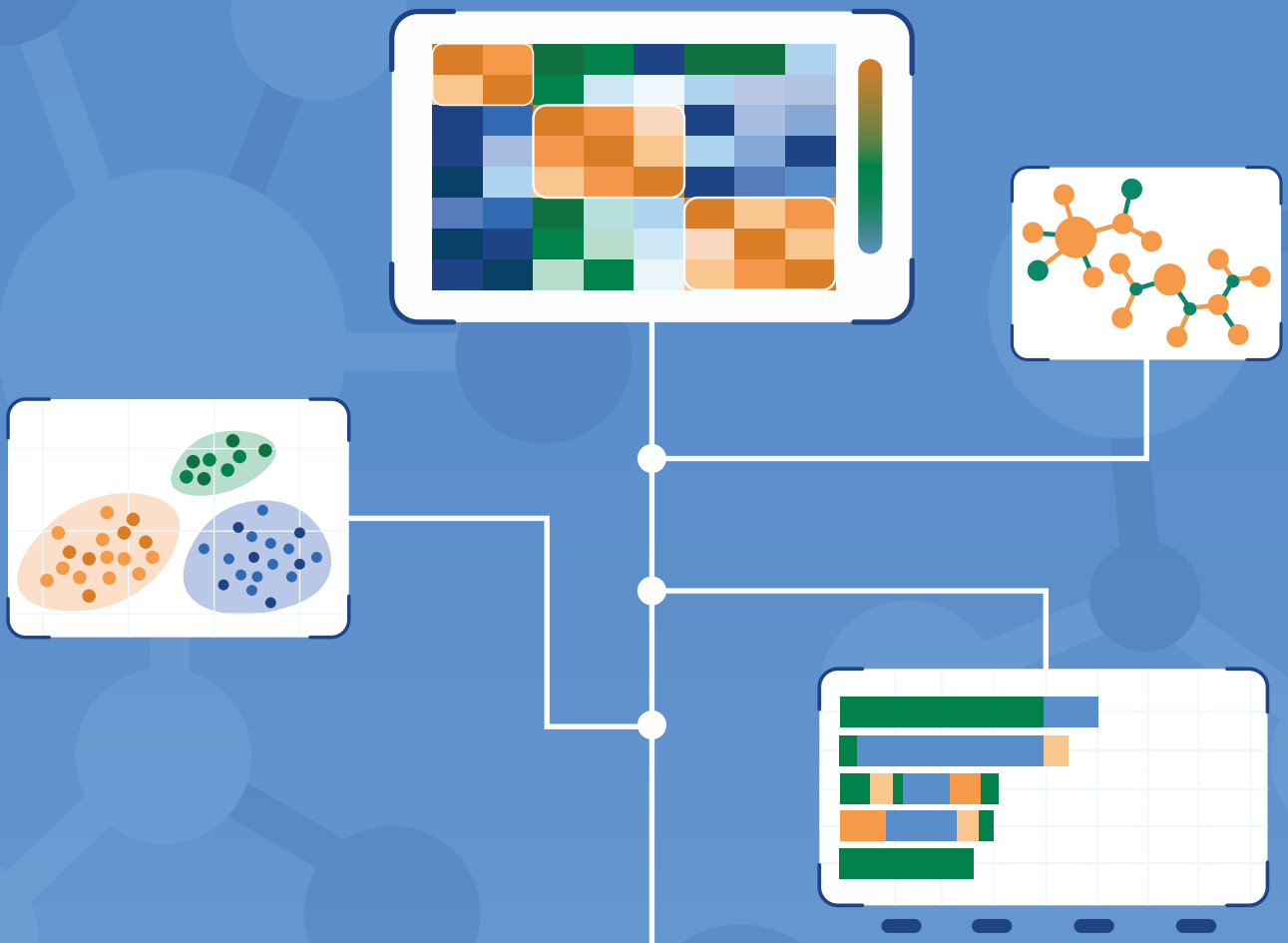
Advancing Chemical Safety Assessments

Cefic-LRI Projects

Completed 2025



LRI Long-Range Research Initiative

cefic

LRI 2025 Closed Projects in Numbers

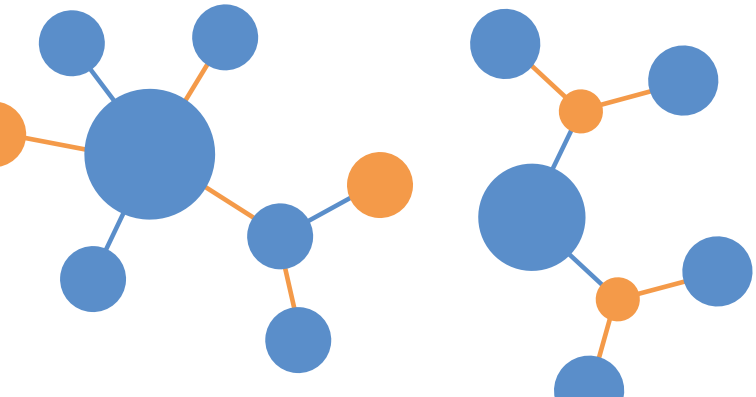
Since 1999, LRI, Cefic's Long-Range Research Initiative Programme has been addressing societal challenges with science to improve safety and sustainability of chemicals. LRI has awarded approximately €90 million to over 250 projects that address European public health strategy priorities.

These peer-reviewed and transparent studies are designed to:

- Understand everyday and occupational exposure to chemicals;
- Investigate the effects of exposure to chemicals on human health;
- Develop tools and approaches to improve chemical risk assessment;
- Reduce animal use in chemical testing.

LRI also addresses many of the environmental objectives of the EU, including:

- Linking environmental factors to health effects;
- Understanding and reducing chemical risks to the environment;
- Improving and advancing chemical risk assessment methods.



In 2025 Cefic-LRI completed

6 projects led by

21 research institutes

29 individual researchers

1 project in collaboration with Concawe

They focused on

DERM: A critical review on the state of the science of micro- and nano- plastic dermal exposure

B26

Assessing the OECD TG309 reference materials and method conditions

ECO55

EMIFACT-MNP: European wide emissions and emission factors of micro- and nano- plastics

ECO60

MATCHING: Providing regulatory context of metabolomics for chemical grouping

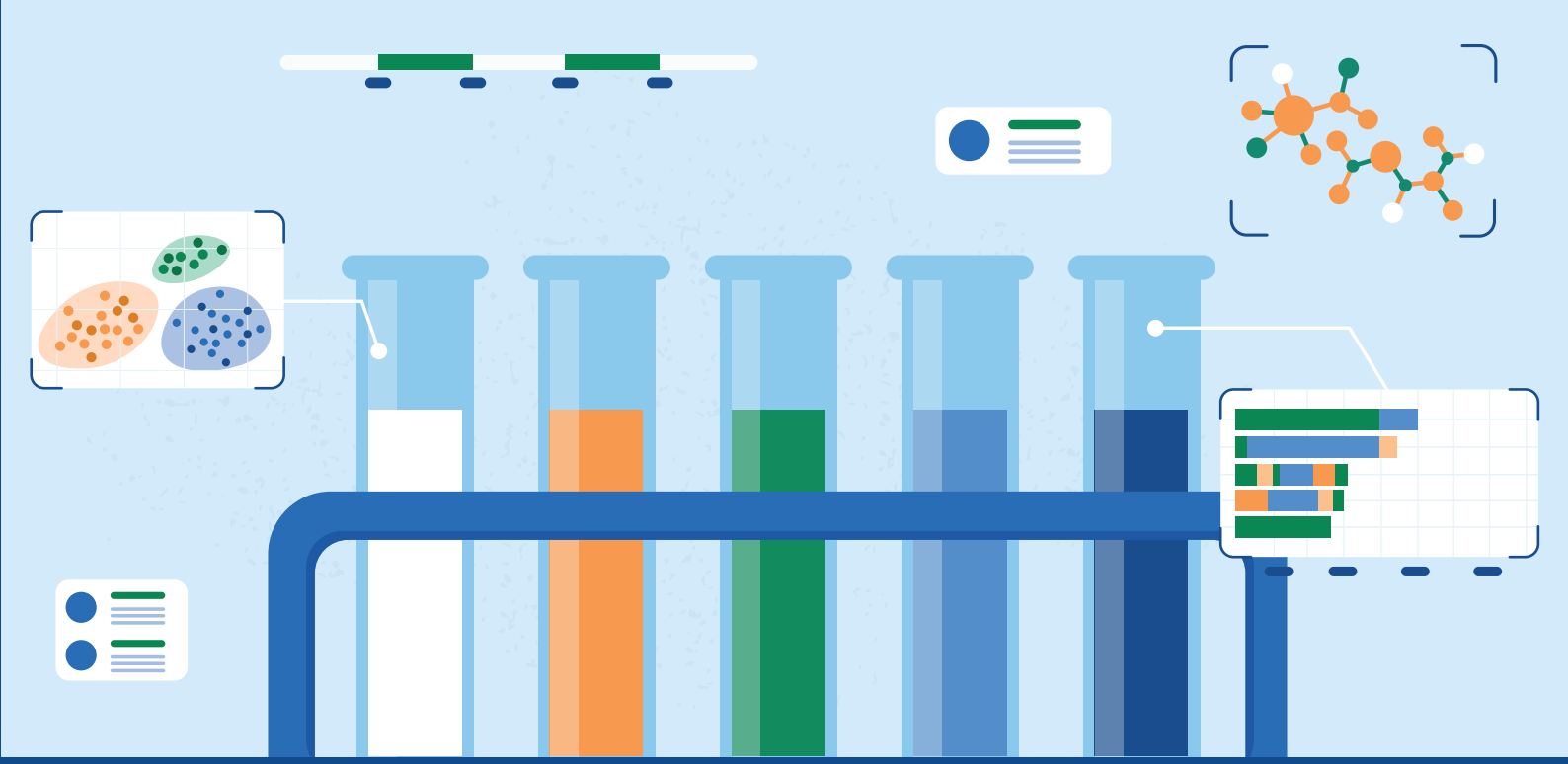
C8

Cluster-µp: Expansion of UTOPIA, an open-source model for micro- and nano- plastics

ECO68

An update to the bioaccumulation assessment tool

BAT



€2,376,500
budget

3
tools

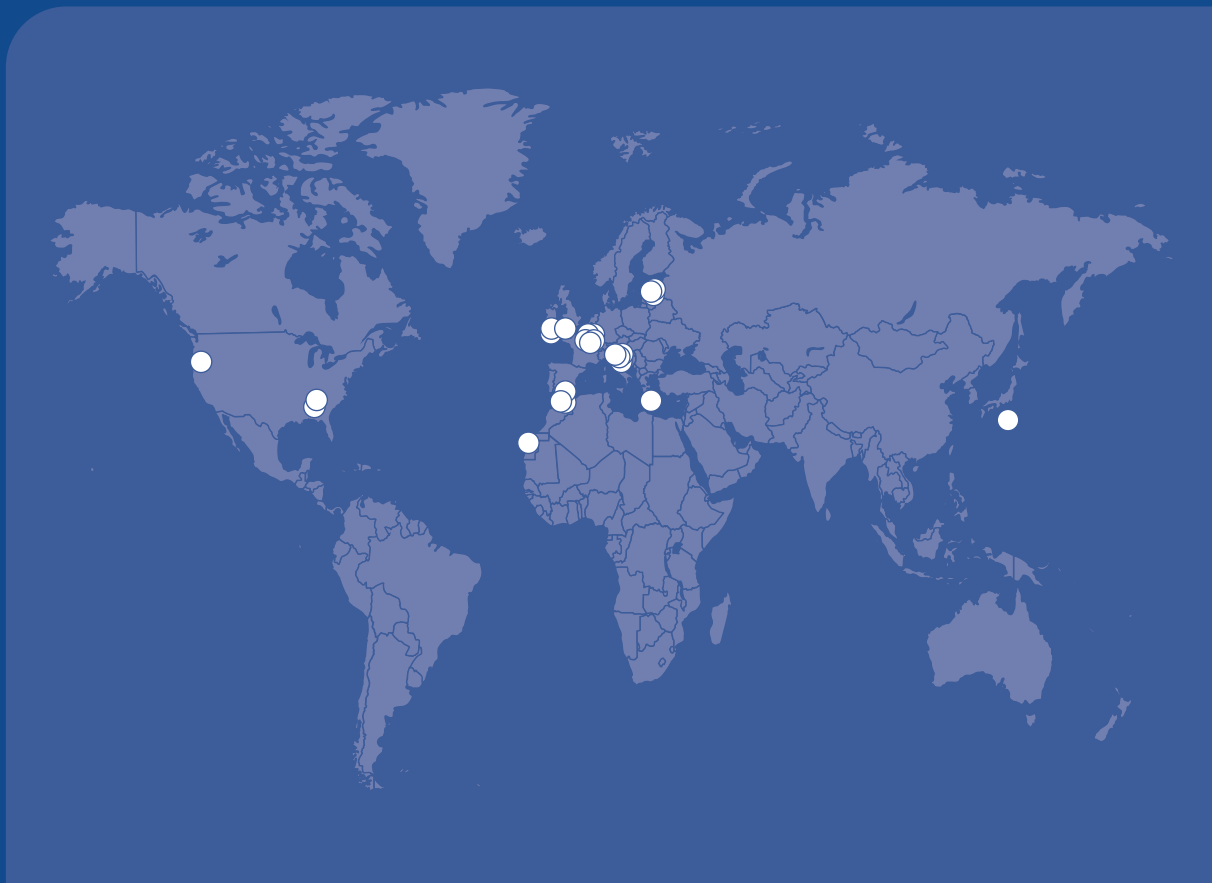
Tool	Model	Project Code
EMIFACT	Modeling emissions of macro- micro- and nanoplastics in the environment	ECO60
UTOPIA	Open-source multimedia model for microplastics	ECO68
BAT	Bioaccumulation assessment tool used for aquatic and air-breathing organisms	Joint project

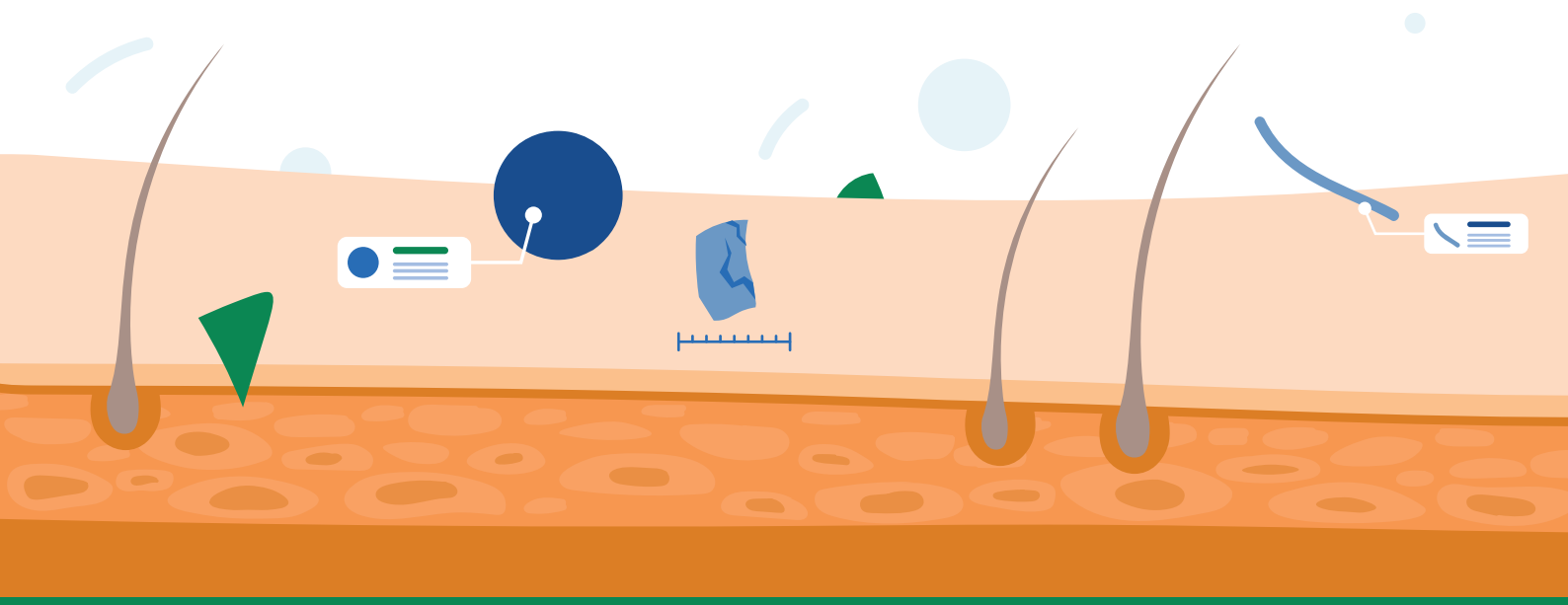
1
database

Database	Model	Project Code
Plastic emissions databases	EMIFACT model for plastics	ECO60

29
presentations

6
scientific publications





dermal exposure | microplastics | nanoplastics | skin uptake

B26

DERM

Dermal Exposure, a Review of Current Knowledge on the Uptake of Micro- and Nano-plastics

1 → Institute

6 → Months

1 → Presentation

€20,000 → Budget

1 → Publication

A comprehensive review summarising the current scientific understanding of dermal exposure and uptake mechanisms of micro and nanoplastics (MNPs). It integrates knowledge from nanomaterial research and evaluates how particle properties may influence skin penetration.

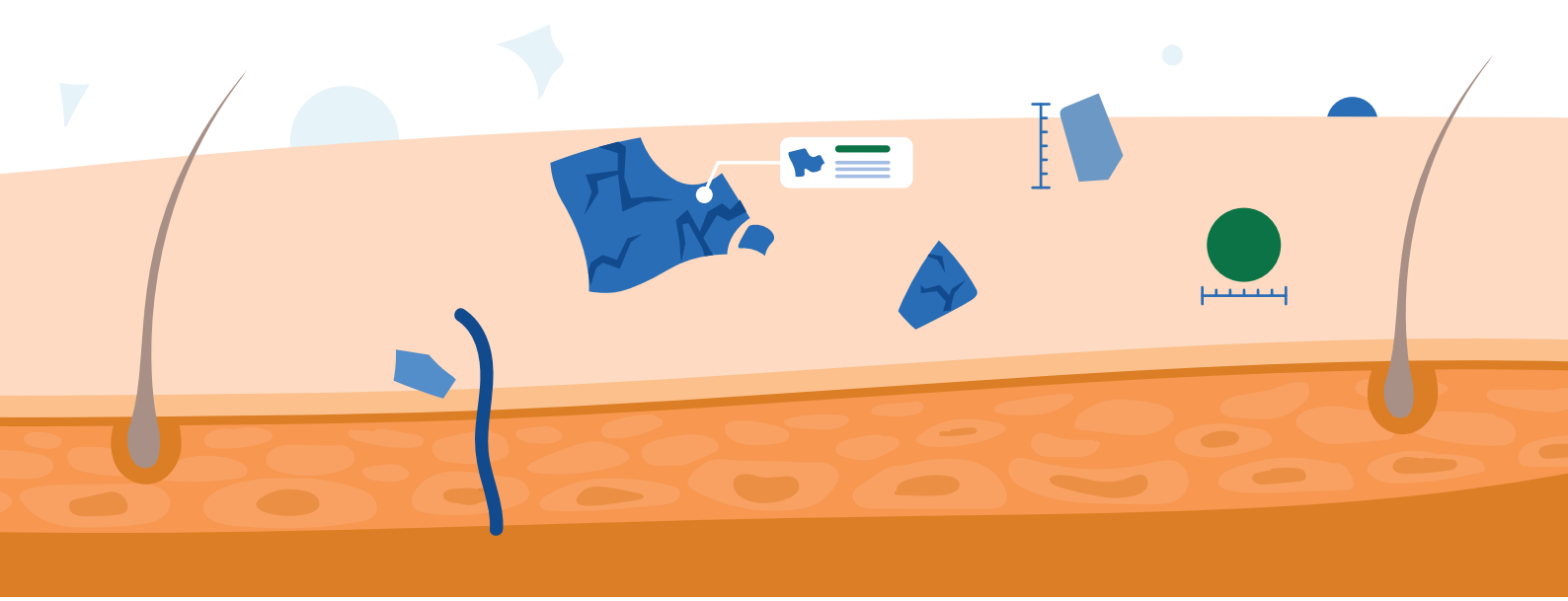
HIGHLIGHTS

- Developed criteria based review of dermal uptake evidence across particle sizes, shapes, surface charge, hydrophobicity and polymer types.
- Highlights scientific gaps requiring further research to understand potential dermal exposure of micro- and nano- plastics.

DERM investigated the current understanding of dermal uptake of MNPs. The review examined how particle size, shape (spherical, needle-like, irregular, fibre), polymer composition, hydrophobicity, charge, surface chemistry, and aging influence dermal exposure to MNPs and related risks.

A literature review covering publications spanning a decade (2015–2025), including grey literature, identified over 1,000 sources; 46 were found most relevant for further analysis. Existing knowledge of dermal uptake of nanomaterials further supported the assessment of MNP uptake.

The review concluded that current data remain too limited to determine a definitive size-based threshold for the dermal uptake of MNPs. However, it is acknowledged that general understanding of skin physiology offers useful indications that could be explored through further testing.

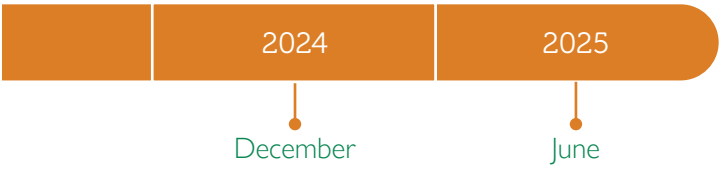


DISSEMINATION

most recent

1 *LRI Workshop 2025, Brussels, June 2025.*

TIMELINE



RESEARCH TEAM

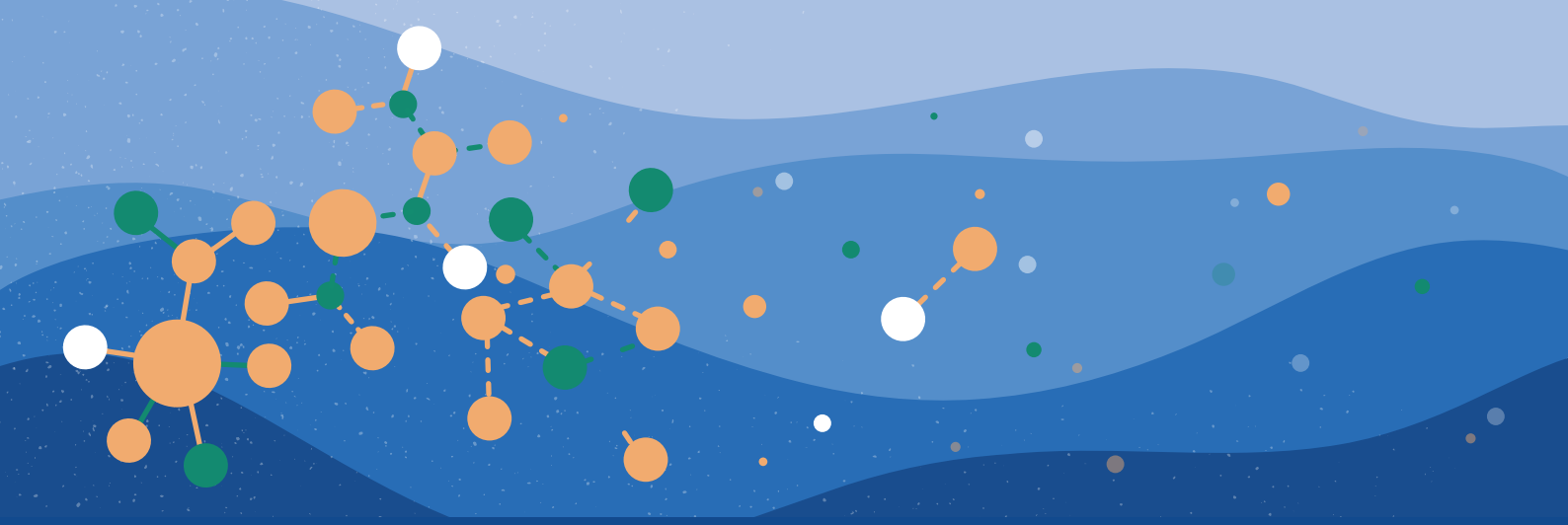
→ *Principal Investigator*
Polly McLean, Institute of Occupational Medicine (IOM)

→ *Collaborators*
Dr. Karen S. Galea and Emily Christopher, Institute of Occupational Medicine (IOM)

PUBLICATIONS

→ McLean, P., Christopher, E.A., Sleeuwenhoek, A. et al. *Dermal exposure, review of current knowledge on the uptake of micro-and nano-plastics. Micropl.&Nanopl. 6, 12 (2026).*

https://doi.org/10.1186/s43591-025-00163-4



OECD TG 309 | aerobic biodegradation | chemical persistence | environmental fate

ECO55

Assessing the Impact of Sample Collection on Microbial Population and Validity Criteria in the OECD 309 Surface Water Mineralisation Test

3 → Institutes

3.7 → Years

11 → Presentations

€529,190 → Budget

2 → Publications

Assessed OECD Test Guideline 309 to determine how temperature, sampling conditions, sampling storage and microorganism community impact biodegradation outcomes for the reference substances. It also aimed to identify additional reference materials that could be suitable for testing under this guideline.

HIGHLIGHTS

- Identified sampling and storage constraints affecting microbial dynamics and test validity.
- Provided temperature-specific guidance to improve experimental setup and microbial handling.
- Highlighted seasonal and physicochemical variability affecting biodegradation and test repeatability.
- Conducted ring trial to determine better reference chemicals.

This project aimed to improve the OECD Test Guideline 309 and provided recommendations on how to collect, store and use water.

It identified and validated an expanded set of relevant reference substances and submitted a data-driven evaluation of the test's robustness and applicability across different temperatures to the OECD for future improvements.

Variability in the results across labs prevented the identification of reference materials that might be better suited for the guideline.

Outcomes showed that storage temperature and duration affect microbial composition which could have significant impacts on aerobic degradation: the breakdown of substances by microorganisms in the presence of oxygen.

DISSEMINATION

most recent

1. *ECHA PBT Expert Group, Helsinki, October 2025.* Assessing the Impact of Sample Collection on Microbial Population and Validity Criteria in the OECD 309 Surface Water Mineralisation Test.
2. *LRI Workshop 2025, Brussels, June 2025.* Assessing the Impact of Sample Collection on Microbial Population and Validity Criteria in the OECD 309 Surface Water Mineralisation Test.
3. *SETAC Europe 2025, Vienna, May 2025.* Results of Ring Testing for the Selection of Reference Substances for Improving Chemical Persistence Assessment in Higher Tier OECD 309 Simulation Test.

TIMELINE

RESEARCH TEAM

→ *Principal Investigator*
Dr. Odd Gunnar Braksatd, SINTEF Ocean

→ *Collaborators*
Deni Ribicic and Roman Netzer, SINTEF Ocean
David M. Brown, Ricardo Energy and Environment
Chris Hughes, Embark Chemical Consulting
Silke Fiebig and Dirk Scheerbaum, Noack Laboratorien GmbH

PUBLICATIONS

→ Sigrid Hakvåg, Dirk Scheerbaum, Christian Maess, Kate Schofield. *Investigation into the OECD 309 Surface Water Mineralisation Test – Exploring Impacts of Sample Collection and Storage, Experimental Factors and Reference Compounds LRI ECO55 – SINTEF. Sintef Ocean., 2025.*

https://nva.sikt.no/registration/019b0224d31d-f6f7a2b9-2204-444d-82bb-aab515b051f1

→ Schofield, H.K., Hughes, C.B., Scheerbaum, D., Maess, C., Brown, D.M. *The selection of reference substances for improving chemical persistence assessment in higher tier OECD 309 simulation tests. Ecotoxicology and Environmental Safety 308 (2025).*

https://doi.org/10.1016/j.ecoenv.2025.119499

microplastics | nanoplastics | emission flows | plastic release model | European mass flows

ECO60

EMIFACT-MNP

EMIssion FACTors for Micro- and Nano-plastics

3 → Institutes

2.75 → Years

6 → Presentations

€300,000 → Budget

1 → Publication

Developed a comprehensive and predictive European scale modelling framework that generates emissions and emission factors in 30 European countries. It covers a wide range of scenarios for a broad range of plastics from macro- to nano- scale and provides lifecycle information of widely used polymers.

HIGHLIGHTS

- Expanded existing Swiss predictive material flow analysis for plastics.
- Refinement of information and data estimations via sector stakeholder engagement.
- Generated emission-factor databases similar to SpERCs (Specific Environmental Release Categories).

EMIFACT-MNP provides a comprehensive map of plastic emissions, establishing a basis to understand and manage plastic emissions in Europe.

The model expands on Swiss material flow analysis model – how materials move through a system – (2018; 2022) and adapts it to 30 European countries.

The model provides information on mass flows – amount of material moving through a system per unit of time – based on size and polymer type.

The model incorporates multiple processes and lifecycle uses, generating over 450 emission flows for seven common polymers: LDPE, HDPE, PP, PS, EPS, PVC, and PET. It covers size distributions from nano to macro, capturing key processes that modify particle size such as abrasion and fragmentation during textile washing, mulch-film degradation and recycling, and aggregation in wastewater treatment plants.

The model shows that each country's emission flow may differ based on policy or practice, and pathways highly differ between macro- and microplastics.

One such example was the end of life treatment of plastics, including landfill, sludge reuse, and incineration.

The model integrated available data, including stakeholder interviews to generate predicted emissions and compare them against emission factors. This work has helped map plastics emissions across Europe.

DISSEMINATION

most recent

1. *MARII Summit, Madrid, October 2025.* Reconciling plastic release: Modelling of macro and microplastic flows to the environment.
2. *LRI Workshop, Brussels, June 2025.* EMIFACT-MNP: EMIssion FACTors for Micro and NanoPlastics.
3. *SETAC Europe, Vienna, May 2025.* Reconciling plastic release: Comprehensive modeling of macro- and microplastic flows to the environment.

TIMELINE

RESEARCH TEAM

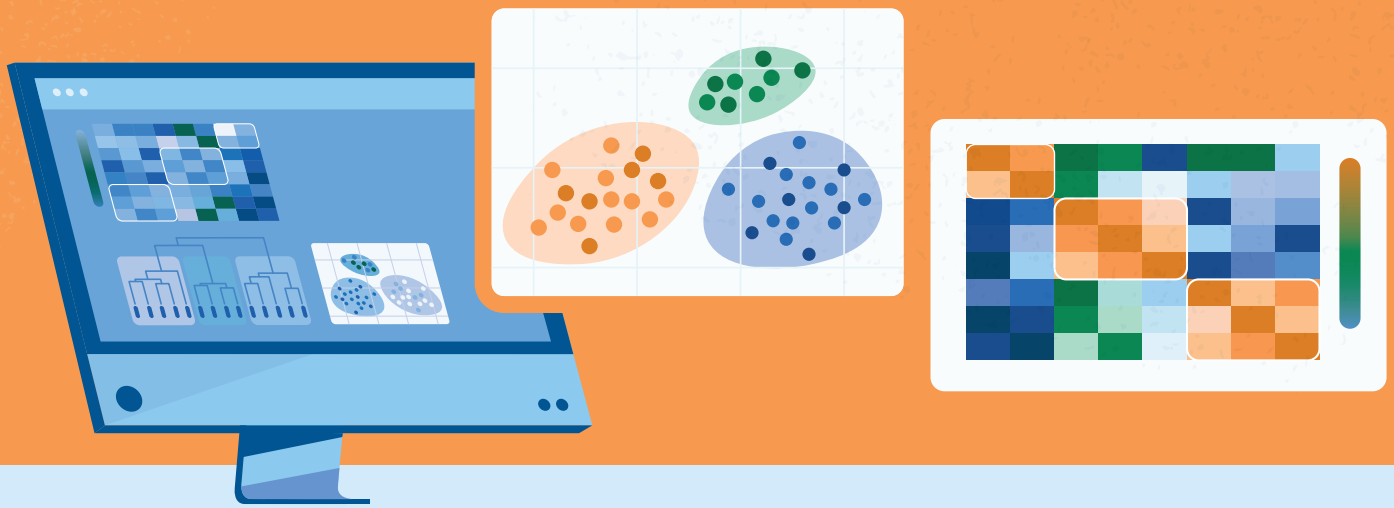
→ *Principal Investigator*
Dr. Sam Harrison, UK Centre for Ecology & Hydrology, Lancaster Environment Centre

→ *Collaborators*
Prof. Bernd Nowack, Empa-Swiss Federal Laboratories for Materials Science and Technology
Prof Mark R Wiesner, Duke University

PUBLICATIONS

→ Jiang, D., & Nowack, B. *Reconciling plastic release: Comprehensive modeling of macro- and microplastic flows to the environment. Environmental Pollution, 346, 126800.*

https://doi.org/10.1016/j.envpol.2025.126800



metabolomics | chemical grouping | validation | New Approach Method (NAM)

C8

MATCHING

Assessing the Repeatability of Metabolomics Within a Regulatory Context Through a Multi-laboratory Ring-trial

8 → Institutes

3.5 → Years

6 → Presentations

€549,530 → Budget

2 → Publications

MATCHING was developed into a two-phase project to address a set of objectives to further metabolomics use for regulatory purpose focused on supporting chemical grouping and read-across.

MATCHING delivered the first metabolomics ring trial focused on regulatory acceptance and use by evaluating whether metabolomics could support chemical grouping and read-across.

HIGHLIGHTS

- Demonstrated reliability of regulatory relevant conclusions regardless of variability in analytical methods used and provides best practices.
- Supported ECHA and OECD on omics and grouping/read-across work specifically as case studies for reporting modules.
- Identified meaningful biological patterns in the metabolomics data and supported explanations for likely toxicological effects for each chemical group.

→ METABOLOMICS

is the study of the small molecules ("metabolites") produced by cells, tissues, or organisms.It helps reveal how a biological system responds to a chemical or environmental exposure.

→ CHEMICAL GROUPING

means organising chemicals into categories based on similarities – often in their structure, biological responses, or toxicity profiles.

→ NEW APPROACH METHODS (NAMS)

are modern scientific methods that help assess chemical safety without relying on animal testing.

→ PHASE I

The first phase focused on an inter lab trial to demonstrate the reliability of metabolomics-based grouping to further best practice guidance for the use of metabolomics in regulatory context.

Researchers were able to correctly identify the grouping of eight test substances into three categories in both rat genders.

A key outcome was that data quality assessments are crucial before grouping evaluation for regulatory application to ensure quality control.

→ PHASE II

Following the success of the grouping, Phase II demonstrated that there was sufficient evidence for plausible biological patterns in the metabolomics data leading to likely toxicological effects for each chemical group.

The dataset has been used to test modules such as the OECD Omics Reporting Framework (OORF), the OECD Chemical Grouping Application Reporting Module (CG-ARM), and ECHA omics-based grouping workflows. Additionally, the research has helped advance international regulatory frameworks that address uptake of New Approach Methodologies (NAMs).

DISSEMINATION

most recent

1. *PrecisionTox Webinar: Using Omics Bioactivity Data to Increase Confidence in Chemical Groups, online, December 2025.* Metabolomics bioactivity-based grouping: introduction and case studies.
2. *EUROTOX 2025, Athens, September 2025.* Inter-study reproducibility of plasma metabolomics data after 28-day treatment in rats – insights from the blinded ring trial MATCHING.
3. *EUROTOX 2023, Ljubljana, September 2023.* Metabolomics-based chemical grouping – a robust and reproducible tool enabling read-across.

TIMELINE

RESEARCH TEAM

→ *Principal Investigator*
Prof. Mark Viant, University of Birmingham

→ *Collaborators*
Hennicke Kamp and Tilmann Walk, BASF Metabolome Solutions GmbH
Richard Beger and Jinchun Sun, US Food & Drug Administration
David Crizer, National Institute of Environmental Health Sciences
Timothy Ebbels and Toby Athersuch, Imperial College London
Aniko Kende, Syngenta
Ralf Weber, University of Birmingham
Pim Leonards, Vrije Universiteit Amsterdam

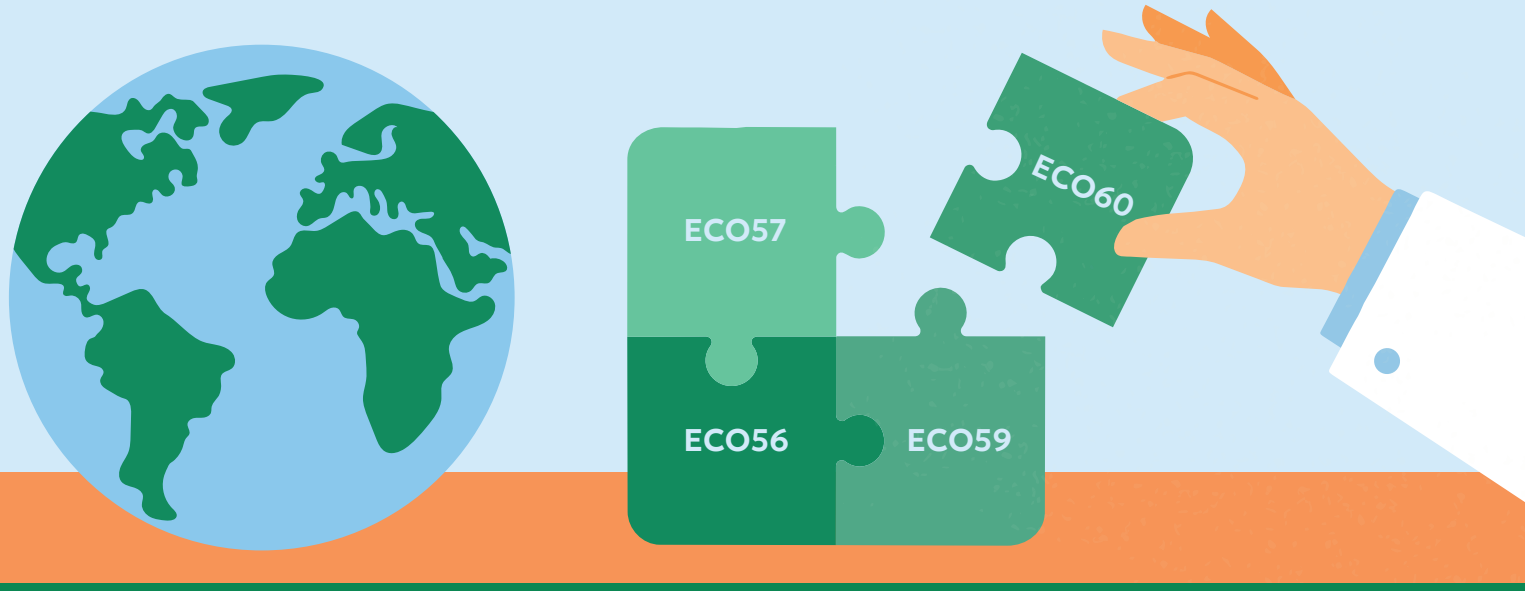
PUBLICATIONS

→ M. R. Viant, E. Amstalden, T. Athersuch, M. et al. *Demonstrating the reliability of in vivo metabolomics based chemical grouping: Towards best practice. Arch Toxicol. 98(4):1111-1123, 2024.*

https://doi.org/10.1007/s00204-024-03680-y

→ Harrill, J.A., Viant, M.R., Yauk, C.L., et al. *Progress towards an OECD reporting framework for transcriptomics and metabolomics in regulatory toxicology. Regulatory Toxicology and Pharmacology, 125, 105020, 2021.*

https://doi.org/10.1016/j.yrtph.2021.105020



microplastics | nanoplastics | unit world model | environmental exposure

ECO68

Cluster-µp

Integration of Research Results from the ECO56-60 Microplastics Project Cluster

5
→ Institutes

1
→ Year

2
→ Presentations

€200,000
→ Budget

Cluster µp integrated the research outputs of the ECO56–60 microplastics projects into an updated, unified UTOPIA model. This update expands the harmonised exposure and concentration predictions across multiple environmental compartments (e.g., air, freshwater, coastal water, ocean, soil, beach sand, and sediments).

HIGHLIGHTS

→ Combined global exposure modelling (ECO56), transport models (ECO57), fragmentation insights (ECO59) and emission factors (ECO60) into a coherent framework.

→ Standardised key parameters and modelling assumptions across previously independent projects.

→ Improved long term interoperability of the Cefic-LRI microplastics environmental models.

Cluster-µp brought together a team of key researchers from the ECO56-60 projects to transfer and integrate the research results from these projects into the UTOPIA modelling platform and provide an updated version of UTOPIA.

The project delivered an updated open-source Jupyter notebook with the integrated models.

To ensure transferability a standard procedure for integration was developed. Included in the model are:

→ The wet and dry atmospheric settling processes as a function of size and shape (ECO57);

→ Fragmentation and discorporation rates (ECO59) presented challenging as the data had to be scaled from laboratory to real-world environmental conditions. Improving this parameterisation will continue beyond the project;

→ Emission factors (ECO60) via size-specific emissions to match the pre-defined size ranges of the UTOPIA model at the European scale;

A webtool was developed with a simplified version of the model.

Further research needs to expand the model include:

- More complex models;
- Emissions factors beyond Europe;
- Consideration of plastic-associated chemicals;
- Improved fragmentation parametrisation/discorporation of plastics.

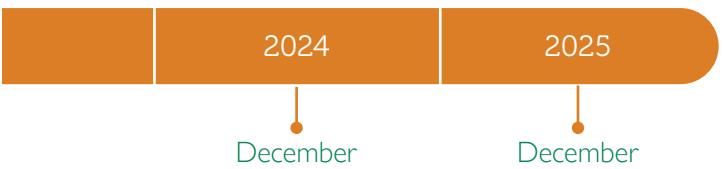
The project moves us one step closer to having exposure assessment of plastics in the environment.

DISSEMINATION

most recent

1. *LRI Workshop , Brussels, June 2025.* UTOPIA: Development of a Multimedia Unit World Open Source Model for Microplastic.
2. *SETAC Europe, Vienna, May 2025.* Modelling the environmental fate of microplastics with UTOPIA, an evaluative unit world model for microplastics.

TIMELINE



RESEARCH TEAM

- *Principal Investigator*
  Professor Matthew MacLeod, Stockholm University
- *Collaborators*
  Dr. Prado Domercq, Stockholm University
  Dr. Antonia Praetorius, University of Amsterdam
  Dr. Sam Harrison, UK Centre for Ecology & Hydrology (UKCEH)
  Prof. Dr. Bernd Nowack, Empa – Swiss Federal Laboratories for Materials Science and Technology
  Prof. Mark Wiesner, Duke University

PUBLICATIONS

- Github: Updated open-source Jupyter notebook.
  https://github.com/microplastics-cluster/utopia_package/tree/utopia_package_ECO68

bioaccumulation | weight of evidence | modelling tools

BAT

Concawe / Cefic-LRI Collaboration

Update of Bioaccumulation Assessment Tool

1 → Institute

4 → Months

1 → Presentation

€50,000 → Budget (Joint Concawe and Cefic-LRI)

This update delivers key scientific and functional improvements to strengthen bioaccumulation assessments and support regulatory and research needs. It integrates laboratory and field data with modern NAMs. This offers a more robust and transparent basis to evaluate bioaccumulation potential in aquatic and air-breathing organisms.

HIGHLIGHTS

- Updates to in vitro and in vitro to in vivo extrapolation (IVIVE) – translating experimental cell based results and observation to whole organisms interpretations – study input sheets and calculations.
- Inclusion of particulate organic matter (POM) and dissolved organic matter (DOM) in water.
- Expands input for substance physical-chemical properties.

First released in 2018, the Bioaccumulation assessment tool (BAT) was developed to support weight-of-evidence approach by guiding users on how to generate and collect data for bioaccumulation assessments.

The tool aligns with the OECD Guiding Principles and Key Elements for Establishing a Weight-of-Evidence for Chemical Assessment, as well as with OECD guidance for Integrated Approaches to Test and Assessment (IATA). The OECD IATA for Bioaccumulation was informed by the scientific basis of BAT.

The updated version provides multiple updates addressing limitations indicated by stakeholders including:

- Revisions to the chemical update efficiency calculations;
- Updates and additions to specific organisms/compartments;
- Addressing ionisable organic chemicals;
- Alignment with the bioaccumulation estimation tool (BET) used for screening level assessment.

DISSEMINATION

most recent

1 *ECHA PBT Expert Group Meeting, Helsinki, October 2025.*

TIMELINE

RESEARCH TEAM

→ *Principal Investigator*
Jon Arnot, Arnot Research and Consulting

→ *Collaborators*
Alessandro Sangion, Arnot Research and Consulting

Long-range research initiative
Cefic AISBL
Rue Belliard 40 1040 Brussels Belgium
www.cefic-lri.org
EU Transparency Register n° 64879142323-90

Contact:
Katherine Santizo, LRI Programme Manager
lri@cefic.be

Layout and illustrations by Tigre Rossa Design Agency