International Council of Chemical Associations

CLOSING THE MICROPLASTIC INFORMATION GAP

-A MARII WEBINAR SERIES-

MICROPLASTICS ADVANCED RESEARCH AND INNOVATION INITIATIVE

An introduction to MARII

11 APRIL 2024

PROGRAMME

2:00-2:10 CET	**Introduct**	***Jing Hu, Dow (Co-chair of MARII)***
2:10-2:25 CET	Methods to detect and quantify microplastics	*John Norman (ACC)*
2:25-2:40 CET	Risk assessment of microplastics in the marine environment	*Takashi Mori (JCIA)*
2:40-2:55 CET	Advancing the assessment of ecotox of microplastics	*Filipe Almeida (Cefic)*
2:55-3:10 CET	Advancing the assessment of microplastics human health toxicology	*Camilla Carteny (PlasticsEurope)*
3:10-3:30 CET	Q&A	Craig Davis, ExxonMobil (Co-chair of MARII)

The webinar will be moderated by Craig Davis, ExxonMobil (Co-Chair of MARII)

You will be automatically muted and your camera will be switched off.

This webinar series is organised with the suppor of ecetoc

The first part of this webinar (presentations) will be recorded and later posted on our websites. The Q&A will not be broadcast.

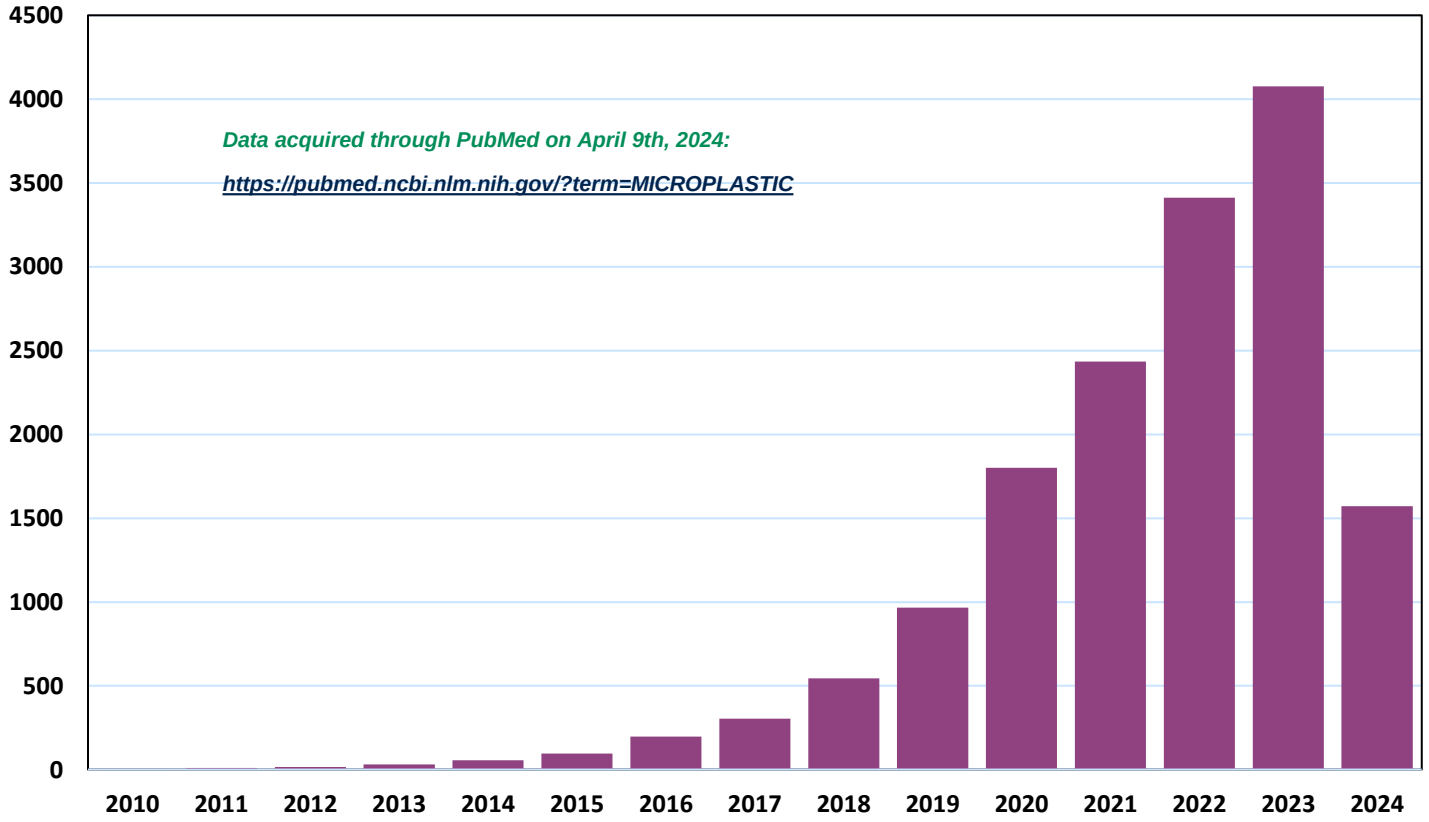
International Council of Chemical Associations

Microplastics Advanced Research and Innovation Initiative (MARII)
– A Global Perspective –

April 2024

Issue Landscape

Increased Microplastics Information



Some Regulatory Initiatives

- **Europe**
  - Restriction on intentionally released MPs, Initiative on unintentionally released MPs
- **U.S. State Activity**
  - California, Hawaii, Minnesota – testing protocols for drinking water
- **Stockholm**
  - Persistent Organic Pollutants Review Committee (UV328)
- **Plastics Treaty**
  - Microplastics is part of the discussions and of the UNEP options paper for an Internationally Legally Binding Instrument on Plastics Pollution

Need for Risk Based Approaches

- **We need to have science developed when regulatory and public interest is sustained**

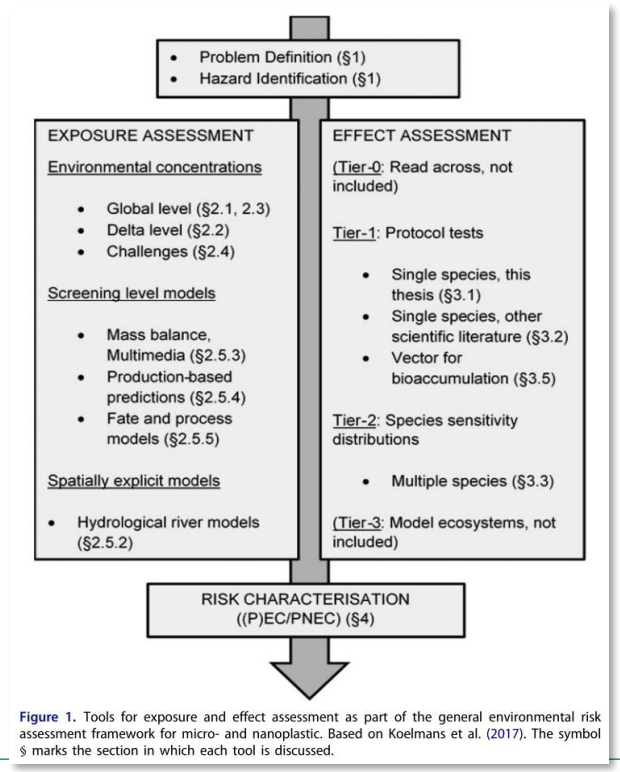
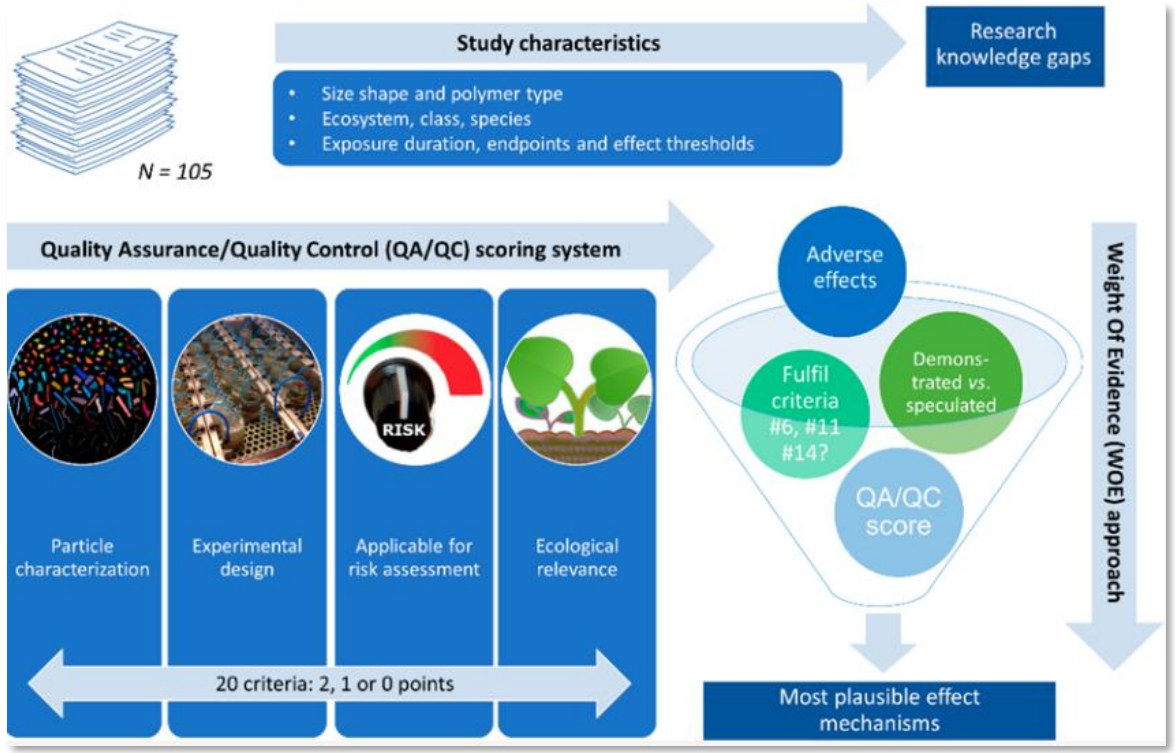


Figure 1. Tools for exposure and effect assessment as part of the general environmental risk assessment framework for micro- and nanoplastic. Based on Koelmans et al. (2017). The symbol § marks the section in which each tool is discussed.



https://dx.doi.org/10.1021/acs.est.0c03057

Closing the Research Gaps

Information Needs for Microplastics

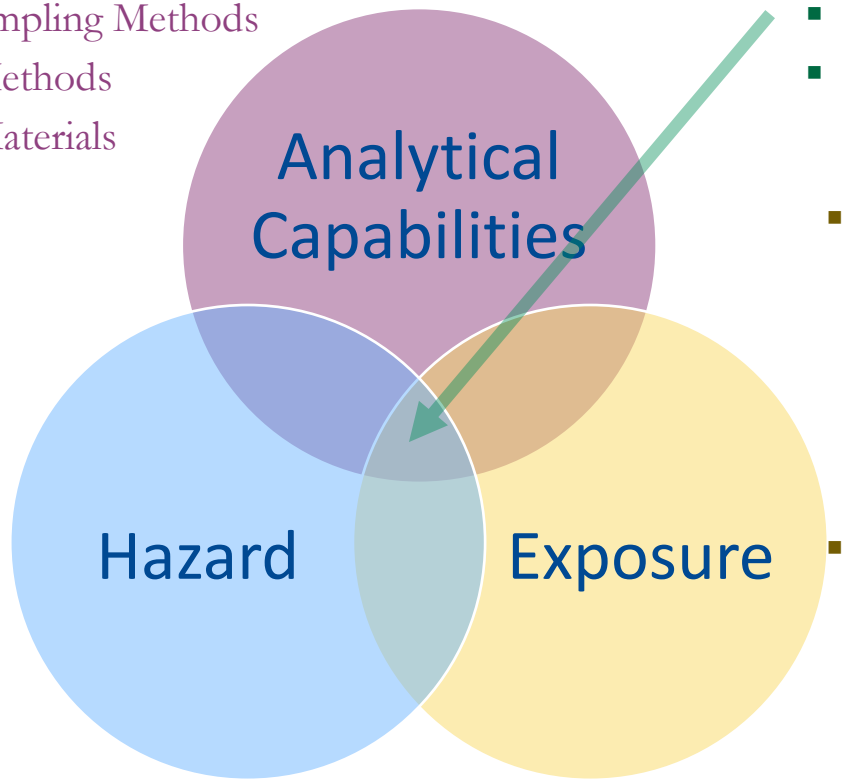
- **Standardized methods and high-quality information is necessary to inform risk-based decisions**
  - QA/QC Needs - Sampling Protocols, Analytical Standards, Reference Materials
  - Exposure - Routes of Exposure and Environmental Fate
  - Hazard - Human v. Ecological Targets
  - Risk Assessment - Framework to Inform Regulatory Actions

Translating Information Needs into a Quantitative Risk Assessment Framework

Risk Assessment

- Probabilistic Risk Modelling
- Environmental Risk Framework

- Standard Sampling Methods
- Analytical Methods
- Reference Materials



- Approaches to identify **human health** hazards
  - Via ingestion pathway
  - Via inhalation pathway

- Approaches to identify **environmental** hazards
  - Aquatic ecotoxicity
  - Model organisms

- Human Health
  - Uptake and internal distribution
  - Composition of indoor and outdoor air

- Environmental Exposure
  - Fate, transport, and sediment deposition
  - Adsorption and bioaccumulation

Microplastics Advanced Research and Innovation Initiative

Ongoing Industry Microplastics Research

ICCA Microplastics Cross-Cutting Group

Coordination Management Global Timelines

ACC

CEFIC

PEu

JCIA

MARII

Microplastics Advanced Research and Innovation Initiative

Scientists in

Academia

Agencies

Industry

A global forum on exchange for microplastics research

MARII is a global forum for industry, academic, agency, and renowned research institutions to exchange on microplastics research.

Exchange forum for industry on microplastic research

Provide the full picture on microplastics research across industries and regions.

Organize global meetings to facilitate information exchange

Engagement with world-renowned academics to complement industry research

Demonstrate active commitment by industry on the research topic.

Where to meet MARII

2023

Society of Toxicology Annual Meeting

- March 2023 - Symposium on Microplastic Risk Assessment
- Microplastic Meet and Greet Reception

Workshop on Human Health

- May 2023 – Sessions on Human Health & Microplastic by Plastic Europe's Brigid

SETAC Europe 33rd Annual Meeting

- May 2023 - Three sessions
- Microplastic Meet and Greet Reception

Second MARII Symposium (Seattle, US)

- June 12-13 – Focus on progressing risk assessment

SETAC North America Annual Meeting

- November 2023 – Session on Fate of Plastics
- MARII Booth

2024

MARII Webinar Series

- 2024 – Six webinars planned

Society of Toxicology Annual Meeting

- March 2024 – Continuing Education Course and Reception

SETAC Europe 34rd Annual Meeting

- May 2024 – Microplastics and additives with reception

Workshop on Human Health

- 2024 – Sessions on Human Health & Microplastic by Plastic Europe's BRIGID

Third MARII Symposium (Sao Paulo, BR)

- Stay tuned…

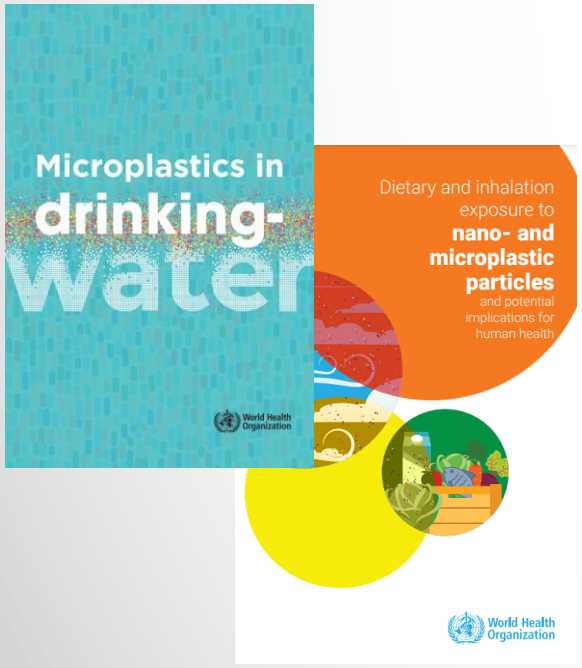
More to come in 2024/2025…

Thank you

American Chemistry Council Research

Overview

ACC Microplastic Research Committee focuses on research to develop standardized material and methods with appropriate QA/QC checks to develop high quality microplastic data



"The lack of standard methods for sampling and analyzing microplastics in the environment means that comparisons across studies are difficult. In addition, few studies were considered fully reliable."

ACC Microplastic Consortium Research

Marine Fate (complete)

- Paper completed and published

Microplastic Resin Kits

- Hawaii Pacific University (complete)
  - V1.0 – 20+ resins available to researchers
  - V2.0 – PE and PP available to researchers

Characterization of Microplastics in Publications

- University of Rochester
  - Provide researchers “best-practices” for characterizing microplastics
  - Assess potential unreported characteristics or contaminants of samples

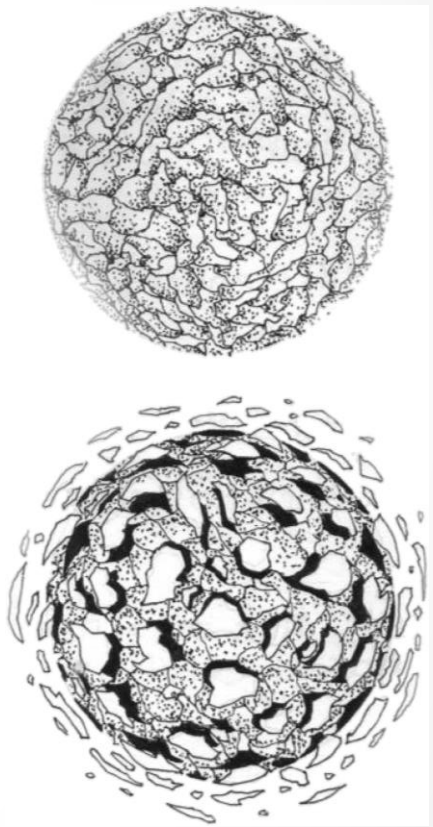
ACC Microplastic Consortium Research

Reference Materials

- Reference material workshop, Late 2024
  - More than 30+ key researchers attended the first meeting.
  - Report on ACC's LRI program: [LINK]

AI Assisted Literature Search

- ToxStrategies
  - Development a single, centralized, and systematically curated literature repository to assist researchers identify key, high-quality studies to inform future research



Andrady. (2017). DOI: 10.1016/j.marpolbul.2017.01.082

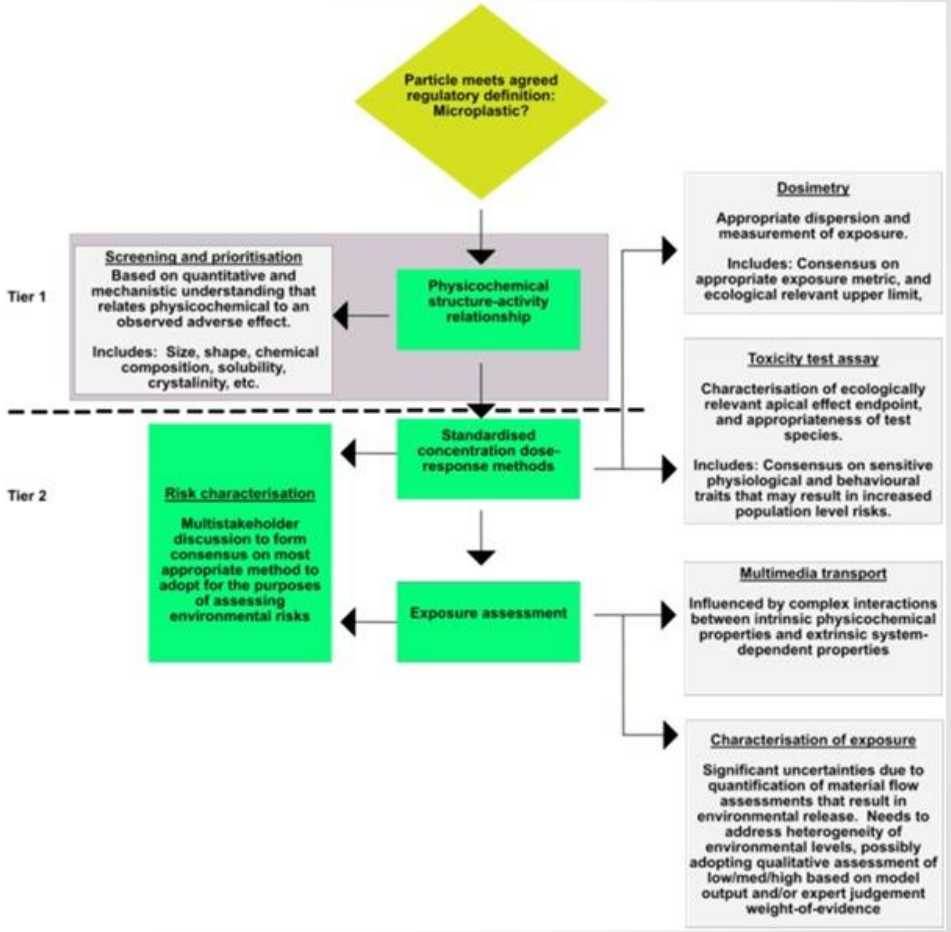
ACC Microplastic Consortium Research

Standard Quality Scoring System for Health and Environmental Papers

- Gouin, et al. 2019. Environmental Toxicology and Chemistry. 38:10. p. 2087–2100. doi: 10.1002/etc.4529

Sediment Core

- SINTEF Ocean
  - Hawaii Pac University developed method to separate and isolate MP from core
  - Characterize the spatial and temporal characterization of the transport and deposition of microplastics (MP) along the Palar River into the Indian ocean.
  - Assess how the composition and abundance of transported MP have changed over time



ACC Microplastic Consortium Research

Nano- sized Microplastics

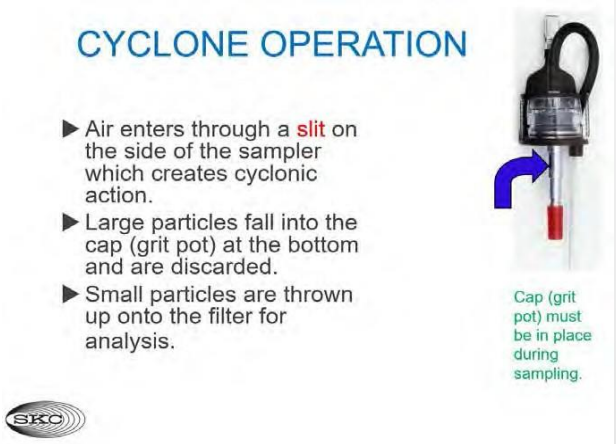
- University of Pennsylvania
  - Improve understanding of the behavior and impacts of nanoplastics by developing and optimizing methods to separate, concentrate, measure and identify them

Air Quality

- University of Rochester
  - Indoor Air Quality (complete) – developed collection and analytical methods to sample and quantify MP in air; data presented at SOT and in draft
  - Outdoor Air Quality – Examine quantity and type of microplastics in air in different environmental settings

Soil Sample Methodology

- ETH Zurich
  - Provide researchers with a common method to collect and assess MPs in various soil-types



Questions

Japan
Chemical Industry
Association

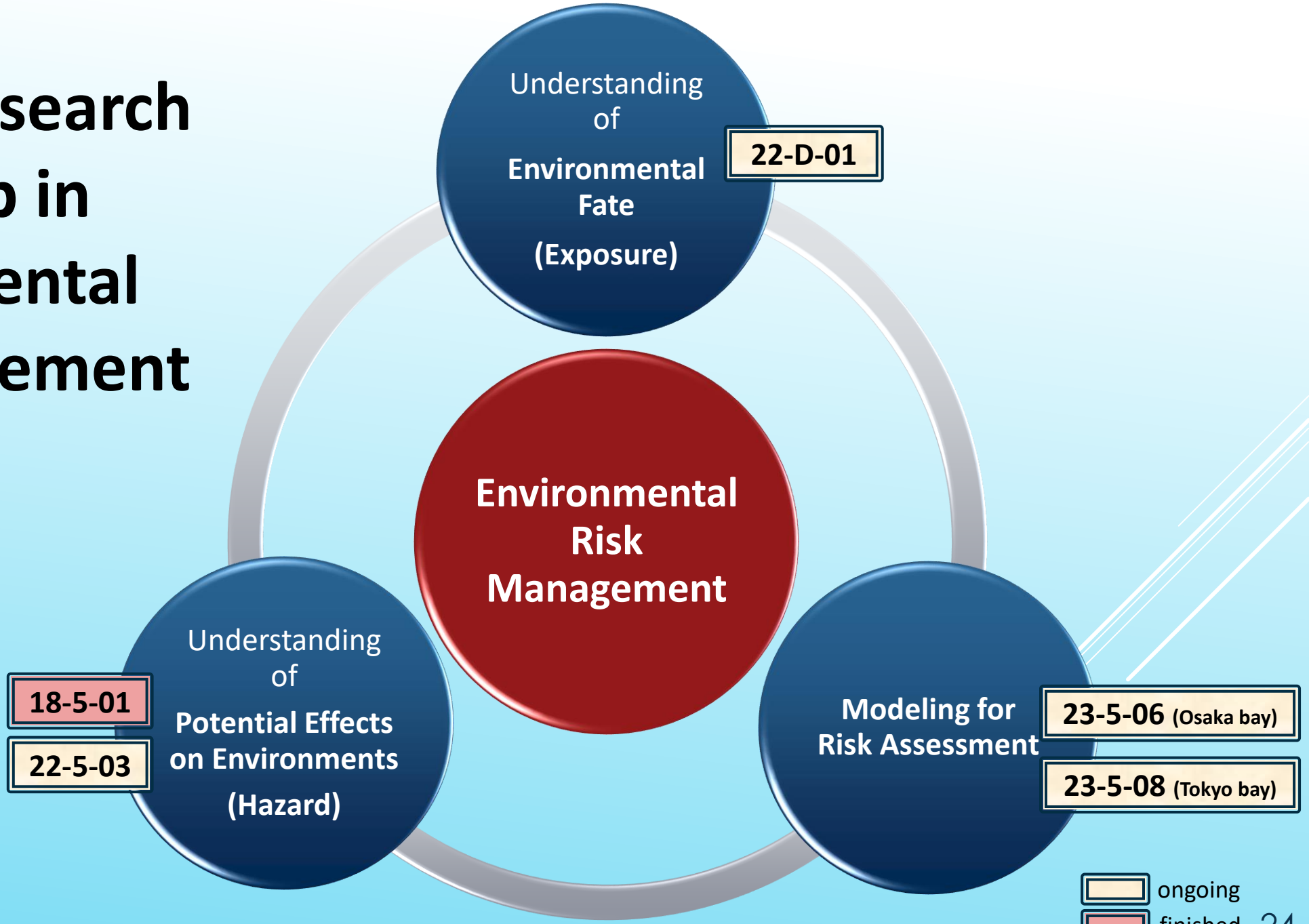
Microplastics Research Programme
JCIA-LRI

JCIA-LRI MP Research Programme

- Basically 3-year project, but progresses are evaluated strictly and annually to ensure scientific progress.
- Focus on environmental risk assessment
- 4 projects ongoing (as of April 2024)

  1 project finished (2018～2020)

How MP Research Can Help in Environmental Risk Management



JCIA MICROPLASTICS RESEARCH: 22-D-01
(ENVIRONMENTAL FATE)

Research Title

Elucidation of the kinetic mechanisms of MP formation contributing to risk assessment and preparation of reference MPs

Principal Investigator and Collaborating Researchers

Hiejima Yusuke (Kanazawa University, Japan)
Kuroda Shinichi and Oku Hiroyuki (Gunma University), Kuriyama Takashi and Matsuba Go (Yamagata University), Kouzai Hiroaki (Kanto Gakuin University), Igarashi Toshio (SC Environmental Science)

Brief Description of Project

This study aimed to clarify the kinetic mechanisms by which secondary microplastics are generated from plastics, using the principles of polymer science and engineering. There are three main areas of focus: a detailed analysis of microplastics collected in the environment, along with specimens subjected to weathering; the kinetics of microplastic formation during artificially accelerated exposure tests; and the development of reference microplastics with sufficiently high throughput. These approaches will contribute to risk assessments, and will help develop efficient methods to prepare reference microplastics based on their formation mechanism.

JCIA MICROPLASTICS RESEARCH: 18-5-01

(POTENTIAL EFFECTS ON ENVIRONMENTS)

Research Title

Study on the contribution of microplastics to bioaccumulation and biological magnification towards fish

Principal Investigator and Collaborating Researchers

Tatarazako Norihisa (Ehime University, Japan)
Shin Takahashi (Ehime University), Yoshifumi Horie (Akita Prefectural University)

Brief Description of Project

The microplastics (MPs) are known to adsorb chemical substances and there is a concern about those chemicals may be taken more efficiently to organisms intermediated by MP and that biological concentration or biological magnification is accelerated. Our study aimed to try to clarify whether the chemical substances adhered to MP are eluted, and absorbed / transferred / accumulated in the body of organisms. There were difficulties to explain the presence or absence of the vector effect only by analyzing the chemical concentration accumulated in the body, we employed new method to detect whether the toxicity changes under the condition of coexistence of the MP and chemical, and to confirm the vector effect indirectly. In conclusion, the vector effect of MP exists in theory, however, it is estimated that the amount of MP in the environment has no harmful effects in reality.

JCIA MICROPLASTICS RESEARCH: 22-5-03

(POTENTIAL EFFECTS ON ENVIRONMENTS)

Research Title

Constructing a model for estimating a vector effect of microplastics and predicting impact in the real environment

Principal Investigator and Collaborating Researchers

Yuji Oshima (Kyushu University, Japan)
Yohei Shimasaki (Kyushu University), Kang Ik Joon (Kyushu University),
Yuki Takai (Kyushu University)

Brief Description of Project

Microplastics can act as vectors for other environmental contaminants, absorbing organic and inorganic pollutants. Previously, there had been no known studies examining this vector effect or related kinetics. The current project aims to construct a model for estimating the vector effect of microplastics and predicting its impact in the environment.

JCIA MICROPLASTICS RESEARCH: 23-5-06

(MODELING FOR RISK ASSESSMENT)

Research Title

Ecotoxicological risk assessment of microplastics -as a model case of Osaka Bay-

Principal Investigator and Collaborating Researchers

Yoshifumi Horie (Kobe University, Japan)
Hideo Okamura (Kobe University), Gomez Christopher (Kobe University), Akira Ijiri (Kobe University), Kazuyo Yamaji (Kobe University)

Brief Description of Project

There is currently a lack of data on risks posed by microplastics in natural ecosystems. The purpose of this project is to assess the ecological risk posed by microplastics using Osaka Bay as a model case. First, researchers investigated microplastic residues in the surface water of the sea in the Osaka Bay area as a measure of ecosystem exposure to microplastics. Second, they examined whether the time required to remove microplastics is affected when ingestion occurs through a food chain. Third, the effects of microplastics on the life cycles of aquatic organisms (Daphnia and fish) were investigated. Finally, the researchers explore whether microplastics in the water are harmful to aquatic organisms.

JCIA MICROPLASTICS RESEARCH: 23-5-08
(MODELING FOR RISK ASSESSMENT)

Research Title

Assessing sources, emissions and environmental risk of microplastics in support of effective risk reduction strategies

Principal Investigator and Collaborating Researchers

Wataru Naito (National Institute of Advanced Industrial Science and Technology (AIST), Japan)
Masashi Gamo (AIST, RISS), Kiyotaka Tsunemi (AIST, RISS), Hideo Kajihara (AIST, RISS), Kyoko Ono (AIST, RISS), Isamu Ogura (AIST, RISS), Bin-Le Lin (AIST, RISS), Xue Mianqiang (AIST, RISS), Yuichi Iwasaki (AIST, RISS), Yuriko Ishikawa (AIST, RISS), Yutaka Kameda (Chiba Institute of Technology).

Brief Description of Project

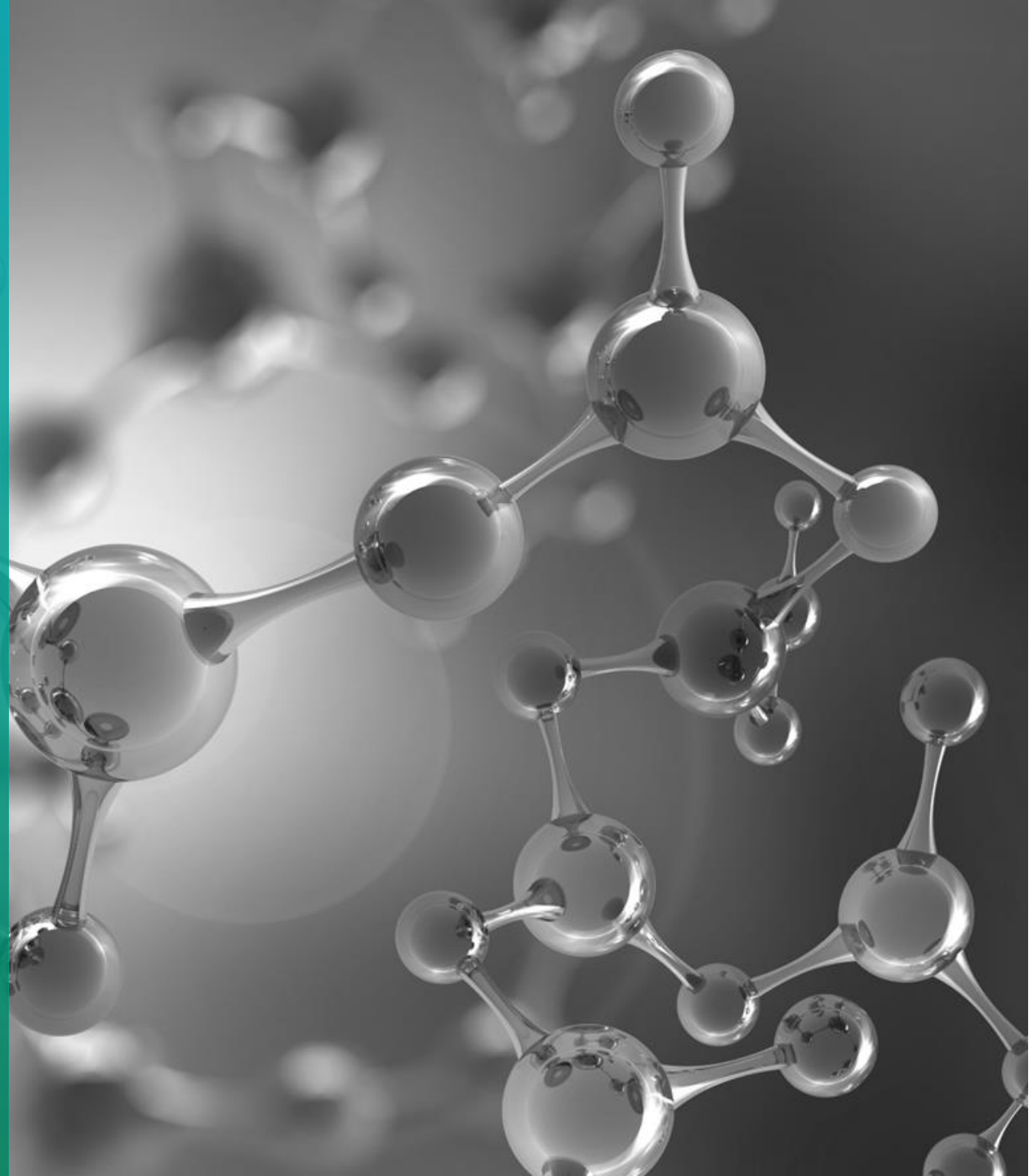
This research project aims to facilitate realistic and effective risk management strategies to mitigate microplastic pollution. The project focuses on analyzing the load and sources of microplastics in Tokyo Bay, and conducting practical risk assessments. Leveraging material flow analysis and precise field data, the researchers' goal is to quantitatively assess the sources of microplastic pollution in marine environments. A second aim is to quantify the temporal changes in microplastic-related environmental risks and the efficacy of various mitigation measures. The researchers have proposed an environmental risk assessment methodology tailored to the unique characteristics of microplastics, drawing from practical case studies in Tokyo Bay and the latest insights from Japanese and international sources.

Future Plan

Japan Chemical Industry Association

We will keep encouraging microplastics research on “Hazard”, “Exposure” and “Risk” under JCIA-LRI in order to contribute better understanding potential impact of microplastics on the environment.

European Chemical Industry Council (Cefic)



Cefic Long Range Research Initiative (LRI)
Microplastics Research Programme

The European Chemical Industry Council, AISBL – Rue Belliard, 40 - 1040 Brussels – Belgium
Transparency Register n°64879142323-90

Cefic- LRI Microplastics Research Programme

A 5-year research in Cefic-LRI – Part of the ICCA global initiative

Budget of 1M per year to carry out relevant research

Successfully launched in 2021

10 projects launched

3 M commitment delivered

Addressing multiple data gaps

- Environment: Aquatic and terrestrial compartments
- Modelling tools for predictability

Project management:

ecetoc

WE ARE THE CENTRE FOR CHEMICAL SAFETY ASSESSMENT

Environmental Risk Assessment Models

3 years, estimated 1.5 million EUR

Objective: To **develop** a **user-friendly**, generic **multimedia risk assessment model** for evaluating the **environmental fate** and **impact** of **microplastics**.

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Scope: Support decision-making with a **user-friendly model** covering all types of microplastics, **encouraging collaboration** within the scientific community.

Framework Features:

- **Integration** of existing data for dynamic risk assessment updates.
- Modular design for **future expansion** and **sensitivity analysis**.
- **Open-source** availability for broad **research and development** participation.

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Microplastic Research

Hazard

ECO 49
MP Effects
Threshold

- **ECO49**[1]: Completed in 2023
  - Research Team: Bart Koelmans, Martine van den Heuvel-Greve and Ivo Roessink at Wageningen University
  - Goal: Evaluate existing EU hazard assessment framework and its application to microplastics, examining the levels of microplastic that result in effects on aquatic organisms.

ECO 61
Terrestrial
toxicity

- **ECO61**: To be completed in December 2025
  - Research Team: Karsten Schlich, Fraunhofer Institute for Molecular Biology and Applied Ecology and Christopher Hughes, Ricardo
  - Goal: Apply Organisation for Economic Co-operation and Development (OECD)/ International Organization for Standardization (ISO) standardized effect test systems to several types of microplastic in the context of agricultural practices

[1]de Ruijter VN, Redondo-Hasselerharm PE, Gouin T, Koelmans AA. *ES&T,* **2020***,* *54* (19), 11692-11705. DOI: 10.1021/acs.est.0c03057

de Ruijter VN, Hof M, Kotorou P, van Leeuwen J, van den Heuvel Greve MJ, Roessink I, Koelmans AA. ES&T, **2023**, 57 (48), 19430-19441. DOI: 10.1021/acs.est.3c06829

Microplastics Research

External Exposure

ECO57

Air processes LRET Metrics

- **ECO57** - To be completed June 2024
  - Research Team: Antonia Praetorius (University of Amsterdam), Mick Whelan (University of Leicester), and Todd Gouin (TG Environmental)
  - Goal: Develop a robust modelling framework for assessing the long-range environmental transport (LRET) of plastic additive chemicals (PACs) facilitated by microplastics

Internal Exposure

ECO59

Fragmentation process and rates

- **ECO59** - To be completed June 2024
  - Research Team: Claus Svenden (UKCEH), Wendel Wohlleben (BASF), Mark Wiesner (Duke), Antonia Praetorius (University of Amsterdam)
  - Goal: Develop an open-source mechanistic model for predicting the fragmentation and degradation rates of plastics under various environmental conditions

Microplastics Research

Additives

ECO58

Leaching rates and residence times

- **ECO58**: Completion in Summer 2024
  - Research Team: Lee Ferguson and Mark Wiesner at Duke University
  - Goal: create a robust model predicting polymer additive release, transformation, and bioaccessibility in aquatic environments by development based on chemical/physical properties of additives, polymers, and leaching environments, supported by laboratory experimentation

ECO60

Emission factors

- **ECO60**: To be completed in December 2024
  - Research Team: Sam Harrison (UKCEH), Mark Wiesner (Duke), Bernd Nowack (Empa)
  - Goal: Develop a model that predicts environmental emission factors (EF) for plastics across their full lifecycle, covering macro-, micro- and nanoplastics and considering a wide range of polymers and usage scenarios

Emissions

Microplastics Research

ECO56

Unit World Model

- **ECO56**[2]: Completion in Summer 2024
  - Research Team: Matthew MacLeod (Stockholm University), Sam Harrison (UKCEH), Antonia Praetorius (University of Amsterdam)
  - Goal: Develop an open-source, unit world multimedia modeling platform for comprehensive microplastic fate analysis

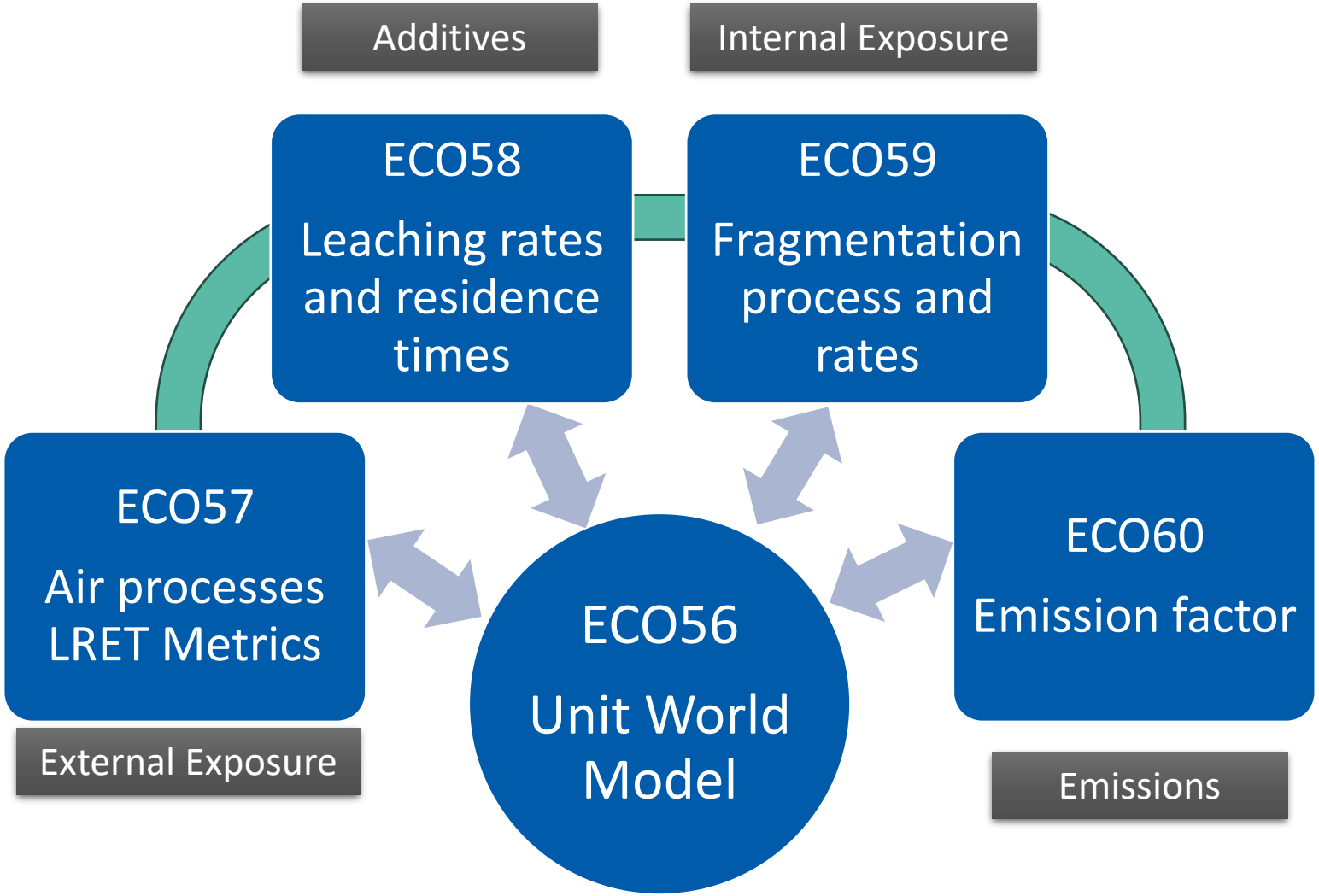
[2]MacLeod M, Domercq P, Harrison S, Praetorius A. Nature Computational Science, 2023, 3, 486-494. DOI: 10.1038/s43588-023-00445-y.

Microplastics Research

Hazard

ECO 49
MP Effects
Threshold

ECO 61
Terrestrial
toxicity



Risk assessment

Thank you for your attention

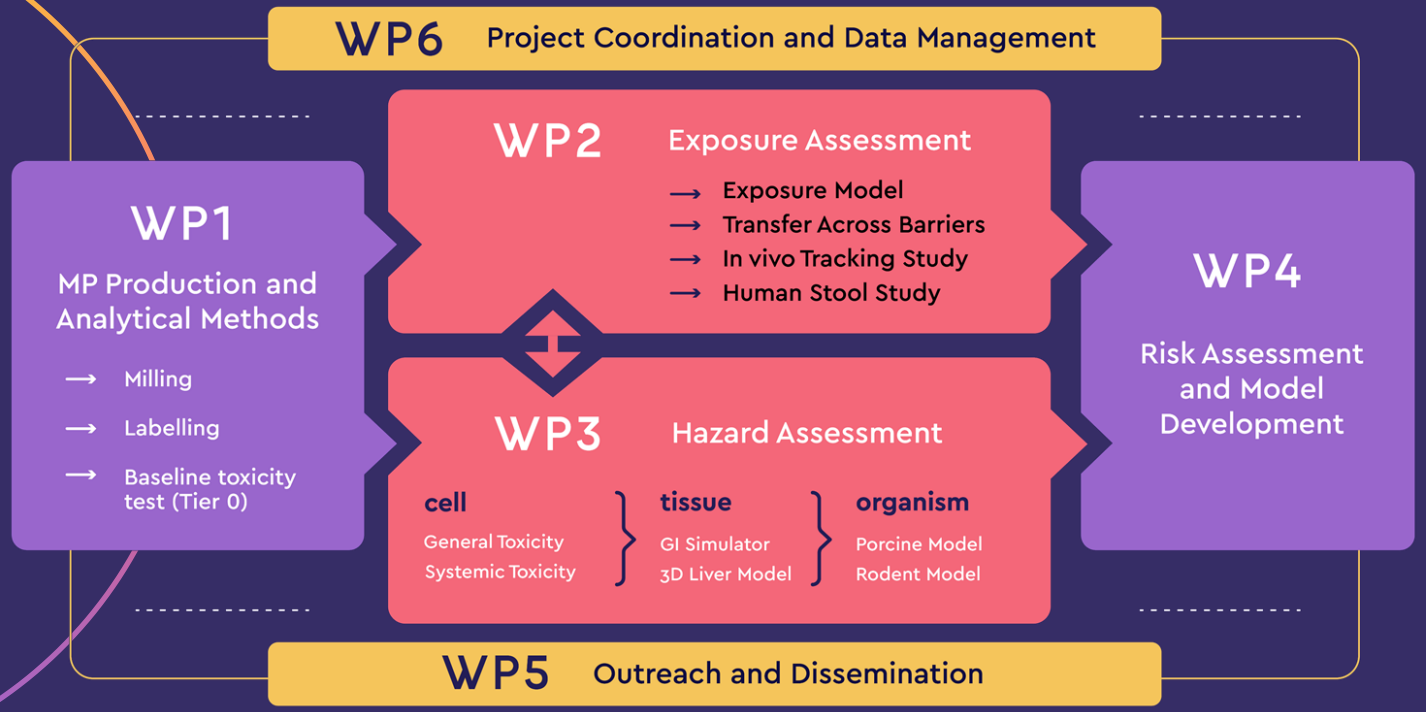
Cefic-LRI

The Brigid Project: advancing the assessment of microplastic human health toxicology

- Camilla C. Carteny
- Plastics Europe

MARII 1st webinar – 11th April 2024

Brigid: structure and aims



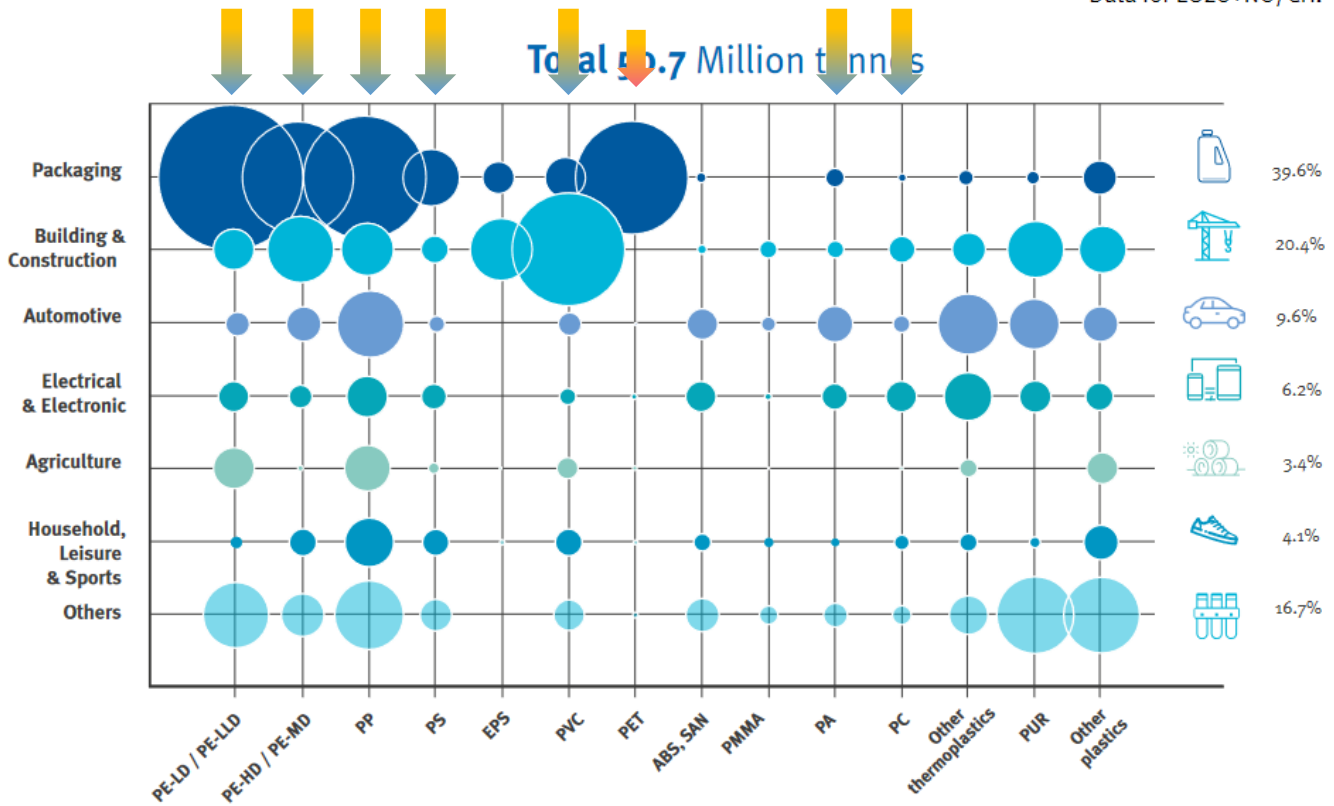
- Multimillion euro budget
- Five years duration (2022-2026)
- Consortium of impartial scientific partners from public and private institutes
- Open and transparent communication of results
- Objective: human health risk assessment of microplastics ingestion

Polymer selection

SOURCE: PlasticsEurope Market Research Group (PEMRG) and Conversio Market & Strategy GmbH

PLASTICS DEMAND BY SEGMENT AND POLYMER TYPE IN 2019

Data for EU28+NO/CH.



Testing materials

LLDPE/LDPE, HDPE, PP, PS, sPVC, PA-6, PC, PET*

Three size classes: <1, 10, 100 µm

Micronisation:

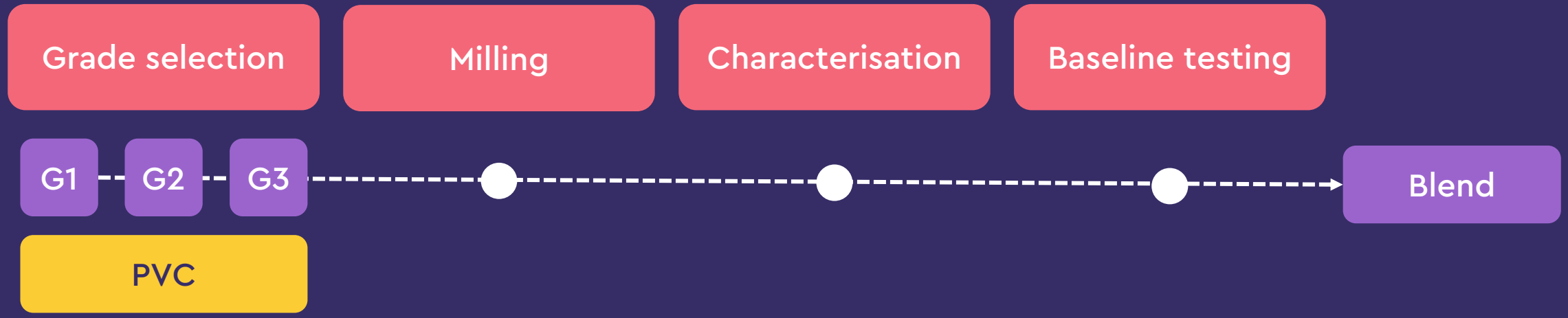
- Jet milling
- Cryogenic milling
- Ball milling
- Melt emulsion

Labelling:

- C^{14}
- Fluorescent probe
- Yttrium oxide
- Quantum dot

*in collaboration with Petcore Europe

Focus on WP1: microplastic production



Focus on WP2

WP2
Exposure assessment

In silico exposure model
(Cefic LRI B24)

Inhalation project
(Cefic LRI C10)

In vitro
Model of transfer across biological membranes (barrier model)

In vivo

- MP tracking study (MP uptake through oral route)
- Human stool study (influence of diet on MP presence in stool)

Focus on WP3

WP3
Hazard assessment

In vitro
- Tier 1: general toxicity
- Tier 2: systemic toxicity*

Ex vivo
- Gastrointestinal simulator
- 3D Liver model*

In vivo
- Porcine model
- Rodent model

*based upon demonstrated internal exposure

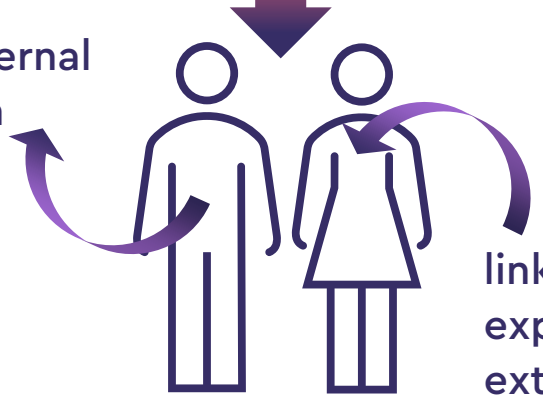
Focus on WP4: Risk Assessment

In vivo hazard studies

Hybrid approach

New Approach Methodologies (NAMs) data

human internal exposure from external sources estimation



linking measured internal exposure to potential external sources

brigid

bridging the knowledge gap on microplastics' impact on human health

Thank you for your attention

camilla.carteny@plasticseurope.org

PLASTICS EUROPE

Enabling a sustainable future