Sub-statement on the potential risk(s) from exposure to microplastics: Inhalation route

Microplastics - Inhalation route - Research priorities for risk assessment

In this guide

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Data gaps

94. For the inhalation route the significant data gaps include the lack of:

- Harmonised analytical methods for detection of different NMPs during sample collection.
- Methods of detection of NMPs in tissues and their systemic effects.
- Understanding the contribution and effects of different exposure scenarios (*e.g.* indoor and outdoor environments).
- Understanding how different pre-existing lung and other disease states may be involved in any effects from microplastic exposure.

- How available occupational data and on other particle types should be extrapolated to the general population.
- Data on inhalation exposure to NMPs that are resuspended in an indoor environment.

Priorities for risk assessment

95. The COT recommends the following research priorities ranked in order of importance for addressing the data gaps in the potential toxicity of NMPs in humans and suggest a call should be put out to researchers (Table 1). Information in these areas will assist in the future risk assessment of these particles by inhalation and other routes of exposure.

Table 1. Table of future priorities for risk assessment divided into opportunities for improved study design and reporting, as well as research needs.

Ranking Order	**Field**	**Opportunities for improved study design and reporting**	**Research needs**
1	Physicochemical properties /Analytical methodologies	No information.	Development of reference standards and an appropriate fit for purpose quantification and detection methodologies for NMPs in different matrices. Standardisation of the NMPs used and reported.

		Studies to explore the effect (s) of the same type of NMP on different tissues and of different types of NMP on the same target tissue.	Investigations of the extent to which NMPs with a range of sizes and compositions are assimilated into human tissues and development of techniques capable of identifying the presence of microplastics in the human body (e.g. in biopsies, samples from tissue banks, if possible, histopathology sections; residual controls at point of sampling).
2	Biological effects	Consistency in the use and reporting of the standards used, the source of the NMPs, clear characterisation of the NMPs used and standardised reporting of dosimetry.	Exploration of steady states.

		Standards in measuring and reporting size of particulates.	From studies of particles at the nanoscale, it has been reported that nanoplastics can deposit lower down in the lung and have been shown to translocate across the pulmonary cellular barrier to secondary organs. Further research needed to confirm. More studies needed looking into the potential effects of nanoplastics are needed to understand size related effects.
3	Physicochemical properties	Consistency in the use and reporting of the standards used, the source of the NMPs and clear characterisation of the NMPs used.	

			Studies on the absorption, distribution, digestion and removal (excretion) of different particle types and sizes.
4	Adsorption, Distribution, Metabolism and Excretion Toxicokinetics.	Studies on the persistence and potential accumulation of NMPs in the human body and on the extent to which NMPs are digestible.	Steady states studies. Provide and maintain a data base of information assessing biodistribution of NMPs. Evaluation of current dosimetry models for use with NMPs.
5	Migration and degradation.	Assessment of the degradation of novel/emerging plastic-based materials on the market such as biobased plastics (e.g. bamboo ware, polylactic acid, chitin) and other advanced polymer matrix composite materials during their use and end of life for their contribution to NMPs.	It is unclear whether, and by how much, they already contribute to the burden of NMPs or similar particles. Research is needed to explore this and apply to future novel materials.

			Microplastic concentrations in the environment are expected to increase in the future. In addition, increased and widespread use of single-use plastic personal protective equipment due to the COVID-19 pandemic may also be a significant contributing source of plastic pollution.
6	Migration/degradation and analytical methodology/detection.	Regular assessment of NMPs in water, air and relevant food stuff as well as establish a monitoring programme.	The quantification methods for microplastic particulate matter are currently limited and can only be estimated, thus improved technology is required. Regular assessment of NMPs in water, air and relevant food stuff as well as establish a monitoring programme. This can then be shared between academia, researchers and government bodies both nationally and internationally.