Background

Current models and concepts for determination of migration of substances from plastics are based upon the Piringer model[1] and are enshrined in food contact legislation. Recent advances in model development have shown that the Piringer model describes steady-state conditions well but that diffusion within the plastic (polymer) limits migration under most realistic use and exposure conditions which are not at steady-state. This new exposure science may provide an opportunity to advance both human health and environmental exposure and risk assessments from a wide range of structural matrices including polymers, micro and macro-plastics, metals and alloys.

Regulation of polymers under REACH is imminent and requires the development of a Technical Guidance Document (TGD) on the exposure assessment of low molecular weight components from solid, insoluble polymers. In addition, food contact regulations and associated TGD relating to repeated use and short contact conditions require updating to reflect recent scientific developments. Furthermore, greater understanding of exposure from macro- and micro-plastics is urgently needed to inform on the risk assessment of these materials and reduce societal concerns.

Workshop objectives

1. Recognising the state of the science on experimental and computational exposure modelling of the release of Low Molecular Weight Compounds (LMWC) from polymers.
2. Share cross-sector expertise on available models/methods and recent developments for exposure assessment of low molecular weight components in polymer matrices, for human health and environmental risk assessments.
3. Identify areas of research and development and how to best progress.

Workshop deliverables

1. After the workshop, the Organising Committee will compile the outcome into a proposal for future research (both HH and ENV) – how can science help to address regulatory needs and societal concerns?

2. The medium/long-term objective is to support with developing a framework for regulatory validation.

Advancing the science of exposure assessment of low molecular weight components in polymer matrices Day 1		
12:00 – 12:10	Welcome & setting the scene of the workshop	ECETOC (Moderation of the day: Blanca & Miguel)
12:10 – 12:35	For which purposes are exposure assessments of LMWC released from matrices necessary?	Mark Pemberton
12:35 – 13:00	Prediction of diffusion in polymers based on activation energies	Dr Frank Welle (Fraunhofer)
13:00 – 13:25	Modelling migration risk and consumer exposure related to short term repeated use food contact applications	Dr Rainer Brandsch (SAFE+ Algorithmics GmbH, Germany)
13:25 – 13:50	Physics-based exposure models for medical device leachables	David Saylor (US FDA)
13:50 – 14:15	Reference methods for the assessment of material emissions and the resulting AIRBORNE exposure	Dr. Olivier Noiset (Certech)
Coffee break		
14:45 – 15:10	The Plastic Additives Initiative (PLASI) - What impact did it have on ECHA's work?	Andreas Ahrens, Stefano Frattini (ECHA)
15:10 – 15:35	Developing a Test Guideline for measuring release from metal matrices: some learning lessons	Violaine Verougstraete (Eurometaux)
15:35 – 16:00	Case study 1: The Cefic LRI ECO58 project: Development of a comprehensive polymer additive release and bio accessibility model for micro- and nano-plastics	Lee Ferguson (Duke Uni)
Coffee break		
16:20 – 16:45	Case study 2: Estimating microplastics releases during service life in construction applications: a presentation of the MiRA project (Microplastics Releases from Article Service Life)	Geoffroy Tillieux (EuPC / EuMBC)
16:45 – 17:10	Case study 3: Refined exposure assessment of migrated styrene from repeat-use ABS kitchen articles	James Doyle (Creme Global)
17:10 - 17:35	Discussion of Learnings from Day 1 and take away messages	EuPC
17:35 – 17:45	Outlook to next day & dinner instructions	ECETOC
19:30	Networking Dinner	

Advancing the science of exposure assessment of low molecular weight components in polymer matrices Day 2		
12h00 – 12h30	Lunch	
12h30 – 12:45	Recap of day 1 and breakout group instructions	Plastics Europe
12:45 – 14:15	Break out groups: Strengths of science, broader applicability, knowledge gaps and research needs.	Moderators and rapporteurs
Coffee break		
14:45 – 15:45	Reporting back from the breakout groups & Discussion	Moderators and rapporteurs
Coffee break		
16:00 – 16:30	Polymers, registration requirements and exposure science (Title TBC)	Heli Hollnagel (Dow, representing OC)
16:30 – 17:15	Panel discussion: What are the concerns of regulators and stakeholders? How can they be addressed through research?	Moderator: Blanca Serrano (ECETOC) Panel members: Bart Koelmans (Wageningen University & Research), Katrin Schutte (European Commission), Michel Cassart (Plastics Europe), Miguel Arranz Prieto (Cefic)
17:15 – 17.30	Summary of research opportunities to address knowledge gaps	Bruno Hubesch (Cefic LRI)
17:30 – 17.45	Wrap-up and close of workshop	ECETOC

ORGANISING COMMITTEE:

Marcel Bosma, Ziggo
Michel Cassart, PlasticsEurope
Heli Hollnagel, Dow
Chris Howick, Inovyn
Bruno Hubesch, Cefic LRI
Mark Pemberton, Systox
Miguel Arranz Prieto, Cefic
Erik Rushton, Lyondellbasell
Geoffroy Tillieux, EuPC

Andreea Cuciureanu, ECETOC
Andrea Salvadori, ECETOC
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Contents

Abstract 1: For which purposes are exposure assessments of LMWC released from matrices necessary?

Mark Pemberton – Systox

<table>
<tr><td colspan="2">The hazard assessment of substances and mixtures is well established and based upon concepts of inherent hazardous properties and proportionality. In contrast, the hazard assessment of substances and mixtures within matrices requires the additional consideration of bioavailability. Matrices can take many forms, both natural and synthetic, and release of substances from these may be intentional or unintentional. Since many of the products that enrich our lives are, or contain, matrices the study of the bioavailability of substances within them is essential for proper hazard and risk assessment. ECETOC recently proposed a Conceptual Framework for Polymer Risk Assessment (CF4Polymers) and supporting this and other assessment frameworks is the advancement of exposure science.</td></tr>
<tr><td>  </td><td>Mark is an industrial Regulatory Toxicologist with over 46 years' experience of toxicology and global regulatory affairs within different sectors of the chemical industry including general chemicals, polymers and plastics, films and specialty chemicals. Mark has hands-on practical experience of all aspects of industrial and regulatory toxicology from toxicology testing, contracting, occupational health, risk assessment, product registration, food contact regulations and regulatory compliance to litigation defence. Mark has over 36 years' experience managing trade associations in Europe and North America and sits on several European, US and UK, National regulatory panels and workgroups. Mark is a long-standing member of the European Centre for Ecotoxicology and Toxicology of Chemicals (ECETOC) Scientific Committee and has worked on, chaired and directed numerous task forces on chemical and regulatory issues. Currently Mark's client base covers all 3 regions of the world.
Mark is the co-owner director of Global MSDS Ltd. Global MSDS provides SDS and labelling services and software to the chemicals and related industries.</td></tr>
</table>

Abstract 2: Prediction of diffusion in polymers based on activation energies?

Frank Welle – Fraunhofer

The current model for the prediction of diffusion coefficients in polymers (AP model) is highly conservative, especially for low diffusion polymers like PET and styrenic polymers. Furthermore, the AP model employs a fixed activation energy of diffusion within the polymer, which leads error in the prediction especially at elevated temperatures. Experimental determination of activation energies across the temperature range of interest is key to modelling more realistic diffusion coefficients.	
	Frank Welle is a chemist who received his doctoral degree (Dr. rer. nat.) from the University of Freiburg, Germany. In 1997 he moved to the Product Safety and Analytics Department of the Fraunhofer Institute for Process Engineering and Packaging (IVV). Since 2005 he is deputy head and since 2019 head of the department. The focal points of his professional activities include in particular the analysis of post-consumer substances in recyclates as well as non-intentionally added substances (NIAS) in packaging materials in general. Determination of the barrier properties towards organic molecules and diffusion coefficients in polymers is also part of his activity at Fraunhofer IVV.

Abstract 3: Modelling migration risk and consumer exposure related to short term repeated use food contact applications

Rainer Brandsch – SAFE+ Algorithmics GmbH

Food contact materials (FCMs) can transfer chemicals arising from their manufacture to food before consumption. Regulatory frameworks ensure consumer safety by prescribing methods for the assessment of FCMs that rely on migration testing either into real-life foods or food simulants. Standard migration testing conditions for single-use FCMs are justifiably conservative, employing recognized worst-case contact times and temperatures. For repeated-use FCMs, the third of three consecutive tests using worst-case conditions is taken as a surrogate of the much shorter contact period that often occurs over the service life of these items. Food contact regulations allow for the use of migration modelling for the chemicals in the FCM by considering for diffusion in the material and partitioning that occurs between the FCM and food/simulant during prolonged contact, under which steady-state conditions may occur.

	Dr. Rainer Brandsch (1969) studied Chemistry at the Technical University Karlsruhe, Germany with main focus on technical and polymer chemistry. After graduation in chemistry science in 1996 he started its dissertation at the University Freiburg, Freiburger Materialforschungszentrum (FMF), Germany which he succeeded in 1999. In parallel he studied economic science at the distance University Hagen, Germany. After two years engagement in the chemical industry as head of laboratory he joined an applied research laboratory for six years as research scientist being involved in the major national and international research projects (AIF, BMBF, EU, industry associations) focused on the topic of interaction between packaging and filled goods (food, cosmetic, pharma, etc.). In 2005 he took over the management of the non-profit industry association for food technology and packaging e.V., of which he was the executive chairman of the board from 2008 to 2010. Dr. Rainer Brandsch is an internationally recognized expert in migration modeling and compliance evaluation of food contact materials and founder of the companies MDCTec Services GmbH (Compliance & Migration Service), SAFE+ Certification GmbH (Certification & Petitioning) and SAFE+ Algorithmics GmbH ("digital laboratory"). Based on his competences Dr. Rainer Brandsch is member of the Migration Modeling Task Force, and scientific advisor to the EU Commission, member of the Commodities Commission at the German Institute for Risk Assessment (BfR) and member of the KTW-Commission of the German Environmental Protection Agency (UBA).

Abstract 4: Physics-based exposure models for medical device leachables

David Saylor – FDA

Medical device materials contain chemicals that may pose toxicological concern(s) if released in sufficient quantities. Toxicological risk assessment approaches are increasingly being used in lieu of animal testing to address these concerns. Currently, these approaches rely primarily on in vitro extraction testing to estimate the potential for patients to be exposed to chemicals that may possibly leach out of device materials, but the clinical relevance of the test results are often ambiguous. Recent developments suggest physics-based models can be used to provide more clinically relevant exposure estimates. However, the lack of data available to parameterize and validate these models presents a barrier to routine use. This presentation will provide an overview of these approaches, including potential benefits and limitations of current models, and key technical challenges to expanding the applicability and improving the clinical relevance of the model predictions.

	Dr. Saylor has been a staff member at the US Food and Drug Administration for the past 18 years in the Division of Biology, Chemistry and Materials Science (DBCMS) within the Office of Science and Engineering Laboratories (OSEL) in the Center for Devices and Radiological Health (CDRH). At the USFDA, he has pursued research in theoretical and computational materials science applied to medical device applications. These efforts have focused on the dynamics of medical device material systems and tissue interactions at multiple length scales: atomistic/molecular, microstructural, and device scales. This research has addressed a variety of premarket and postmarket issues for medical devices, including the impact of manufacturing changes and tissue composition on the performance of controlled drug release systems, the release and retention of nickel in patients implanted with nickel-containing alloy devices, and patient exposure to potentially toxic additives in biomedical plastics.

Abstract 5: Reference methods for the assessment of material emissions and the resulting AIRBORNE exposure

Olivier Noiset - Certech

New standardized approaches have been developed in the framework of product emission analyses considering the application conditions and the resulting exposure for end-users. These are based on the good testing practices (GTP) adopted by CEN and ISO working groups, mainly within TC146 and TC264 involved in Air Quality.	
	Dr Olivier Noisert obtained his PhD in Sciences (Chemistry) at the « Université Catholique de Louvain » (UCL, Belgium) in 1997. And was a research assistant at the university from 94 to 97. He left the university and became a « Senior Technologist » for Cabot Corporation from 1997 to 2000 : in charge of the analytical lab and the weathering center for the worldwide business units dedicated to polymer/carbon black products. From 2000, he has been working in Certech, which is a research center providing support to industries. Olivier is involved in all the fields relating to Air Quality, Odours and Environment. He is now “Quality Manager” of the center and Senior Consultant for the Air Quality Department with a great expertise focused on sensory and chemical characterizations of material emissions. Since 2002, he is involved in several working groups of NBN, CEN and ISO. Nominated as the national expert for the Air Quality Technical Committees, mainly CEN/TC264 and ISO/TC146, he participated to the drafting of more than 20 international reference standards. He received in 2017 the national NBN Award for his major contributions to standardisation work.

Abstract 6: The Plastic Additives Initiative (PLASI) - What impact did it have on ECHA's work?

Andreas Ahrens and Stefano Frattini – ECHA

<table>
<tr><td colspan="2">The presentation will provide a short recap on the joint industry-ECHA project (2017-2019), and give some insights on how it impacted on ECHA's assessment of regulatory needs for the various groups of phase-in substances. This includes for example that the technical function of the substances in products and processes is more systematically taken into account when organising the assessment process for groups of substances. This will be exemplified for flame retardants. We will also present the Practical Guide for Industry: Describing the uses of additives in plastic materials and estimating the related exposure that had been published 2020 as a follow up from the PLASI project. Initial benchmarking criteria regarding the potential for release were an important element in this practical guide. Some of the criteria had also been translated into rules for ECHA's technical completeness check of CSRs taking place since spring 2021. Finally, the presentation will look ahead towards the reform of REACH under the Chemicals Strategy for Sustainability and the future role of use and release information related to articles.</td></tr>
<tr><td></td><td>Andreas Ahrens joint ECHA in beginning of 2008, in the early days of the Agency. He works in the Exposure and Supply Chain Unit of ECHA. Over 8 years, Andreas was running a horizontal programme on Chemical Safety Assessment, which also included a common action plan with industry and Member States. The programme aimed to improve the use, exposure and risk management information in REACH registration dossiers and in the related communication up and down the supply chain. More recently, Andreas has been involved in setting up and running a manual completeness check for the CSRs in the registration dossiers and is working on various topics related to the reform of REACH under the Chemicals Strategy for Sustainability.

Stefano Frattini graduated in 1994 in environmental engineering with the thesis degree on environmental fate of pesticides in Po basin, Italy. Worked from 1994 till 2009 as free consultant mainly in the field of risk assessment and remediation of contaminated sites. Working in ECHA since 2009, with focus on projects related to Chemical Safety Assessment (including Chesar tool development), exposure scenarios and exposure assessment for both environment and human health. Contributed to several projects on exposure to substances in articles, including PLASI project for the release potential screening.</td></tr>
</table>

Abstract 7: Developing a Test Guideline for measuring release from metal matrices: some learning lessons

Violaine Verougstraete – Eurometaux

Most metals are on the market not in their pure form but as alloys. Alloys are typically designed to have different properties than those of their ingredient metals (e.g., to make them less reactive, more durable, provide greater strength or improve machinability). Recognizing the possibility that some types of mixtures may react differently than the sum of their parts, EU REACH but also the EU CLP has considered alloys as special preparations and special mixtures, "whereby the inclusion in a matrix shall be considered" (EC, 2007).
The systemic toxicity of metals & metalloids and many of their local toxicity effects are associated with the release of soluble metal ions and their uptake by the body and/or interaction at their target organ sites (i.e. bioavailability of the metal ions). The assumption is that all ingredients in alloys are considered to be bioavailable to some extent. However, the metal ion release may differ significantly between the metallic alloy and its pure metal ingredients.
To measure that difference in release and evaluate the possible impacts on toxicity, the metal sector has developed a 'bioelution test' that estimates the relative in vitro bioaccessibility (IVBA) of an alloy by comparing results with those from a reference material, such as a pure metal. The protocol of this bioelution test was carefully verified by EURL ECVAM on request of DG ENV and subsequently submitted to the OECD WNT Expert Group, to draft a Test Guideline. This process is still ongoing.
The presentation will focus on the main (technical) learnings on the process of developing this protocol.

Violaine Verougstraete studied medicine and toxicology at the Catholic University of Louvain, did a DEA in Public Health and obtained her PhD in Public Health in 2005 from the Catholic University of Louvain (Belgium).
She worked as a researcher at the Industrial Toxicology and Occupational Medicine Unit of the Catholic University of Louvain for 8 years. She collaborated in the EU Risk Assessment « Cadmium and Cadmium Oxide ».
Between May 2005 and December 2011, she worked for Eurometaux as Health and Alloys Manager. Her main task consisted of coordinating Eurometaux's scientific activities and projects, e.g. the HERAG and MERAG programmes on risk assessment methodologies for metals, support the development of tools to address metal specificities backing up the REACH registration and CLP dossiers.

Abstract 8: Case study 1: The Cefic LRI ECO58 project: Development of a comprehensive polymer additive release and bio accessibility model for micro- and nano-plastics

Lee Ferguson – Duke University

Comprehensive risk assessment of polymer additives in the aquatic environment depends critically on the ability to measure and subsequently predict exposure of sensitive receptors to these materials. Robust models are needed to assess leaching of additives and other polymer-associated chemicals (PAC) from plastics into water and digestive environments of exposed biota. Significant challenges exist to development of these models, including wide molecular diversity in PAC chemical space, varied and increasing types, sizes, and formulations of polymers introduced into the environment, complexity in nano-/microplastic transport and degradation in the environment, and variability in receptor organism digestive environments, among others. We will discuss our progress in developing a robust and generalizable model to predict polymer additive release, transformation, and bioaccessibility in context of realistic aquatic environments. This model is based on chemical and physical properties of chemical additives, polymer materials, and leaching environments, and will be parameterized through both incorporation of existing data available for these properties and through laboratory experimentation. We anticipate that the developed model will represent a significant advancement in our understanding of PAC dynamics in the aquatic environment and will be directly useful to risk assessors/managers dealing with polymer release into the environment and associated implications.

Dr. P. Lee Ferguson is an Associate Professor of Environmental Science and Engineering at Duke University in Durham, NC. He received B.S. degrees from the University of South Carolina in Chemistry and Marine Science in 1997 before earning a Ph.D. in Coastal Oceanography at State University of New York – Stony Brook in 2002. His postdoctoral research was conducted in the area of proteomics at the Pacific Northwest National Laboratory in Richland, WA. Before joining Duke, Dr. Ferguson was an Assistant and Associate Professor of Chemistry at the University of South Carolina. Research in the Ferguson laboratory is focused on Environmental Analytical Chemistry. Specifically, a major thrust of research in the lab involves the application of high resolution, accurate mass (HRAM) mass spectrometry coupled with multidimensional chromatographic separations, bioaffinity isolation techniques, and chemoinformatic methods to detect, identify, and quantify emerging contaminants (including endocrine disruptors, pharmaceuticals, surfactants, and persistent organic pollutants) in wastewater and drinking water. His recent work has centered on the development of non-targeted analysis workflows and methods, assessment of polyfluorinated alkyl substances in water and wastewater, and leaching and bioaccessibility of polymer-associated chemicals from microplastic particles in the aquatic environment.

Abstract 9: Case study 2: Estimating microplastics releases during service life in construction applications: a presentation of the MiRA project (Microplastics Releases from Article Service Life)

Geoffroy Tilleux - EuPC/EU MBC

For the time being there is no sound scientific basis for estimating microplastics releases during the article service life. Default approaches related to additives releases overestimate potential microplastics releases. At the same time no dedicated test method exist that might enable to estimate those release. This project focused on construction application and investigated both potential test methods, a common assessment framework and the building of exposure scenarios related to the actual conditions of use.

Geoffroy graduated in 2000 from Solvay Business School, specialisation Finance and manufacturing, Université Libre de Bruxelles,. He obtained a Master in Law in 2012 from Université Catholique de Louvain and a Master in environmental management in 2017 from the Université Libre de Bruxelles. He has been working for the European Plastics Converters Association since 2000. As Director of the EuPC Technical Department, Geoffroy coordinates the raw materials committee, food contact issues and risk and socio-economic assessments related to the REACH legislation. Since 2019, he coordinates activities related to microplastics. He also heads the Regulatory Compliance Services Division of Polymer Comply Europe, EuPC's service company.

Abstract 10: Case study 3: Refined exposure assessment of migrated styrene from repeat-use ABS kitchen articles

James Doyle – Creme Global

Dietary exposure to chemical migrants from plastic kitchenware during the preparation of food is complex and dependent upon a range of factors relating to the design and use conditions of kitchenware items, migration rate into food, dietary factors etc. The effects of dietary exposure to chemical migration from Acrylonitrile Butadiene Styrene (ABS)-based kitchen utensils and small electrical appliances was investigated using probabilistic exposure modelling to better understand the challenges involved in performing higher tier exposure assessments.

Creme Global is focused on advancing aggregate and cumulative exposure and risk modelling methods and capabilities for the benefit of industry, regulatory, and public interest communities. Dr. James Doyle works as Director Global Accounts in Creme Global, where he supports top tier clients across multiple industries with exposure, data science and other associated projects and products. James brings over 20 years of experience of commercialisation and business analysis in the high tech world, translating advanced materials and polymer solutions to address identified business needs across diverse industrial markets including healthcare, electronics, automotive, aerospace and renewable energy. Along the way he's co-authored over 20 international peer reviewed papers in the area of polymers and materials science (H-index of 18), listed as inventor on several patents, managed an active spin-out portfolio, and co-founded a medical device start-up company. With a degree and PhD in the area of physics and materials science, James was also the project manager for a host disruptive technology research projects with De Puy, Johnson & Johnson, Nokia and Merck, bridging the gap between research and commercialisation, and mapping long term, multi-million investments.

PANEL DISCUSSION

Katrin Schutte – EU Commission DG Environment

	Dr Katrin Schütte is a policy officer at the EU Commission's Directorate for the Environment, which she joined in 2014. Her responsibilities cover several aspects of REACH (mainly Registration and Evaluation); in this role she is leading the work on the definition of registration requirements for some polymers as well as the amendment of the information requirements for all REACH-substances following the Chemicals Strategy for Sustainability. In addition she is co-responsible for the implementation of Directive 2010/63/EU on the protection of animals used for scientific purposes. Katrin has a degree in nutrition sciences from the University of Hohenheim, a PhD in neurobiology from the University of Heidelberg (DE) and is Diplomate of the American Board of Toxicology (DABT) and an European Registered Toxicologist (ERT). Before joining the Commission, she worked for 15 years as a toxicologist and regulatory affairs manager in the consumer products sector.

Michel Cassart – Plastics Europe

	Dr Michel CASSART, graduated as an Engineer in Material Science, started his professional career by working in an Academic Research Environment where he achieved a PhD. He moved to an industrial environment in 1995, while he simultaneously achieved a Master in Business Administration (MBA) in 2002. During more than 20 years he has built up industrial experience in Plastics by occupying various management positions in R&D, Customer Services, Polymer Production Process, Business Management & Business strategy. In 2016 he joined PlasticsEurope to coordinate Food Contact, REACH and some sector groups' activities. In 2020 Michel moved to the position of Sustainable Use Director coordinating all activities related to the sustainable use of plastics including topics such as safety of plastics and microplastics.

Bart Koelmans – Wageningen University

Bart Koelmans is an environmental chemist and ecotoxicologist by training who heads the Aquatic Ecology and Water Quality Department at Wageningen University. In the field of plastic research, his group aims to bridge the gap between conceptual and empirical approaches to obtain a mechanistic understanding of the risks of microplastic for human health and the environment. For microplastics, his risk assessment framework was the first to be applied in a regulatory setting. Bart is a global highly cited researcher (Clarivate Analytics), advises international organizations like the World Health Organization and the UN, led high-profile international working groups on the risks of plastic pollution, such as the European Commission's Science Advice for Policy by European Academies (SAPEA) expert group on Microplastics in Nature and Society, and is Editor-in-Chief of the journal Microplastics and Nanoplastics.
More on https://www.microplasticlab.com/

Miguel Angel Prieto Arranz - Cefic

Miguel Angel Prieto Arranz, is a chemist by training, and is currently the Director of the "Food & feed"- and "Plastic Additives"-clusters in Cefic (the European Chemical Industry Council). He is the responsible Sector Group manager for "FCA" –Food Contact Additives. Before joining Cefic in 2012, he worked in FoodDrinkEurope (the association of the European food and drink manufacturing industries) as food policy, science and R&D manager. Prior to that, he worked as R&D manager at the Technology Transfer Center Bremerhaven (ttz-Bremerhaven) in Germany.

LIST OF PARTICIPANTS

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Marcel Bosma, Ziggo
Rainer Brandsch, SAFE+ Algorithmics GmbH
Michel Cassart, Plastics Europe
Andreea Cuciureanu, ECETOC, BE
Esther Dantas-Costa, BASF
Rene de Graaff, Lyondellbasell
Danaëlle Delage, Environment and Climate Change Canada (ECCC)
Christiaan Delmaar, RIVM
James Doyle, Creme Global
Ralf Eisert, BASF
Tobias Eltze, BASF
Birgit Faust, Dow
Lee Ferguson, Duke University
Norberto Fernandez Soriano, EuMBC
Brian Flynn, Creme Global
Stefano Frattini, ECHA
Athanasios Gkrillas, Dow
Chad Hales, Dow
Heli Hollnagel, Dow
Chris Howick, INOVYN
Bruno Hubesch, Cefic LRI
Elke Jensen, Dow
Bart Koelmans, Wageningen University, NL
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Valérie Moise, Cabot Corporation
Olivier Noiset, Certech
Jens Otte, BASF
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Philippe Pigeolet, Cefic
Miguel Prieto Arranz, Cefic
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Tomas Simat, Dresden University of Technology
Miriam Sarah Strangl, BASF
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Violaine Verougstraete, Eurometaux
Zhanyun Wang, ETH Zurich
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Rolf Wittlinger, BASF
Kara Woeller, P&G
Yuhua WU, Cefic

Breakout Groups – Day 2

Group n° 1 (online)

Blanca Serrano (Moderator)
Erik Rushton (Rapporteur)
Andreas Ahrens
Marcel Bosma
Rene de Graaff
Chad Hales
Bart Koelmans
Søren Ryom Villadsen
David Saylor
Oscar Vandevelde

Group n° 2 (online)

Elke Jensen (Moderator)
Kara Woeller (Rapporteur)
Caroline Bisschoff
Rainer Brandsch
Danaëlle Delage
Alexander Lichtblau
Jens Otte
Tomas Rydberg
Katrin Schutte
Zhanyun Wang

Group n° 3 (f2f)

Geoffroy Tillieux (Moderator)
Anthanasios Gkrillas (Rapporteur)
Michel Cassart
James Doyle
Birgit Faust
Bruno Hubesch
Miriam Sarah Strangl

Group n° 4 (f2f)

Mark Pemberton (Moderator)
Chris Howick (Rapporteur)
Norberto Fernandez Soriano
Brian Flynn
Heli Hollnagel
Olivier Noiset
Miguel Prieto Arranz
Rolf Wittlinger