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

Microplastics - Inhalation route - Background

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1. In 2019, as part of horizon scanning, the Committee on Toxicity of Chemicals in Food, Consumer Products and the Environment (COT) identified the potential risks from microplastics as a topic it should consider to inform UK Food Standards Agency (FSA) discussions on this area (TOX/2019/08). Since then, several discussion papers have been presented to the COT and in 2021, the COT published an overarching statement on the potential risks from exposure to microplastics (COT Statement 2021/02), which contained their working definition of microplastics as synthetic particles or heavily modified natural particles with a high polymer content that are submicron-mm in size (0.1 to 5,000 µm or micrometres). Plastics that are below this size range are classed as nanoplastics (i.e. 1 nm to 0.1 µm) (COT, 2021). The Statement also includes available information on such particles.

2. The Statement provided a high-level overview of the current state of knowledge, data gaps and research requirements with regards to the topic. This was followed by a sub-statement considering oral exposure to microplastics in more detail.

3. The COT previously noted that there is little data on the effects of microplastics on mammals (including humans) whether taken in orally or via inhalation. The majority of microplastics (>90%) are excreted from the body but small amounts may remain in the gut (gastrointestinal tract (GIT)) or move from the GIT into organs or tissues due to endocytosis by M cells or paracellular persorption. No epidemiological or controlled dose studies that evaluated the effects of orally ingested microplastics in humans were identified and there is a similar lack of information on inhaled microplastics.

4. Although exposure to airborne microplastics can arise from a wide range of environmental sources (see paragraphs 65-73) there is still limited information regarding the concentrations of airborne microplastics.

5. In 2022, England's Chief Medical Officer Professor Chris Whitty published a report on indoor and outdoor air pollution which included comments on microplastics. In the report it is noted that microplastics are in the air unintentionally by stating:

"The airborne transport and inhalation of microplastics is an example showing how unintended air quality consequences might possibly arise far downstream from the public use of an originally safe synthetic product. Too great a focus on only meeting existing air quality standards and regulations, without considering how atmospheric composition may change with society and technology more broadly, may lead to problems that could have been intercepted earlier with greater non-targeted surveillance and horizon-scanning. A clear evidence gap exists between the extensive regulatory efforts placed on monitoring existing regulated air pollutants and research studies of emerging atmospheric composition, the latter being rarely systematic or long-term in nature" (CMO, 2022).

6. The fate and dispersion of microplastics in outdoor environments is dependent on several factors (see paragraph 68).

7. Atmospheric deposition of microplastic particles (MPPs) onto food prior to consumption must also be considered as a potential source of exposure. For example, Catarino et al., (2018) compared the potential exposure of humans to

household dust fibres during a meal with the amounts of MPPs present in edible mussels from Scottish waters, showing that exposure was considerably higher from the household source. However, this is out of the scope of the present statement. Further information is available in COT Statement 2021/02 the Overarching Statement.

8. An American study (Cox et al., 2019) estimated daily consumption and inhalation to be 142 MPPs and 170 MPPs in adult males, respectively. For adult females, the estimated values are 126 MPPs and 132 MPPs, respectively. Based on these values, an estimated exposure of ~120,00 and ~98,000 MPPs annually was calculated in male and female adults, respectively

9. The deposition of inhaled microplastics within the lung is dependent on the particle's physicochemical properties, as well as the subject's physiology and lung anatomy shown from paragraph 39.

10. Inhalation of microplastics could result in toxicity due either to the particles (i.e. physical effect) or their leachates (i.e. chemical effect). The mechanisms of inhaled particle injury are covered in paragraph 74. With regard to the available inhalation studies in laboratory animals, Environment and Climate Change Canada and Health Canada (ECCC and HC) in their review of the scientific literature noted that no dose-response relationship had been observed in mortality, survival time, behaviour, clinical observations, or tumour incidence from inhalation exposures (ECCC and HC 2020).

11. The COT previously reviewed risk assessments of MPPs carried out by various groups such as the European Tyre and Road Wear Platform; Tyre Industry Project (Jekel, 2019), Joint Research Centre (Grigoratos & Martini, 2014), Defra (AQEG, 2019), Health and Safety Executive (RUBIAC, 2007; HSE, 2011), Committee on Medical Effects of Air Pollutants (COMEAP, 2015; 2020), WHO (WHO, 2013), National Institute for Public Health and the Environment (Verschoor et al., 2016), and ECHA (ECHA, 2017).

12. The COT concluded that the literature data on exposure to particles from tyre wear would need separate consideration from microplastic exposure since the particles are chemically quite different in their polymeric nature. The COT considered that inhalation was likely to be the most significant route of exposure to TRWPs (tyre and road wear particles). Detailed risk assessments of such materials were considered outside of the scope of the current exercise, however some information has been included to provide context.