LRI ECO66: NEXT GENERATION RISK ASSESSMENT METHODS SUPPORTING THE IDENTIFICATION OF ENVIRONMENTAL CO-EXPOSURES OF POTENTIAL CONCERN

Background

Science and policymakers have been seeking ways to address potential risks from combined exposure to multiple chemicals, recognizing that humans and the environment come into continuous contact with chemical mixtures, not single substances. Advances in analytical methods have resulted in the inclusion of a growing number of analytes in environmental monitoring programs thus supporting the characterization of environment co-exposure. At the same time, the ubiquitous identification of co-exposures raises concern about their potential risk to biota. The lack of clear insights to support co-exposure management contributed to the recent proposal for a generic Mixture Assessment

Factor (MAF) for application under the REACH regulation, which is not fit for purpose in the management of co-exposures of environmental relevance.

Decision trees, such as the LRI-funded Cefic MIAT[1] decision tree, support the analysis of a wide diversity of co-exposure datasets. Case studies evaluating the risk of co-exposure to humans or the environment have successfully demonstrated that only very few combined exposures are of potential concern and that only a few substances are typically responsible for observed or predicted effects (Price et al, 2012; Munz et al, 2017; Vallotton and Price, 2016; Covert et al, 2020). However, the scope of such analyses is restricted to the chemicals initially prioritized/included in the monitoring programs (often a snapshot in time) based on existing or emerging concerns for their hazard, and hence do not cover the entire chemical space of real-life co-exposures. Typically, studies focus on a subset of substances, as a comprehensive exposure characterization requires extensive resources (Munz et al, 2017). However, the analysis of large monitoring datasets has illustrated that the exposure is site-specific and strongly influenced by the local environment (urban vs rural), use pattern (based on human activity), wastewater management efficiency, as well as the potential presence of historical contaminants (Arche/Vito, 2021, Rodea-Palomares et al, 2023. Finally, monitoring approaches (grab vs flow proportional sampling) may provide some insights into the temporal scale. In summary, substances driving the co-exposure concern differ by region, land use, and time (seasonality, weather). This information is insightful in identifying the few chemicals of greater concern in the mixture and may support local management of co-exposure.

Approaches supporting proactive identification of substances and/or use patterns that would be required to inform the management of co-exposures across the EU are still in their infancy. Recent research performed under the auspices of the EU-funded SOLUTIONS project (van Gils et al., 2020) developed an unprecedented prospective risk assessment of thousands of chemicals, including chemicals regulated under the REACH legislation, plant protection products and pharmaceuticals. Van Gils et al. (2020) developed a material flow model to predict diffuse and point source emission to European freshwaters with daily and catchment spatial-temporal resolution (Posthuma et al., 2019; van Gils et al., 2020). Posthuma et al. (2019) used this model to predict, with daily resolution, the prevalence of concurrent chemical mixture risk for more than 1700 chemicals at the European scale. In their prospective risk assessment, Posthuma et al. (2019) found that […The top 15 ([chemicals]) explained nearly 99.5% of the mixture exposure effects, with <0.5% explained by the remaining 1745 compounds…].

[1] Mixtures Industry Ad-hoc Team

Objectives

The project's objectives are to develop a risk assessment model enabling the identification of priority co-exposure of substances in commerce and legacy pollutants at the watershed level to support efficient and targeted proactive management of co-exposures.

1. Advance predictive risk assessment models to characterize cumulative exposure representative of exposure in space and time for legacy chemicals and substances in commerce:
    1. Include use information from REACH and Cefic membership, PPP, Biocides etc. to inform exposure.
    2. Identify and incorporate information on exposure to legacy substances with respect to spatial distribution and exposure levels.
    3. Review sources of hazard information and evaluate the applicability of reference values for use in a tiered risk assessment approach, considering exposure may illustrate a snapshot in time (grab sampling) or reflect long-term exposure.
    4. Develop geographical-based models to support co-exposure management at the water catchment scale by the inclusion of spatial watershed modeling approaches (e.g., Geographic Information Systems)

2. Perform probabilistic Fate simulations to characterize the magnitude of co-exposures on subsets of chemicals based on tonnage and use patterns.
3. Explore methodologies to refine the spatial grid of the risk assessment and allow for inclusion of site-specific information (e.g. monitoring)

Scope

Environmental contaminants with likelihood of exposure in the environmental matrix, including industrial organic chemicals manufactured in the EU at present.

Out of scope (optional)

Microplastics

Deliverables

The final report shall contain an executive summary (2 pages max), a main part (max. 50 pages) and a detailed bibliography. It is expected that the findings will be developed into at least one peer reviewed publication, following poster(s) and presentation(s) at suitable scientific conference(s).

Partnering / Co-funding

Applicants should provide an indication of additional partners and funding opportunities that can be appropriately leveraged as part of their proposal. Partners can include, but are not limited to industry, government/regulatory organizations, research institutes, etc. Statements from potential partners should be included in the proposal package.

Fit with LRI objectives / Possible regulatory and policy impact involvements / Dissemination

Applicants should provide information on the fit of their proposal with LRI objectives and an indication on how and where they could play a role in the regulatory and policy areas. Dissemination plans should also be laid down.

DEADLINE FOR SUBMISSIONS: July 31st, 2024 at 11:59 PM.

Please see www.cefic-lri.org/funding-opportunities/apply-for-a-grant/ for general LRI objectives information, project proposal form and further guidance for grant applications.

Related links

Arche/Vito, Characterising Chemical Co-Exposures In The EU To Support a Combined Exposure Assessment Strategy. Report, 2021. I Microsoft Word - CEFIC-CoExposure_ARCHEfinal.docx (arche-consulting.be)

Covert, A., Shoda, M. E., Stackpoole S. M., Stone W. W. 2020. Pesticide mixtures show potential toxicity to aquatic life in U.S. streams, water years 2013–2017,Science of the Total Environment 745 (2020) 141285 https://doi.org/10.1016/j.scitotenv.2020.141285

Munz N.A. et al. 2017. Pesticides drive risk of micropollutants in wastewater-impacted streams during low flow conditions, Water Research, Volume 110, 2017, https://doi.org/10.1016/j.watres.2016.11.001

Posthuma, L., van Gils, J., Zijp, M.C., van de Meent, D., de Zwart, D. 2019. Species sensitivity distributions for use in environmental protection, assessment, and management of aquatic ecosystems for 12 386 chemicals. Environ. Toxicol. Chem. 38, 905–917.

Rodea-Palomares I., Gao Z., Weyers A., Ebeling M.. Risk from unintentional environmental mixtures in EU surface waters is dominated by a limited number of substances, Science of The Total Environment,Volume 856, Part 2, 2023, https://doi.org/10.1016/j.scitotenv.2022.159090

Price, P., Han, X., Junghans, M., Kunz, P., Watts, C., Leverett, D. 2012. An application of a decision tree for assessing effects from exposures to multiple substances to the assessment of human and ecological effects from combined exposures to chemicals observed in surface waters and waste water effluents. Environ. Sci. Eur. 24, 34. https://doi.org/10.1186/2190-4715-24-34

Vallotton, N., Price, P.S. 2016. Use of the Maximum Cumulative Ratio As an Approach for Prioritizing Aquatic Coexposure to Plant Protection Products: A Case Study of a Large Surface Water Monitoring Database. Environ. Sci. Technol. 50, 5286–5293. https://doi.org/10.1021/acs.est.5b06267 van Gils, J., Posthuma, L., Cousins, I.T., Brack, W., Altenburger, R., Baveco, H., Focks, A., Greskowiak, J., Kühne, R., Kutsarova, S., Lindim, C., Markus, A., van de Meent, D., Munthe, J., Schueder, R., Schüürmann, G., Slobodnik, J., de Zwart, D., van Wezel, A. 2020. Computational material flow analysis for thousands of chemicals of emerging concern in European waters. J. Hazard. Mater. 122655. https://doi.org/10.1016/j.jhazmat.2020.122655

Timing: Start in Q4 2024, 24 months

LRI funding: €300,000 – 350,000

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