



Scientific Advice Mechanism

Environmental and Health Impacts of Microplastic Pollution – from scientific evidence to policy advice

Workshop Report

**An Expert Workshop of the Group of Chief Scientific Advisors of the
European Commission's Scientific Advice Mechanism (SAM)**

Organised by the SAM Unit

(10-11 January 2019, Brussels)

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Microplastic Pollution

An Expert Workshop of the Group of Chief Scientific Advisors
of the European Commission's Scientific Advice Mechanism (SAM)

10 – 11 January 2019, Berlaymont Building, Brussels

WORKSHOP REPORT¹

Background

The first step towards the production of a Scientific Opinion by the Group of Chief Scientific Advisors of the Commission's Scientific Advice Mechanism (SAM) was its Initial Statement on this topic published in July 2018. This was followed by publication in November 2018 of a background paper² on the microplastic pollution policy context by the SAM Unit and in January 2019 of an Evidence Review Report³ by the Science Advice for Policy by European Academies (SAPEA) consortium as inputs to the Advisors work on the Scientific Opinion. The SAPEA report, which draws on relevant scientific literature from the natural, social, behavioural, legal and political sciences, was endorsed by the Advisors. The purpose of this expert workshop was to review the state of scientific knowledge as summarised in the SAPEA report and other papers through the lens of a fast-moving policy agenda at national, EU and international level in order to bridge from the current scientific evidence to an EU policy-orientated Scientific Opinion on this subject. The workshop involved 29 experts, including nine members of the working group which produced the SAPEA report.

Opening Session

In opening, the Group of Chief Scientific Advisors recalled the purpose, format and rationale of the workshop. In addition, introductory remarks by two Commission Directors General underlined the need for scientific advice on this topic, recalling that the case for relevant parts of the 2018 EU plastics strategy was made difficult by the relative paucity of robust scientific evidence. Furthermore, with microplastics mainstreamed into the public consciousness across Europe and the world, policy makers face the difficulty of responding to the public's expectation for rapid action. For such a response to be wise and efficient, science must be married with sound policy making. This means discerning where prompt action is required and filling knowledge gaps in need of urgent answers on which new actions and adjustments to existing ones may depend.

¹ See workshop programme, expert briefing and list of participants in annex

² <https://ec.europa.eu/research/sam/index.cfm?pg=pollution>

³ <https://www.sapea.info/topics/microplastics/>

I. Scene-setting & international context

Microplastic pollution is found in aquatic, soil and air environmental compartments the world over, even in the remotest locations, hence its global nature. The way the problem is addressed in different jurisdictions by regulations affecting sectors of activity can also have international reach via implications for the economy and trade.

Most people worldwide decry the accumulation of plastic pollution in the environment and the effects it has on biota and ecosystems, irrespective of what science says about such impacts. People also intuitively understand the microplastic part of the problem with added fear of the unknown arising from its invisibility to the naked eye and the ease with which it may be unwittingly ingested or inhaled and the effects this might have.

Plastics are ubiquitous to modern living and in the prevailing socio-economic system. While recognizing the socio-economic value of plastic, the public also sees (micro)plastic pollution as an indicator of a broken plastics system. Most of the problems with plastics lie in their misuse together with unintentional consequences of their use and how they are disposed of, rather than with plastics *per se*.

Plastic pollution and climate change are two tracers of the fossil fuel based society. Plastic is carbon-based and linked to the carbon cycle, and can be seen as a possible carbon sink or source. There is the need for a much more sustainable plastics system at all levels. How the microplastics part of this overall problem is handled will be an essential metric of success or failure.

Whatever specific measures might be justified to address microplastics downstream from where they originate, these should not distract from but rather help also address the need to solve the problem at the higher systems level or scale. In discerning measures appropriate to different levels of aggregation and different actor-types (public, private), it is important to involve multiple stakeholders, including NGOs keeping in mind holistic, full life-cycle considerations and interdisciplinary knowledge.

There is a disconnect between public expectations for action on microplastics and what can or should (from a scientific perspective) be delivered. If optimally tailored and heeded, science advice can strongly anchor decisions, facilitate transparent communication and public understanding of action and inaction as well as helping to attenuate ill-advised, knee-jerk, copy-cat and virtue-seeking political responses. In the process, it is also important to frame evidence in a way that prevents its misuse by those seeking to advance specific interests without regard for the overall public good.

The approach to microplastics at different governance levels has not changed much since 2013. There is a dominant focus on the marine environment. The modes of action advocated and sometimes enacted aim at education (awareness raising, science), engineering (products, processes, applied research) and enforcement (penalties, bans). Furthermore,

similar rationales and measures are replicated across different governance levels and bodies, though not necessarily redundantly so.

A key distinction between EU and broader international forums is that EU action is rules based while other international forums are custom-based which can also eventually lead to codified legally binding measures.

One of the virtues of the EU rules-based approach, of which the subsidiarity principle forms part, is that it gives agency to member states permitting measures to be adapted to individual member state circumstances. The international implications of EU-based measures impinging directly upon a marketplace of 510 million people and indirectly on a lot more via trade and other areas of global responsibility and engagement, are very high and need to be constantly borne in mind. This makes the EU plastics strategy adopted in January 2018 a leading example of a holistic and systemic approach within which to address microplastic pollution. A similar plastics strategy for Canada launched in November 2018 is in the same vein.

A large amount of time and energy is being spent examining microplastics at international level through different organizations, frameworks and working groups. This is generating a lot of words, promises and good intentions but not necessarily a lot of action. And yet, international collaboration is key to addressing this issue. A global problem needs global solutions.

Among the wealth of initiatives leaving a trail of analyses, pronouncements, resolutions, action plans, *etc.*, of particular note to watch out for in the coming months are: advice from an *ad hoc* open-ended expert group on marine litter and microplastics to the March 2019 fourth UN Environment Assembly (UNEA-4); an expected extension of technical guidelines on the environmental and health aspects of plastics under the Basel Convention by May 2019; a review during 2019 by the WHO of the human health impacts of microplastics via food and air exposure pathways, expanding on its initial work focussing on drinking water; a forthcoming (March 2019) GESAMP guidelines for harmonised monitoring and assessment of plastics and microplastics in the oceans; among others.

II. Regulatory instruments & legal and political sciences

There is an increasing call by policy makers for clear and robust scientific underpinnings and rationales on which to base hard and soft policy measures which address microplastic pollution - whether narrowly focused, issue-specific or rather broad systemic measures where microplastics pollution is one of several interrelated symptoms of wider problems. This should be seen against a background of existing and emerging policy measures which have thin or non-existent foundations in the natural sciences and where other factors such as public opinion, political opportunity, disamenity considerations, *etc.*, some of which can be grounded in social sciences research, are driving the agenda. In such a situation, it is important that science and scientific advice be brought into the debate in a carefully dosed

and transparently-communicated way, especially when many scientific uncertainties and knowledge gaps sit alongside some few consensual scientific insights.

In addition to the precautionary, proportionality and polluter-pays principles governing EU environmental policy measures, science advice and policy action in this area should keep in mind other overarching imperatives enshrined in the EU treaty such as sustainable development and ensuring a high level of protection and improvement in the quality of the environment.

Scholars suggest that effective intervention will continue to require a mix of measures from authorisations, emission reductions, protection goal setting, *etc.* - involving both hard and soft law. In EU terms, it is helpful to keep in mind the different classes of applicable policy rationales - internal market (authorisations, REACH, *etc.*); end-of-pipe (waste treatment); and the quality of the receiving environment – as well as overarching policy strategies such as circularity, noting, however, that circularity cannot apply to *in situ* microplastics and that it should not apply to substances that are, or are likely to be, harmful in themselves or vectors of other persistent toxins.

The Marine Strategy Framework Directive was showcased as the only legally-binding instrument committing EU member states to take measures against microplastic litter. Mention was also made of many EU measures which are either implicitly or explicitly relevant to microplastics or could become more so in the future, especially those which are subject to cyclical reviews and revisions. The general concern for the dynamic efficiency of policy measures and their potential for positive effects on innovation was also mentioned as being pertinent to this cyclical approach.

In order to optimally tune scientific advice to policy needs, it is important to have clear problem formulations in each case - what do policy makers really want: to reduce risk? to reduce harm? to reduce release of plastic to the environment? something else?

At one level, it was suggested that the distinction between primary and secondary microplastics can help to orientate policy interventions and the use of relevant science in relation to a focus on mitigating or preventing negative environmental or health impacts. At higher aggregation levels, policy interventions may need to focus on aspects and problems of which microplastic pollution *per se*, is a symptom. At such levels, system-wide trade-offs and cost/ benefit analyses or opportunity costs need to be considered. Other more specific cost considerations to bear in mind pertain to the cost of helping to close key scientific knowledge gaps and holes.

The example of a proposed restriction under REACH by ECHA on intentionally added microplastics to products based on a combination of risk assessment approaches which concludes that there is an inadequately controlled risk to the environment, illustrates one way of applying science and acknowledging uncertainties in a specific regulatory context. By extension, ECHA's conclusion and reasoning could be applied to other more abundant

sources/fractions of primary and secondary microplastic emissions such as precursor pellet loss, tyres and textile fibre abrasion, though REACH cannot be a route for measures applicable to these.

III: Behavioural & social sciences

Insights from the social and behavioural sciences add to the understanding of risks and uncertainties in environmental and health impacts of microplastic pollution. Their combination with natural sciences evidence in the SAPEA report was considered to be a welcome novelty.

The decision-making processes and behaviour on which the social sciences can focus are found everywhere within the plastics system – they can be looked at from an economic, societal or environmental angle and from the perspective of organisations and interests that represent these different angles. They can relate to a range of mechanisms of change which are either top-down (legislation, soft law, incentives and fines) or bottom-up (voluntary agreements, grassroots dynamics, NGO, self-organised and individual leadership).

There is evidence of an exponential increase in the coverage of the microplastics topic in both mass media and scientific literature. Nevertheless, scientific publications on the behavioural social sciences dealing particularly with micro and nanoplastics, are few and far between compared to the natural sciences. Broader relevant literature on risk perception, risk communication and behaviour change can be drawn on to compensate for this.

The media play an important and powerful role in the public understanding of plastic pollution given its high popularity and newsworthiness. However, the media do not always report science in a straightforward and clear way just as scientists also report their findings in a way which is influenced by values.

The media landscape is also changing with the rise of social media, where tailored content and an increasing use of images and visual grammar, give rise to new opportunities for meaningful engagement and empowerment of citizens.

The study of the general public's knowledge and risk perception of microplastics is very limited. However, risk perception research more generally has shown that expert and non-expert judgments often differ, because they are ruled by different factors. For some people, risk perception is based on benefit trade-offs and for others on moral reasoning. But, in general, the public rely on experts to assess the risks of something they cannot see – as is the case for micro and nanoplastics - and therefore risk perception becomes a question of who do people trust?

Communicating risk and uncertainty is challenging, and is often presented as dilemma. However, people in general prefer transparent and honest communication on the nature of the risks and uncertainties, which they then tend to accept more readily as long as they are not prolonged over time. The example of the Intergovernmental Panel on Climate Change

(IPCC) using verbal descriptions of uncertainty and probabilities in their reports was mentioned, but the level of understanding of these has been revealed to vary greatly. Risk communication is not only about facts nor just the top-down passing on of information. It is important to think about co-creation and participatory approaches so that regulation will have stronger acceptance.

Addressing microplastics pollution and its effects requires integration, interdisciplinary analysis, innovation and evaluation. There is a need for systematic analysis of actors and their constraints and motivations, noting that behavioural change can sometimes occur much quicker than the typical time needed to develop and implement legislation. This suggests a preference for bottom-up voluntary measures or 'nudging' approaches when speed is required. In the case of voluntary measures by firms, these can work best under the threat of legislation.

The planetary boundary framework concept (which defines the environmental limits within which humanity can safely operate) may influence global sustainability policy development as plastic pollution is still at an emerging stage, and does not yet constitute a coherent picture. Current knowledge is very fragmented. It needs systemic integration, looked at from different perspectives and over different timeframes. The human perspective is just one of the many possibilities. There are already many pieces of legislation and there is a policy coherence challenge on how to put also all these pieces together.

The concept of risk is very important. How do we define risk for a problem that is completely human-caused? Risk professionals and the general public do not share the same perspective. The former see risk as a product of hazard and exposure ($\text{Risk} = \text{Hazard} \times \text{Exposure}$), whereas for the latter view risk more as a combination of the real or perceived hazard and the outrage felt ($\text{Risk} = \text{Hazard} \times \text{Outrage}$). Even among specialists, there are different approaches to risk assessment as pointed out in the next section.

IV. Natural sciences

While there is consensus on the ubiquity of microplastics - in air, water, soil, the food chain and biota including humans, significant challenges remain for scientific measurement and test methods in order to better understand and monitor the origins, pathways, fate and behaviour of microplastics. Added to this challenge, is their complexity in terms of size, shape, polymer and chemical composition, compounded by additional processes of relevance to their potential impact such as biofouling, ageing, adsorption/leaching of chemicals, as well as possible cocktail effects and bioaccumulation/evacuation.

With regard to nanoplastics, even though concentrations or exposures are still largely unknown, the scientific community is convinced that their presence and possible adverse effects are plausible, though this really does constitute a gaping knowledge hole.

Based on a limited number of studies following a threshold based PEC/PNEC⁴ approach, there is currently no evidence of widespread risk due to microplastic pollution but this is not the same as saying there is no risk as adverse effects can still occur below the preliminary PNEC values derived in these studies. There are certain locations (e.g. ports) where concentration levels are known to be at or near effect thresholds. Other scientific approaches to risk assessment such as the non-threshold approach proposed by ECHA, which is similar to the risk assessment of PBT/vPvB substances⁵, as well as threshold and 'case-by-case' assessments, conclude that releases of intentionally added microplastics pose a risk that is not adequately controlled.

As concentrations change over time, scientific scenario analysis and modelling is instructive for predictions and quantification of uncertainty. Based on such analyses, business-as-usual will result in future concentrations of microplastics increasing and exceeding effect threshold levels in many different locations (noting that other more inaccessible or to-date unmeasured locations may already be experiencing concentrations beyond the effect thresholds – such as deep water sediments, terrestrial soils, etc.).

Evidence and knowledge about ecological effects decrease with increased ecological relevance (*i.e.*: from subcellular level up to ecosystem level). Work carried out under JPI Oceans suggests that acute ecotoxicity tests were not informative enough to derive ecological thresholds for microplastics.

Experts agree on the value of clearly defining protection goals (*e.g.*: maximum tolerable emission limits, no harm to the environment) and examining how science can provide workable proxies for these while cautioning that this may require significant effort and time. One such example of a proxy for environmental threshold could be derived based on species sensitivity distribution.

There are no published studies which have purposefully looked at environmental effects on human health. Although there is a dearth of such studies, some evidence for uptake and distribution throughout the body indicate the digestive tract and airway as entry pathways to consider together with the need for exposure assessment studies. Despite the lack of representative microplastics used in experiments, experts conclude that microplastics contamination in the food chain is driven by air and running water. Evidence suggests presence of microplastics and possibly nanoplastics in edible animal species (fish, bivalves, and crustaceans), food products and beverages but concludes that contamination of the human diet, compared to other sources, is probably not presently relevant but may become so over time. However, future trends indicate possible increase in exposure which, in particular when long-term, could reach toxic threshold and visible effects.

⁴ Predicted No-Effect Concentration (PNEC) and Predicted Environmental Concentration (PEC)

⁵ Persistent, Bioaccumulative and Toxic/very Persistent and very Bioaccumulative

Other scarce evidence suggests that migration from packaging of nanoplastics to food (*e.g.*: nanosilver particles used to extend shelf life) is unlikely but could represent a potential area for further regulatory examination.

Experts pointed out that to date there have been no studies published for many types of food. Drawing on the work carried out under JPI Oceans, experts agreed on the need for integrated exposure assessment of microplastics in humans and identification of critical exposure routes. They also underlined the need for further development of standardised analytical procedures for the measurement of micro- and especially nanoplastics in different matrices as well as the need for toxicological studies. This is necessary for the establishment of accurate protection goals, for data collection at international level and for the monitoring of the risk related to microplastics.

The discussion raised a variety of other points such as: whether to continue with the Risk Assessment approach based on acute toxic endpoints or rather develop and establish innovative and workable methods capable of assessing complex systems – mixtures, *etc.*; seeing what relevant insights can be derived from comparisons of polymers to natural fibres or inorganic particles in terms of underlying behaviour and impact mechanisms in biota and ecosystems; the need for caution regarding how the relevance for policy of life cycle assessments can vary depending on the initial definition of boundary conditions and scope (*e.g.* Danish plastic shopping bag study).

V. Towards a Scientific Opinion

While science does not necessarily have to be the basis for policy decisions and legislation, when relevant scientific knowledge and advice are available, they can serve as a strong anchor. Additionally, the (un)availability of pertinent scientific knowledge may have implications for the legal basis on which actions or measures are taken – the single market logic in this respect being potentially different from a risk or harm reduction rationale or other similar science-based considerations which tend to underpin environmental measures.

In addition to insights on the environmental and health impacts of microplastic pollution, science and scientific advice could also shed light on broader considerations such as the trade-offs arising in other areas from taking action on microplastics (*e.g.* possible increased carbon footprint of alternative materials offsetting gains in reduced plastic pollution, *etc.*). This, together with wider considerations (as mentioned above such as fixing the broken plastics system, *etc.*) could lead to expanding the scope of legislation to better address the problem (*e.g.* promoting eco-design, *etc.*).

Coherence is an important consideration looking across different policy instruments and levels of governance as well as between the public and private spheres of action (for the private sphere, in the case of firms, this brings into play voluntary commitments, standards, *etc.*). Choosing instruments which are appropriate for the prevailing circumstances and

tailoring them to clear policy objectives is very important. Direct voluntary action can constitute a quicker response than legislation though its effectiveness may depend on how well framed in policy terms are its objectives.

The high level of attention and public consensus surrounding microplastics suggests that conditions similar to those which were in place at the time of the Montreal protocol, occur today for microplastics - therefore a similarly rapid international agreement might be worth pursuing, especially if industry were to play a supportive role.

Specific targets for policy measures should already include microplastics which science considers to have the highest likelihood of a negative impact in the medium to long term given that, in the near term, irrefutable scientific evidence of a widespread health or ecological impact is unlikely. As stated in the SAPEA report, this means targeting microplastics related to high volume usages, high emission profiles (e.g. textiles, tyres) and/or intrinsic hazardous properties (PVC, fibres, size and shapes classes more likely to cross biological barriers and bioaccumulate).

In keeping with modern, common-sense regulatory practices, the choice of instrument should target the largest possible impact with the least possible effort or disturbance to stakeholders while being politically feasible. Echoing the SAPEA report, the best available knowledge from the behavioural and social sciences should also be mainstreamed into instrument choice and implementation.

A lot can be achieved in the near term by taking advantage of the power of the EU and its ability to manage the single market by harnessing the existing legislative instruments and on-going cyclical reviews such as those listed in the Policy Context background paper, some of which may constitute low hanging fruits.

The large fraction of textile fibre leakage could be significantly reduced by mandated performance standards for domestic washing machines, industrial laundries and similar, attainable via industrial innovation. In the process, this would reduce or eliminate the downstream pollution of soils by microplastics trapped in sewage sludge used as fertilizer.

Eliminating unintentional leakage of microplastics by primary plastics producers could be addressed by introducing a condition in integrated pollution and control licences under the industrial emissions directive, aiming at the biggest risks/ biggest polluters in a first instance.

The significant component of secondary microplastic pollution from tyre abrasion and rubber crumb on synthetic playing fields could be addressed by modifications to hydrocarbon interceptors for road networks and dedicated drainage systems.

Increasing resources for ECHA, as was proposed, would permit better more balanced assessments which would accelerate the substitution of hazardous chemicals by others which are not or are less harmful – such as the many chemicals contained in commercialised plastics and which end up in the environment – e.g. textile microfibers carry hazardous plasticisers, dyes, water and stain repellents, pesticides, etc.

Synthesis

Based on the above digest of the discussion, the options presented in the SAPEA ERR and other material and evidence presented at the workshop, a number of tentative and non-exclusive orientations are noted as a basis for reflecting on the content of the Scientific Opinion:

- Obtain clarity on what microplastic pollution really entails – understanding and describing the complexity of the issue in terms of: 1. what materially are we talking about (definitions, baselines, types of materials, *etc.*); 2. the geo-physico-chemo-bio-problems associated with it or perceptions thereof (by scientists, citizens, politicians); 3. how it can be addressed - at different levels of aggregation, directly or indirectly, bottom-up or top-down, by different actors (government, civil society, business); and 4. The specific objective of each given action or measure (reduce risk? reduce harm? reduce leakage into the environment? Other? ...)
- Establish standardised analytical procedures to measure micro- and especially nanoplastics in different matrices, to permit toxicological studies establish accurate protection goals, to give rise internationally comparable data and to enable the monitoring of risks
- Broaden attention and action beyond the thus-far primarily marine environment focus in both the public and expert debates on microplastics, to one which adds attention in a balanced and proportionate way to all environmental compartments and loci of concern (marine, freshwater, air, soil, sediments, the human body, biota, food)
- Differentiate between different types of microplastics in terms of form and composition and cocktails thereof, as a function of their relative potential harm coupled with metrics and other means of facilitating practical and effective controls or ways of elimination to be implemented
- Eliminate harmful substances / sources and substance-replacement considering holistic system-wide trade-offs to avoid even more negative consequences arising elsewhere (*e.g.* use of less environmentally sustainable materials, higher carbon footprints of alternatives/ substitutes, *etc.*)
- Consider EU-level rules-based measures applicable to product market approval and environmental policy which constitute low-hanging fruits in terms of filling existing gaps (*e.g.* coverage of plastic fibres in air quality legislation, or mandating the closing off leakage routes such as via filters on washing machines for textile fibres, improved technology for road run-off, addition of requirements into integrated pollution prevention and control (IPPC) licences, *etc.*)

- Identify areas where, and consider what, action could be taken internationally which is compatible and builds on the international attention it is already receiving, taking inspiration from the exceptional consensus surrounding this issue similar to that which permitted an exceptionally rapid agreement and implementation of the Montreal Protocol some decades ago
- Though the aim should be to make all plastics circular, consider what, if anything, should be done about microplastics already in the environment which are impossible to recycle and what the extent of residual plastic leakage into the environment is likely to be in a nominally fully closed-loop plastics system
- Extol and underline the need for scientific inter- and transdisciplinary as well as for better communication and education of the public on the issue regarding what is known and not, and the planning and implementation of EU measures
- Consider the potential opportunity for promoting on one hand new, innovative science in addressing up-stream fundamental knowledge gaps and holes, and on the other hand, innovative solutions, in relation to direct ways and means of reducing/eliminating microplastic leakage into the environment in cases where the potential risk or hazard warrants this, or indirect ways via shifting the production/ consumption paradigm to eco-design, circularity and other zero-waste and similar sustainable concepts
- In addition to a pro-innovation approach, consider on how better to incite and harness voluntary agreements among industry and to promote knowledge sharing between the private and public sectors on key scientific challenges central to ascertaining the real potential risks and hazards of these materials to human health and the environment.

Appendices

1 - List of Attendees

Participants

Surname	Name	Affiliation
Blust	Ronny	University of Antwerp (BE)
Calleja Crespo	Daniel	Director General for Environment, EC (BE)
Carney-Almroth	Bethanie	University of Gothenburg (SE)
Cloetingh	Sierd	SAPEA Board Chair (NL)
Collot	Anne-Gaelle	PlasticsEurope (BE)
Cornell	Sarah	Stockholm Resilience Centre (SE)
Cronin	Richard	Department of Housing, Planning, Community & Local Government, Ireland & SAPEA WG Member (IE)
de France	Jennifer	World Health Organisation WHO (CH)
Dykstra	Pearl	Deputy-chair of the EC Group of Chief Scientific Advisors (NL)
Fortunato	Elvira	Member of the EC Group of Chief Scientific Advisors (PT)
Gouin	Todd	TGER (UK)
Grobert	Nicole	Member of the EC Group of Chief Scientific Advisors (UK)
Hamzawi	Nancy	Assistant Deputy Minister for Science and Technology, Environment and Climate Change Canada (CA)
Hanke	Georg	Joint Research Centre, European Commission (IT)
Henderson	Lesley	Brunel University & SAPEA WG Member (UK)
Heuer	Rolf	Chair of the EC Group of Chief Scientific Advisors (CH)
Hogg	Dominic	EUNOMIA (UK)
Kalčíková	Gabriela	University of Ljubljana & SAPAEA WG Member (SI)
Kalimo	Harri	Institute for European Studies, Vrije Universiteit Brussel (BE)
Kershaw	Peter	Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP) (UK)
Koelmans	Bart	Wageningen University & SAPEA WG Chair (NL)
Kramm	Johanna	Institute for Social-Ecological Research, Frankfurt (DE)
Linder	Mats	Mats Linder, MLSH Consulting (BE)
Mackay	Karen	European Food Safety Agency (EFSA) (IT)
Nemer	Mona	Canada's Chief Science Advisor (CA)
Pahl	Sabine	University of Plymouth & SAPEA WG Vice-chair (UK)
Paquet	Jean-Eric	Director General for Research and Innovation, EC (BE)
Penca	Jerneja	Euro-Mediterranean University (SI)
Petersen	Ole	SAPEA & Vice President of Academia Allea (UK)
Rocha Santos	Teresa	Universidade de Aveiro (PT)
Simpson	Peter	European Chemicals Agency (ECHA) (FI)
Steg	Linda	University of Groningen & SAPEA WG Member (NL)
Syberg	Kristian	Roskilde University & SAPEA WG Member (DK)
ten Brink	Patrick	European Environmental Bureau (BE)
Toussaint	Brigitte	Joint Research Centre, European Commission (BE)
van Wezel	Anne-Marie	Amsterdam University & SAPEA WG Member (NL)
Vighi	Marco	IMDEA Water Institute (ES) and SCHEER Committee member
Wright	Stephanie	King's College London (UK)

**ENVIRONMENTAL AND HEALTH IMPACTS OF MICROPLASTIC POLLUTION
FROM SCIENTIFIC EVIDENCE TO POLICY ADVICE, EXPERT WORKSHOP**

Observers

Surname	Name	Affiliation
Ascher	Annabelle	DG RTD – SAM UNIT Policy Officer
Bintein	Sylvain	DG ENV
Boavida	Dulce	DG RTD – SAM UNIT Policy Officer - SNE
Bray	Jeremy	DG RTD – SAM UNIT Deputy Head of Unit
Clayton	Helen	DG ENV
De Smet	Michiel	DG RTD
El Haouzi	Rashida	DG RTD – SAM UNIT Assistant
Gasc	Emilien	SG
Gavigan	James	DG RTD – SAM UNIT Topic Leader
Gils	Corinne	DG RTD – SAM UNIT Assistant
Hanna	Sandy	Senior Policy Advisor - Office of the Chief Science Advisor Government of Canada
Hualde Grasa	Eva Patricia	DG GROW
Joanny	Geraldine	DG JRC
Klumpers	Johannes	DG RTD – SAM UNIT Head of Unit
Laursen	Henrik	SG
Maltagliati	Silvia	DG RTD
Papadoyannakis	Michail	DG ENV
Petrikovicova	Alena	DG MARE
Rosenstock	Nele-Frederike	DG ENV
Sokull-Kluettgen	Birgit	DG JRC-ISPRA
Van Den Eede	Guy	DG JRC-GEEL
Vanheusden	Veerle	DG SANTE
Vivirito	Valentina	SG
Weiland	Sigrid	DG RTD – SAM UNIT Policy Officer
Weydert	Marco	DG RTD
Whyte	Jackie	SAPEA Senior Scientific Officer
Willmott	Michael	Science & Technology Counsellor, Embassy of Canada to the EU

2 - Workshop Agenda

Expert Workshop

Environmental and Health Impacts of Microplastic Pollution - from scientific evidence to policy advice

Thursday, 10 January 2019 - 10:30 - 17:45 – Meeting Room BERL S3 – 3rd floor

Friday, 11 January 2019 – 9:00 – 13:00 – Meeting Room Jean Rey – 1st floor

Berlaymont Building, 200 Rue de la Loi (at Rond-Point Schuman), Brussels

Objective: The purpose of the workshop is to review the state of scientific knowledge through the lens of a fast-moving policy agenda at national, EU and international level in order to bridge from the current scientific evidence base to an EU policy-orientated Scientific Opinion on this subject.

Day 1	Thursday, 10 January 2019 - 10:30 - 17:45 - Meeting room BERL (S3) – 3 rd floor
10:30 - 10:45	Welcome coffee
10:45 - 11:00	Purpose of the meeting <i>Pearl Dykstra, Deputy-chair of the EC Group of Chief Scientific Advisors</i>
11:00 - 11:15	Opening remarks <i>Jean-Eric Paquet, Director General for Research and Innovation, European Commission</i> <i>Daniel Calleja Crespo, Director General for Environment, European Commission</i>
11:15 - 12:45	<p>I. Scene-setting - international microplastic policy context <u>Moderator:</u> <i>Mona Nemer, Canada's Chief Science Advisor</i></p> <ul style="list-style-type: none"> - The international perspective - <i>Peter Kershaw, Joint Group of Experts on the Scientific Aspects of Marine Environmental Protection (GESAMP)</i> - Canada's plastics strategy - <i>Nancy Hamzawi, Assistant Deputy Minister for Science and Technology, Environment and Climate Change Canada</i> - An EU Member State perspective - <i>Richard Cronin, Department of Housing, Planning, Community & Local Government, Ireland & SAPEA WG Member</i> <p>Discussant – <i>Mats Linder, MLSH Consulting</i></p> <p>Discussion - All</p>
12:45 – 14:00	Lunch
14:00 - 15:30	<p>II. Regulatory instruments & insights from the legal and political sciences <u>Moderator:</u> <i>Nicole Grobert, Member of the EC Group of Chief Scientific Advisors</i></p> <ul style="list-style-type: none"> - Restrictions under REACH - <i>Peter Simpson, European Chemicals Agency (ECHA)</i> - Micro Litter – position paper/guidance review – <i>Georg Hanke, Joint Research Centre, European Commission</i> - SAPEA Evidence Review Report - regulatory & legislative measures – <i>Anne-Marie van Wezel, University of Amsterdam & Kristian Syberg, Roskilde University -SAPEA WG Members</i> <p>Discussants – <i>Todd Gouin, TGER</i> <i>Dominic Hogg, EUNOMIA</i></p> <p>Discussion – All</p>
15:30 – 16:00	Coffee Break

**ENVIRONMENTAL AND HEALTH IMPACTS OF MICROPLASTIC POLLUTION
FROM SCIENTIFIC EVIDENCE TO POLICY ADVICE, EXPERT WORKSHOP**

16:00 - 17:45	<p>III. Insights from behavioural & social sciences <i>Moderator: Pearl Dykstra, Deputy-chair of the EC Group of Chief Scientific Advisors</i></p> <ul style="list-style-type: none"> - SAPEA Evidence Review Report - behavioural & social sciences – <i>Sabine Pahl, University of Plymouth & SAPEA WG Vice-chair; Lesley Henderson, Brunel University & Linda Steg, University of Groningen, SAPEA WG Members</i> <p>Discussants – <i>Sarah Cornell, Stockholm Resilience Centre</i> <i>Johanna Kramm, Institute for Social-Ecological Research, Frankfurt</i></p> <p>Discussion – All</p>
17:45	End of day 1
Day 2	Friday, 11 January 2019 – 9:00 – 13:00 - Meeting room Jean Rey (JREY), 1st floor
09:00 - 10:45	<p>IV. Insights from natural sciences <i>Moderator: Elvira Fortunato, Member of the EC Group of Chief Scientific Advisors</i></p> <ul style="list-style-type: none"> - SAPEA Evidence Review Report - natural sciences <i>Overview of natural sciences evidence - Bart Koelmans, Wageningen University & SAPEA WG Chair & Gabriela Kalčíková, University of Ljubljana, SAPEA WG Member</i> <i>Human Health Impacts – Stephanie Wright, King’s College London</i> - JRC paper on microplastics in the food chain - <i>Brigitte Toussaint, Joint Research Centre, European Commission</i> <p>Discussants – <i>Ronny Blust, University of Antwerp</i> <i>Bethanie Carney-Almroth, University of Gothenburg</i></p> <p>Discussion – All</p>
10:45 – 11:15	Coffee Break
11:15 - 12:50	<p>V. Towards a Scientific Opinion <i>Moderator: Rolf Heuer, Chair of the EC Group of Chief Scientific Advisors</i></p> <ul style="list-style-type: none"> - SAPEA Evidence Review Report – options - <i>Bart Koelmans, Wageningen University & SAPEA WG Chair & Sabine Pahl, University of Plymouth & SAPEA WG Vice-chair</i> - Microplastics in the evolving EU policy context – <i>Harri Kalimo, Institute for European Studies, Vrije Universiteit Brussel</i> <p>Discussants – <i>Anne-Gaelle Collot, PlasticsEurope</i> <i>Patrick ten Brink, European Environmental Bureau</i></p> <p>Discussion – All</p>
12:50 – 13:00	Wrap-up - <i>Nicole Grobert, Member of the EC Group of Chief Scientific Advisors</i>
13:00 – 14:00	Lunch

3 - Briefing for Participants (abridged)

Experts Workshop:

**Environmental and Health Impacts of Microplastic Pollution –
from Scientific Evidence to Policy Advice**

This expert workshop is convened by the Group of Chief Scientific Advisors⁶ ('Advisors') as part of its work to prepare evidence-based policy recommendations to the European Commission in the form of a Scientific Opinion on the *Environmental and Health Impacts of Microplastic Pollution*.

The work of the Advisors on this topic began in 2018 with a scoping workshop in April 2018, followed by an Initial Statement in July 2018⁷. The Advisors plan to complete their Scientific Opinion before summer 2019.

The workshop coincides with the completion and provision to the Advisors of a scientific Evidence Review Report (ERR) on the topic by SAPEA⁸. This report will be made available under embargo to the participants ahead of the workshop. It also coincides with the completion or publication of other pertinent compilations of scientific evidence and analyses by the European Chemicals Agency (ECHA) and the European Commission's Joint Research Centre (DG JRC) and comes shortly after publication of a policy context background paper⁹ by the SAM Unit.

Objective

The purpose of the workshop is to examine publicly available scientific evidence through the lenses of policy relevance and timeliness. The intention is to identify issues on which the Advisors may make concrete scientific evidence-based recommendations in its Scientific Opinion, in order to inform relevant EU policy development work in the Commission at the highest level.

The invited speakers, discussants and other expert participants from a variety of organisations and backgrounds will share their expert knowledge and views on the subject and engage in discussions chaired by members of the Group of Chief Scientific Advisors. In these discussions, the experts should identify where there is potential for new, revised or reinforced EU policy action which can be underpinned by scientific knowledge. Participants

⁶ The Group of Chief Scientific Advisors is the primary implement of the European Commission's Scientific Advice Mechanism (SAM), the other components of which are the Science Advice for Policy by European Academies (SAPEA) consortium and the SAM Unit within DG RTD which feed into and support the work of the Advisors

⁷ see SAM website for more details <https://ec.europa.eu/research/sam/index.cfm?pg=pollution>

⁸ <https://www.sapea.info/>

⁹ https://ec.europa.eu/research/sam/pdf/topics/microplastic_pollution_policy-context.pdf#view=fit&pagemode=none

should contribute in their capacity as experts and not as representatives of organisations or bodies with vested interests and specific agendas.

The Workshop will also serve as useful background for a forthcoming international roundtable discussion on science advice to policy in this area among G7 member representatives, which the Group of Chief Scientific Advisors and Canada's Chief Science Advisor will co-host in Washington DC, on 13 February 2019 in cooperation with France's 2019 G7 Presidency.

In order to facilitate open discussion, the report of this workshop will be prepared following the Chatham House rule, whereby remarks and points made will be reported in a synthetic non-attributed style.

Workshop content preparation

In preparing for the workshop, the expert participants - especially the speakers and discussants - are asked to address the questions below, in so far as they relate to their area of competence, and according to the specific workshop session in which they will speak or may wish to intervene. ***The emphasis should be on the formulation of robust policy advice in a situation of uncertainty and incomplete knowledge, rather than on the identification of knowledge gaps and research questions.***

All participants are expected to familiarise themselves with documents circulated before the workshop – especially the ERR and the policy context background paper, in order to minimise the time for set presentations and maximise the possibilities for additional new material to be tabled and discussions to take place.

The suggested questions may be relevant for more than one speaker/discussant in each session.

Participants are also invited to identify and raise other issues and questions not covered below but which they deem to be relevant to a particular session or to the overall aim of the workshop.

Discussants are asked to relate their remarks when possible to those of the preceding speakers.

Speakers and discussants may use PowerPoint presentations. For logistical purposes, it would be helpful if slides were supplied in advance (by 08 January 2019). This will allow presentations to be pre-loaded/ checked on the computer in the meeting rooms.

Session I: Scene Setting: International Microplastics Policy Context

The purpose of this session is to provide an overview and illustrations of policy-relevant developments internationally from different perspectives including ones, which are connected to the EU. This should help to set the scene regarding the existing and potential future interplay between policy measures developed and actioned at different governance levels, as well as identifying appropriate types of action at these different levels.

Main questions addressed:

- What factors are driving the policy agenda internationally? Is science advice playing a role?
- Are current actions and progress commensurate with the political rhetoric and public expectations? Where and on what basis do experts consider there to be potential for more international synergy and filling policy gaps?
- Is the balance right in the attention paid in international policy fora to microplastics in different environmental compartments (land, air, water)?
- Can experts make the case for binding international agreements? Would a microplastics equivalent of the IPCC (climate change) be justifiable?

Other pointers & questions:

- Summarily describe what is going on at international level in different fora and structures – GESAMP, G7, G20, Basel/ Stockholm Conventions, ...
- What are the expert views from these international fora regarding elements, which have implications for EU policy?
- Give an overview of Canada's plastic strategy¹⁰ and in particular the preparation of the follow-up action plan as it relates to microplastics.
- How relevant for Canada do you see cooperation with the EU and Canada's involvement in forums such as G7, *etc.*?
- What is the interplay and relative importance of EU and other international policy frameworks and how do they impinge upon action in an EU Member State?
- What factors determine action/ inaction nationally and engagement internationally? How much is scientific evidence part of this?
- What is the relative importance of microplastic pollution in broad international private (industry and NGO-driven) initiatives such as the new plastics economy ('rethinking the future of plastics') as well in broad policy concepts and frameworks such as the circular economy, sustainable development goals, the bioeconomy, *etc.*?
- What constraints and trade-offs are there in dealing with microplastics in these broad initiatives - in terms of governance, authoritative scientific advice, *etc.*?
- According to experts, what responsibilities for preventing, curbing or eliminating microplastic pollution should be assigned to different types of stakeholders (industry, public authorities, private citizens)? What types of incentives should play a role?

¹⁰ <https://rco.on.ca/wp-content/uploads/2018/11/STRATEGY-ON-ZERO-PLASTIC-WASTE.pdf>

Session II: Regulatory Instruments & Insights from the Legal and Political Sciences

The purpose of this session is to discuss what scholarly studies and experts have to say on the pertinence, adequacy, efficiency and effectiveness of existing and emerging policy measures in addressing microplastic pollution and its impacts. This discussion should also refer to how far scientific knowledge is present in the rationale underpinning such measures.

Main questions addressed:

- What is the view from science of the rationales upon which existing and emerging policy measures are based? Are there examples of disregard for scientific evidence?
- From a political science perspective, what assessments are there of such measures in terms of: public good; fitness-for-purpose; feasibility; and socio-economic trade-offs?
- Is there scope for science-based advice to better inform policy development, as well as the implementation and evaluation/ revision of such measures?
- Is there evidence on how the impact of microplastic pollution on the environment and health could be curbed by public authorities, and through what systems or instruments? Hard vs soft law? direct vs indirect measures? ...
- Is an incremental emergent policy approach commensurate with the urgency and scale of the problem? Is there a case for a much bolder use of the precautionary principle?

Other pointers & questions:

- Present main elements from the relevant chapter of the ERR
- Summarise recently completed work by ECHA in relation to intentionally-added microplastics in products
- Give status update of similar ECHA work on oxo-plastics
- Present the main elements of the MSFD microliter position paper which relate to microplastics, as well as its implications for the on-going implementation of the MSFD and (possibly?) other regulatory implications beyond MSFD
- Draw attention to any additional insights and evidence in the public domain which may complement or complete those presented in the SAPEA and other reports
- What shared and divergent perspectives are there among industry, regulators and academics on the use of environmental risk assessments of microplastics and nanoplastics in a regulatory context?
- Comment on current and emerging work regarding the precautionary and proportionality principles and environmental persistence
- Comment on the increase in relevant regulatory activity at different governance levels and on private voluntary agreements

Session III: Insights from Behavioural & Social Sciences

The purpose of this session is to discuss insights from the social and behavioural sciences on how the public and policy-making system (including all categories of interest groups - industry, NGOs, citizen groups, activists, policy think-tanks, scientists) perceive and respond to microplastic pollution. Key in this is to discuss the role of these disciplines in mediating between the knowledge and uncertainties in the natural sciences and the development of appropriate and acceptable public policy measures and private sector initiatives. The role of the media should also be covered.

Main questions addressed:

- What robust evidence and findings are there in scholarly work in areas such as environmental and resource economics; applied ethics; political science studies of democracy and public participation; social psychology work on models of human behaviour and motivation; etc. which are relevant to microplastic pollution?
- What insights on the feasibility and appropriateness of measures addressing microplastic pollution can social sciences and the humanities as well as studies of citizen and political psychology, offer to underpin scientific advice?
- How, according to experts, can (apparent/ real) inconsistencies between messages and understandings/ perceptions in scientific, media, the general public and policy communities be reconciled?
- What evidence and analysis is there on the trade-off between foregoing perceived environmental/ health hazards of microplastics and giving up associated benefits and conveniences?
- Does the precautionary principle as a response to risk, uncertainty, ambiguity and ignorance tackle both actual and perceived risk?

Other pointers & questions:

- Briefly present main points of the relevant ERR chapter
- What ways do the general public and media construct and portray their understanding of the microplastic pollution problem and what knowledge and understanding do they draw in the process?
- Discuss the variability in what is deemed to constitute a sufficient basis for action depending on the type of stakeholder and the tensions which such variability creates
- What is the view of scholars on (micro)plastic pollution in the context of the planetary boundaries framework? & what evidence-based policy advice can these give rise to?
- Draw attention to any additional insights and evidence in the public domain which may complement or complete those presented in the SAPEA ERR and other reports

Session IV: Insights from Natural Sciences

The purpose of Session IV is to position the knowledge and understanding from the natural sciences (*e.g.* on microplastic occurrence and concentrations; its hazards and effects on biota and ecosystems; its presence in food webs and the potential environmental and human health risks; *etc.*) in the context of informing and underpinning potential science-based policy recommendations, linking where relevant to the discussions in the previous sessions.

Main questions addressed:

- Point out key scientific knowledge from the natural sciences of relevance to potential environmental and health impacts of microplastics where there is unanimity or clear consensus both in terms of : 1. what is actually happening at present and 2. what is highly likely to be the case in the future in a business-as-usual scenario
- In areas where knowledge is lacking or incomplete, are there expert-based consensual views on some natural science phenomena which would justify scientific advice to act or not act in one way or another?
- What areas of science would experts agree categorically that the low level of knowledge would make it irresponsible to advise policy action or inaction of one type or another?
- Can science provide proxies for or otherwise cater for the need to define clear protection goals, max tolerable emission limits, the lack of baseline and reference levels, and interpretations of what 'not causing damage to the environment' etc. means?

Other pointers & questions:

- Briefly present main points of the relevant ERR chapter and other relevant papers
- Bring in relevant perspectives from work carried out under JPI Oceans and elsewhere
- Is the current debate on human health effects of microplastics unbalanced?
- Is there is a disproportionate focus on microplastics in individual food products?
- Draw attention to any additional insights and evidence is in the public domain, which may complement or complete those presented in the SAPEA and other reports

Session V: Towards an EU Scientific Opinion

The purpose of Session V is to draw on the previous sessions and distil from the discussions and suggestions first emerging candidate elements around which the Chief Scientific Advisors may formulate their recommendations in the form of a Scientific Opinion.

Main questions addressed:

- What position of priority does or should microplastic pollution occupy in the full range of environmental pollutants and stressors in light of what is known of their present and possible future harmful effects?
- In light of the overview of the relevant policy context, are there opportunities, which are potentially more receptive to scientific advice than others? Which ones? (air quality legislation? Water framework directive review? *etc.*)
- Are there currently unaddressed concerns/ blind spots (textiles, tire abrasion, soil contamination,...)?
- Under both the previous points, does the scientific evidence point to the type of policy considerations which scientific advice could offer?

Other pointers & questions:

- Present the main evidence-based options from the ERR indicating their feasibility, practicality or applicability in particular with respect to timescales for EU policy development.
- Provide insights on the overall issue of microplastic pollution from an EU environmental law point of view and on the relevance and utility of scientific-evidence based policy advice.
- How can the impact of different types environmental legislation and broader mixes of measures be optimised in a complex policy-making context where many factors other than scientific knowledge influence the decisions taken?
- Offer reasoned perspectives backed up by evidence on what implications scientific knowledge in this area has for EU policy, from different expert vantage points: industrial; environmental NGO; citizen group; *etc.*
- Draw attention to any additional insights and evidence in the public domain which may complement or complete those presented in the SAPEA and other reports

* end *