Cefic-LRI 2025 Workshop Executive Summary

The Cefic-LRI Workshop 2025 brought together researchers and stakeholders for two days of exchanges focused on advancing chemical safety through cutting-edge science. Researchers shared progress and findings from Long-Range Research Initiative (LRI) projects addressing both human and environmental health EU regulatory challenges on topics such as microplastics, persistence, mobility, and polymers.

- Bridging scientific innovation and regulatory acceptance remains a challenge.

While new methods are emerging rapidly, the process for integrating them into regulatory frameworks remains slow and complex. This was exemplified with the project presentation on improving a screening test for biodegradation that continues its journey to regulatory acceptance after almost a decade. Participants shared insights that could help bridge the gap between scientific innovation and regulatory acceptance.

- Cross-domain learning between environmental and human health is key.

What we learn in one area should help inform others. Ensuring projects build connections between environmental and human health domains is not only useful but increasingly necessary as we move towards next generation risk assessment. In an interactive session on One Health, we discussed the opportunities, challenges and actions to progress on the topic. There was overwhelming support to define the term within the context of chemical assessment.

Main highlights from the projects presented over the two-day workshop are divided into the categories below. A more detailed overview of the workshop follows.

Persistence and Mobility:

1. Current screening and simulation methods used require updates and changes to ensure robust and reliable results for assessment. The projects presented focused on OECD TG306 and TG309.

2. A tiered modeling framework for chemicals with mobility concerns was developed and highlighted the need for exposure and hazard considerations to be aligned to enhance the assessment.

3. Current polymer (bio)degradation studies are constrained by limited insight into the applicability and relevance of existing standardised test methods. The current LRI project will focus on testing polymers in both screening and simulations studies to evaluate possible limitations and where needed, provide recommendations.

Microplastics and Plastic-Associated Chemicals:

1. A cluster of microplastics models were developed to elucidate on processes such as fragmentation, long-range transport, and emissions. The models will be integrated into a multimedia unit world open-source model that can support risk assessment.

2. Leaching behaviour of plastic associated chemicals is complex and requires more work to understand its processes for a quantitative model. Strengthening of chemical standards available is also needed.

3. A gap persists on microplastics for human health. A literature review on dermal uptake concluded that studies mostly use one type of plastic (spherical polystyrene) and follow different methods, making it a challenge to inform on dermal exposure.

The presentations shown during the Workshop are available here – not all presentations were made available. Should you have any queries, please address them to Cefic-LRI Secretariat: lri@cefic.be.

Day 1 : Human health & microplastics

The workshop was opened by Cefic-LRI Programme Manager, Katherine Santizo. She welcomed all participants and introduced Cefic Executive Director for Innovation, Daniel Witthaut. Daniel provided an opening speech highlighting the importance to showcase Cefic-LRI work, as well as the fundamental role research and innovation play for building a future that is safe and sustainable.

Project presentations were started with Emily Christopher from Institute of Occupational Medicine presenting on behalf of the B26 project on a review of dermal exposure to micro- and nano- plastics (MNPs). Her results indicated that current studies do not have a variety of polymer chemistry, skin hydration, or discussions on bioaccessibility and dissolution. The lack of quality information did not allow for a size threshold value to be determined for MNPs. The study also highlighted recommendations for future work including on the impact of shape, polymer chemistry, and skin type differences (i.e., age and race).

Simon Gutierrez from Ricardo followed and presented the ECO55 project on assessing the Impact of Sample Collection on Microbial Population and Validity Criteria in the Organization for Economic Co-operation and Development's (OECD) Test Guideline (TG) 309 for Surface Water Mineralization. The project had three aims to investigate:

1) The influence of sampling and storage conditions on inoculum diversity and performance.

2) The impact of permitted experimental setups and conditions on test outcomes.

3) Potential new reference substances and refinement of test validity criteria.

The main conclusions include that microbial communities are affected by storage time and storage temperature, that water should be cooled during transport to reduce changes of the microbial communities, and that the degradation of sodium benzoate may be less suitable as reference substances as it appears to be less affected by the viability of the inoculum. Ultimately, an interlaboratory ring trial concluded that there is a large amount of heterogeneity with the ring test data for caffeine and 2,4 Dichlorophenoxyacetic acid and that further work is needed to determine factors influencing the test outcome.

To round out the first block of presentations, Amelie Ott from International Collaboration for Cosmetic Safety and Visiting Researcher at Newcastle University presented an ongoing project continuing work from the ECO11 project titled Biodegradation test methods based on Increased cell concentrations (ICC). It was shown that ICC methods can reduce test times and produce more reliable biodegradability assessment. However, it is not currently regulatory accepted. Work is being done to standardise the methods for regulatory acceptance in

activated sludge, freshwater, and marine compartments. Further work is also exploring ICC methods in context of existing studies within LRI, ICCS and AISE.

Boris Meisterjahn from Fraunhofer Institute for Molecular Biology and Applied Ecology (IME) presented on ECO64 focused on the applicability and improvements of OECD (bio)degradation testing for water-soluble polymers. ECO64 is a more recent project that aims to understand how existing standards and guidelines apply to polymers and what modifications (if needed) are required due to different biodegradation processes. Current results have indicated possible representative polymers for testing as well as synthesis of 14C-labelled test polymers. Continued work will focus on biodegradation studies both screening and simulations for possible recommendations for polymer assessment.

Alessandro Sangion followed with a presentation on ECO54 titled developing a tiered modeling framework in support of risk assessment of chemical substances associated with mobility concerns. The project focused on different aspects including reviewing and comparing models, datasets, and Quantitative Structure-Activity Relationships (QSARs) for assessment, developing QSARs, and addressing uncertainty with Persistent, Mobile, and Toxic (PMT) substances. To explore the uncertainty and applicability domain commonly used QSARs were evaluated: OPERA, EPO Suite, IFS-QSAR and QSARINS-Chem in over 80.000 chemical substances registered across different regions. A key takeaway was that the key parameter of Koc may not be the most relevant to assess mobility. Uncertainty in exposure models was done by updating existing models (RAIDAR and PROTEX) to include groundwater compartments to understand the potential of exposure from drinking water sources. The model was evaluated using monitoring data from Switzerland. The presentation conclusions included future directions to further the work which included incorporating emission data into risk assessment, moving beyond Koc for sorption screening, expanding the application domain of models, and expanding monitoring efforts.

The last presentation of the day was by Lee Ferguson from Duke University on the ECO58 project focusing on the comprehensive additive release and bioaccessibility model for risk assessment of micro- and nano- plastics in the environment. The main objective of the project was to create a robust and adaptable model to predict polymer additive release, transformation (where relevant), and bioaccessibility in context of realistic aquatic environments. The project delivered a completed literature review of polymer additive chemical space which led to the development of a polymer additive database. A quantitative model was developed to predict additive distribution among environmental compartments including polymer particles and water. Ultimately, it was concluded that more work is needed to address observed transformation, as leaching behavior is complex and that there is a general lack of chemical standards for many leachables.

Day 2: Environment & One Health

Katherine started Day 2 with a recap from Day 1 presentations. She then introduced Dr. Rita Araujo from DG RTD who presented on EU-funded research and science to policy on micro- and nano- plastics and health. She highlighted the policy efforts on microplastics and showed outcomes from the 2024 Zero Pollution Assessment Report stating that there has been no progress in reducing microplastic releases in the EU. Microplastics reduction and monitoring remains a priority to help achieve their 2030 goals of 30% reduction in MNPs. Future health research will continue to work to better understand health impacts and protect population from exposures. She concluded by highlighting two open calls on health focusing on brain diseases and disorders as well as impacts of micro- and nano- plastics on human health.

Todd Gouin from TG Environmental opened LRI project presentations with ECO57, a project on microplastic long-range transport assessment and estimation tools. He highlighted that the project focuses on processes in two environments: air and rivers. The study of air processes was in-depth accounting for particle and environmental factors such as precipitation and deposition. River processes focused on terrestrial to ocean transport dependent on size, discharge sensitive sedimentation, and resuspension processes. The project team developed a high spatial resolution global scale model with environmental parameterisation from external databases.

Continuing with microplastics, Sam Harrison from UK Centre for Ecology and Hydrology (UKCEH) provided two presentations on projects ECO59 and ECO60. ECO59 was on modelling fragmentation of micro- and nano- plastics in the environment (FRAGMENT-MNP) while ECO60 focused on Emission factors for micro- and nano- plastics (EMIFACT-MNP).

FRAGMENT-MNP's goal was to develop a pragmatic, open-source, mechanistic model of micro- and nanoplastic fragmentation in the environments to predict time evolution of particle size distributions and concentrations dependent on polymer type, degradation state and environmental compartment. The project built an experimental database to parameterize the model and current results indicate that there is good fit between the experimental and modeled results. The research will continue in ECO68 to fit the full database with statistical model to determine relationships between fragmentation, environmental stresses and polymer types.

EMIFACT-MNP's objective is to develop a model that predicts environmental emission factors for a range of plastic emissions spanning a wide range of use (professional, consumer and industrial) to cover whole lifecycles. The approach and considerations of scenarios were shown with an example on agricultural emissions using literature data from more than 30

studies. Through the model, the project will create SPERC-like documentation for various product uses to deliver information on size distributions and country-specific considerations.

To conclude on microplastics environmental models, Matt MacLeod from Stockholm University presented on UTOPIA, the development of a multimedia unit world open source model for microplastics spanning both ECO56 and ECO68. ECO56 delivered a model framework to illustrate microplastic exposure in 17 environmental compartments in a range of sizes and conditions or states (i.e., biofouled or heteroaggregated). In ECO68, the work continues to integrate research outcomes from ECO56-60 and development of a user-friendly interface.

The last project presentation was from Karsten Schlich from Fraunhofer IME on ECO61 focusing on establishing of a holistic environmental risk assessment for microplastics in the terrestrial environment using the study of environmentally relevant particles. The project has three objectives:

1) Produce a critical literature review to aid in selection of MPs to evaluate potential toxicological modes of action.

2) Apply standard assessment methods on different type of MPs.

3) Develop a holistic risk assessment framework for MPs in the terrestrial environment using the outcomes for objectives 1 and 2. Current results indicate that generally low toxicity has been found of tested microplastics at concentrations range of 0.1-10 mg/kg. However, at higher concentrations of 100 and 1000 mg/kg significant effects on various organisms have been observed. Work continues to determine key factors for effects and to continue testing on aged microplastics.

Development of the final terrestrial environment framework is underway.

The workshop concluded with an interactive session on One Health titled *Chemical assessments at a crossroads: What does policy need from science to achieve One Health*. The session was facilitated by Katherine Santizo and Amelie Ott.

Katherine introduced that the objective of the session was to start a dialogue amongst the experts on One Health to better understand perspectives on risks/challenges, opportunities, and actions that needed to be taken. Three short presentations were given to set the scene.

The presentations were by Amelie Ott (ICCS), Leonie Mueller (AlterTox), and Paul Thomas (Kreatis) all focused on different aspects of the theme. The presentations evolved in complexity with Amelie providing an overview of One Health, regulatory commitments, and how chemicals fit within this context. Leonie followed with the contextualization of the topic for chemicals by presenting the “OneToxicology” concept developed within PrecisionTox. The

focus being on moving from analogy to homology between the species to underlie the processes that are same/similar across species. Results from the AF-CSA Conference in March 2025 were also highlighted. Lastly, Paul introduced a Kreatis project on mechanisms of toxic action, an in-silico model whose vision is to unite and quantify human and environmental health. It was highlighted that while the endpoint may be different the key initiating event may be the same and thus provides information that can be used in both disciplines.

At the conclusion of the presentations the participants were asked to form group with a mix of human and environmental health experts to answer three questions:

1. What are the opportunities?
2. What are the risk and challenges?
3. What work needs to be done?

Each group had a rapporteur that provided insight into the discussion. The discussions concluded addressing each question with the following input:

1. Opportunities: There could be a general increased efficiency with an integrated approach that would increase data sharing and sharing of lessons learned across different sectors. It was also mentioned that the integration would lead to a more holistic approach of assessment and knowledge transfer.

2. Challenges: The participants also highlighted many uncertainties that could pose a risk or challenge such as the underlying assumptions that would be needed to take into account that can impact precision, as well as the mismatch of protection goals between humans and environment (e.g., individual vs population).

3. Actions: Many action items were proposed starting with defining the term in the context of chemical safety, how to realign protection goals with the consideration that humans are nested in the environment (ecosystem services approach), what lessons can already be learned in specific areas such as fate of chemicals from environment, endocrine disruption in humans, and wastewater treatment of chemicals. Other areas suggested included how to better inform on exposure to mixtures to integrate fields but also the diversity of the chemical space.

Ultimately, the session provided many considerations that the Cefic-LRI programme and others working in this space can consider for upcoming work and/or projects.