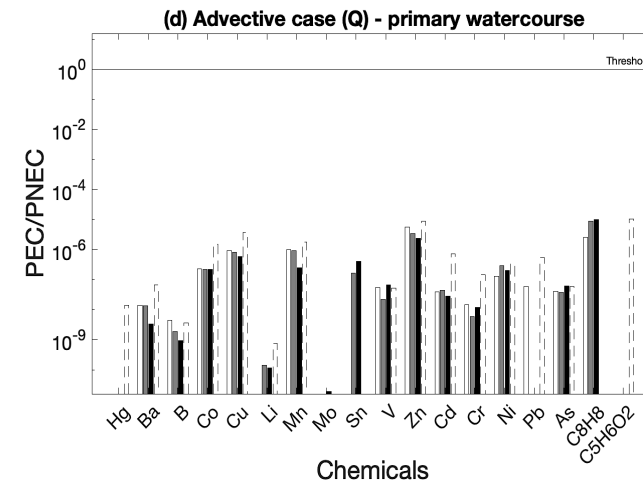
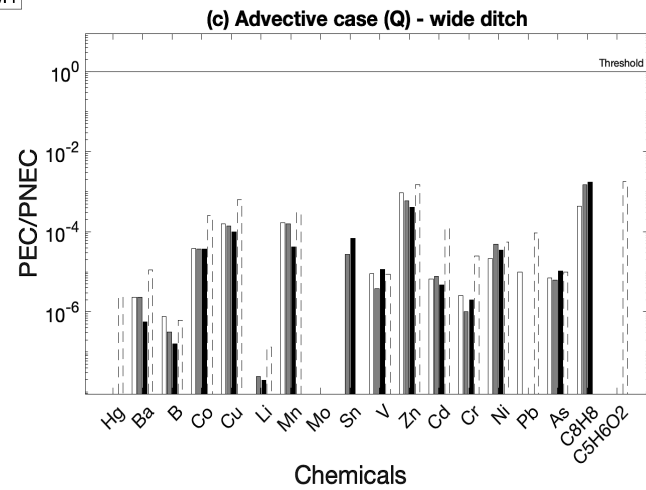
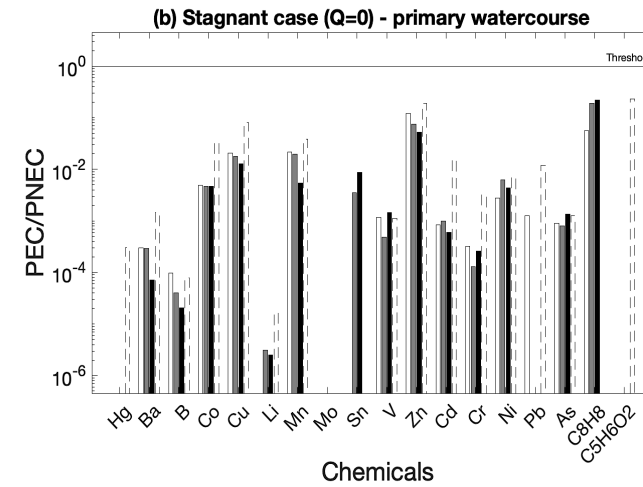
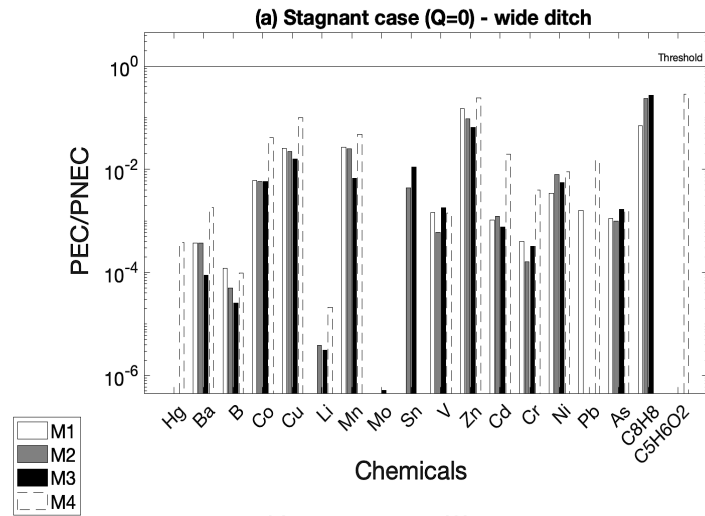
Results: Leaching Test Results



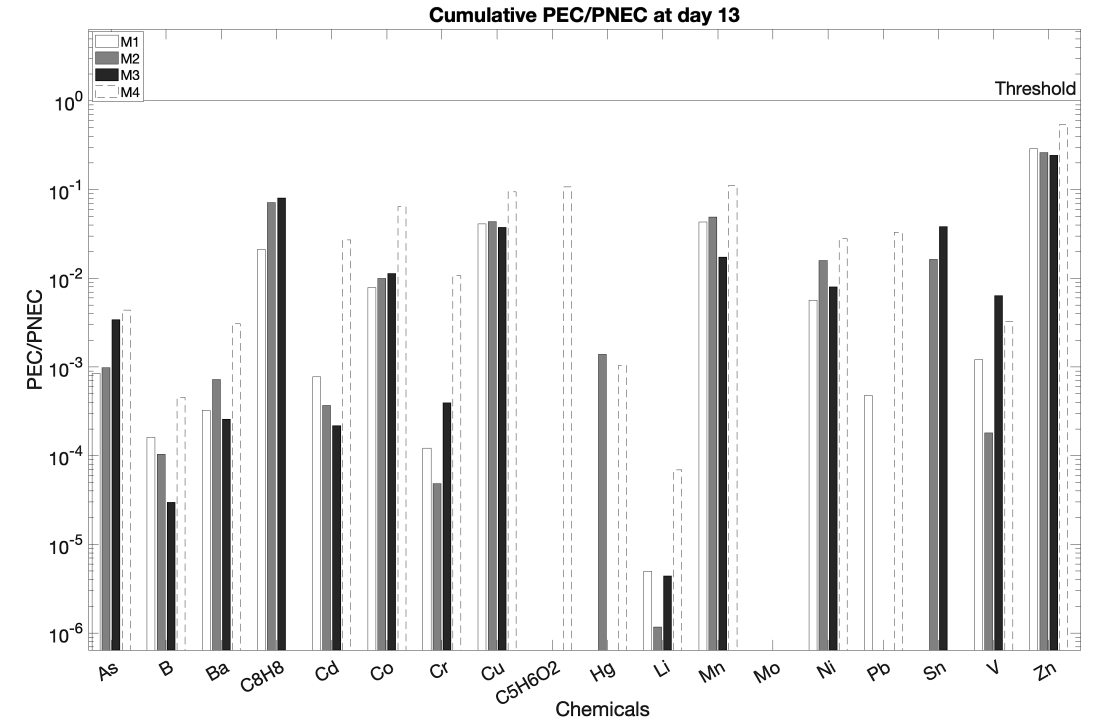
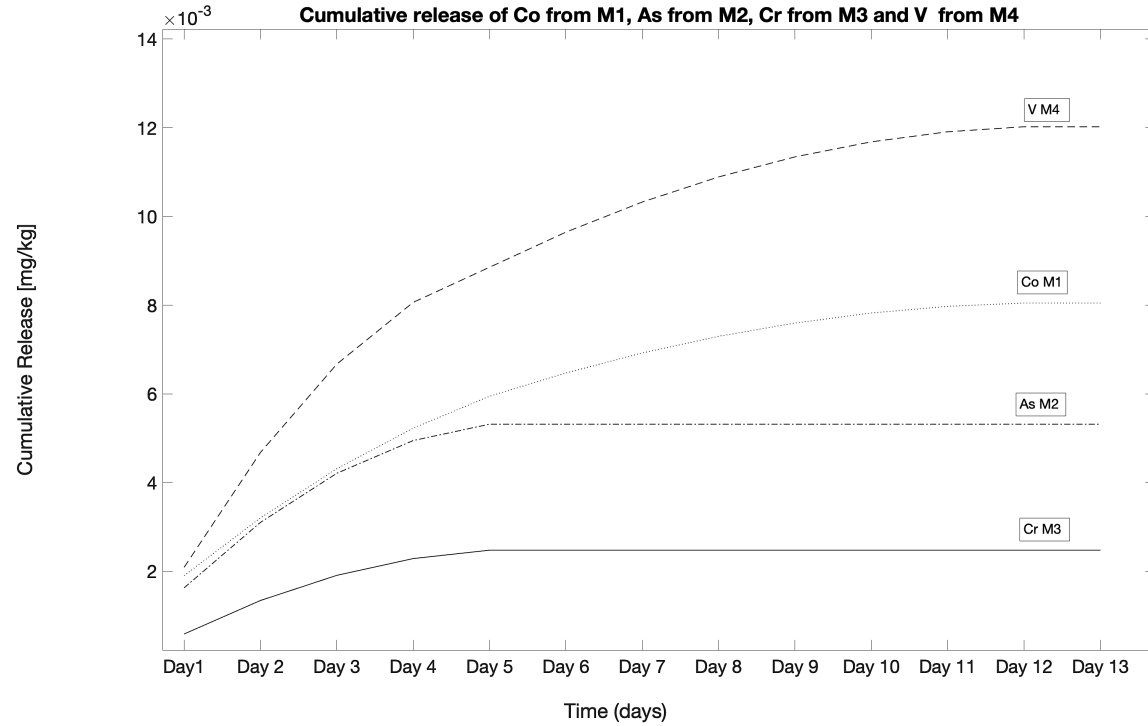
C_3H_8 (Styrene)	Percentage release
M1	0.000425%
M2	0.00204%
M3	0.0022%



Results: Environmental Risk



Results: Environmental Risk



Conclusions

Worst case scenario defined for wide ditch under stagnant conditions

PEC/PNEC below the threshold in all scenarios simulated

Leaching behaviour influenced by several factors

- Age of material influenced the leaching
- Physical properties of leached
- Initial Chemical Content

Future research: on-site data

- Considering the fate of chemicals: redox (oxidants formation), bio-transformation, degradation pathways
- Verification of the actual environmental risk based on on-site conditions

Thank You for Your Attention

This work is part of the project WIDER UPTAKE (www.wider-uptake.eu). This project has received funding from the European Union's Horizon 2020 research and innovation programme under grant agreement No. 869283. This presentation reflects only the author's view, the Commission is not responsible for any use that may be made of the information it contains.

