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Assignment E010

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PREVENTING PANDEMIC PLASTIC POLLUTION

# Purpose

Evidence submission from the Chartered Institute of Environmental Health to the Environment Select Committee

# Introduction

* The Chartered Institute of Environmental Health (CIEH) represents Environmental Health practitioners (EHPs) across the UK.
* Since 1883 CIEH has developed and promoted environmental standards that contribute to better public health and is responsible for training and accrediting EHPs.
* Our mission is:

*“Safer, cleaner and healthier environments for the benefit of all”*

* EHPs work in local authorities and independently to ensure food safety standards, environmental protection and support general health improvement.
* We welcome the opportunity to submit evidence on the growing threat plastic pollution poses to food safety, the environment and public health and to raise awareness of the growing threat of plastic pollution from personal protective equipment (PPE) since the start of the COVID19 pandemic.

# Evidence

## The scale of the plastic pollution

* Since the1950s more than 8.5 billion tons of plastic have been generated of which an estimated 600 million tons have been recycled (7%) and 5700 million tons (67%) has been discarded or burned.[[1]](#footnote-1) (Geyer, Jambeck, and Law 2017) Over 300 million tons are produced each year, of which 40% are single-use. (Waring, Harris, and Mitchell 2018)
* In a single year over 10 million tons of plastic waste is estimated to enter the oceans from the 192 coastal countries around the world. (Jambeck et al. 2015)
* Most plastic waste ends up in landfill sites, waterways and the oceans. (Ritchie and Moser 2021)
* The effect of ultra-violet light in combination with attrition from wind and waves degrades larger plastic pieces into microplastics (MPs) - particles < 5mm in size; and nanoplastics (NPs) - particles under 0.1 micrometre.
* Although macroplastics can directly harm larger animals, MPs and NPs are now ubiquitous in the environment and there is widespread human and ecosystem exposure.
* Microplastic pollution has been found in the Antarctic ice cores (Cunningham et al. 2020) and in deep-sea marine animals in the Mariana Trench at a depth of 10,000m. (Jamieson et al. 2019)

## Plastic pollution from Personal Protective Equipment (PPE)

* The WHO definition of PPE includes face masks, gloves, face shields, and aprons. Face masks may be surgical/medical, respirator masks (also known as N95, filtering facepiece respirators or FFP) or reusable masks – cloth based.
* PPE are largely single-use plastics. (de Sousa 2021)
* Medical face masks are made in three layers – two layers of non-woven plastic, and a filter layer made (generally) from melt-blown polypropylene.
* The COVID19 pandemic necessitated large scale increase in PPE production for medical and personal use, and it has been estimated this increased the production of single-use plastics globally by 300%. (de Sousa 2021)
* By 2021, the worldwide use of facemasks was estimated to have reached 7 billion per day. (Hantoko et al. 2021)
* In the UK an estimated 59 million face masks are used daily of which 53 million are disposed of to landfill.(Laville 2020)
* If every person in the UK used a disposable surgical mask every day this would create 124kt of plastic waste in a year of which 66kt would be contaminated waste and 57kt packaging.(Allison et al. 2020)
* PPE are now contributing significantly to general plastic littering and mismanaged waste. Roberts et al studied the development of COVID related litter in 11 countries over 14 months using crowd sourced data from the Litterati app[[2]](#footnote-2) which allows users to enter the type and location of items of litter picked. (Roberts et al. 2021) They found an 80-fold increase in discarded face masks between October 2019 (pre-pandemic) and October 2020. By October 2020 face masks accounted for 5% of all litter on average.
* There is some international variation in the proportion of litter accounted for by face masks. It was highest in the UK at 6% and lowest in Australia and New Zealand at < 1%.
* Several other studies have reported PPE littering surveys conducted in 2020/21 around the world but there is lack of methodological and reporting consistency making comparison difficult. Nevertheless all confirm face masks as the dominant form of PPE litter, and PPE constituted 16-30% of debris.(Kutralam-Muniasamy, Pérez-Guevara, and Shruti 2022)
* PPE waste is beginning to contaminate marine ecosystems and cause harm to marine organisms such as turtles (Fukuoka et al. 2022) and cetaceans. (Eisfeld-Pierantonio, Pierantonio, and Simmonds 2022)

## Human health and microplastics

### Exposure

* The environmental prevalence of MPs means that there is inevitable human exposure
* MPs have been found in table salt (Blackburn and Green 2022), bottled water, fish and seafood (Rubio-Armendáriz et al. 2022) and although there is considerable uncertainty could result in ingestion of over 10,000 MP particles a day for a diet rich in seafood.(Rubio-Armendáriz et al. 2022)
* Airborne MPs derive from synthetic textiles, tyre erosion and ‘city’ dust and have been found at concentrations of 0.4-59.5 and 0.3-1.5 fibres per m-3 in indoor and outdoor air respectively at particle sizes which can readily be inhaled.(Dris et al. 2016) It is not known to what extent airborne MPs contribute to atmospheric particulate matter (PM2.5 and PM10).(Prata 2018)
* As well as direct exposure MPs also provide a medium of bacterial pathogens.

### Evidence of exposure – is it harmful?

* MPs have been found in human faeces in healthy people and at higher concentrations in people with inflammatory disease confirming ingestion as a source of exposure.(Yan et al. 2022)
* MPs have been shown to cross in to the placenta. Ragusa et al examined post-partum placental tissues in using Raman spectroscopy[[3]](#footnote-3) found evidence of MPs in 4 of 6 placentas reviewed. (Ragusa et al. 2021)
* Although there is no current evidence of adverse health outcomes from MPs exposure toxic in vitro cellular effects have been found in human cells and animal models, and potential mechanisms by which harms can occur have been extensively reviewed.(Lim 2021)

# Preventing pandemic plastic pollution

* What should be done?
* Plastic pollution from discarded PPE is increasingly visible and preventable.
* Although there is limited evidence for adverse human health effects, we strongly recommend a precautionary approach given the likely large scale and long-term cumulative exposure to MPs.
* We believe that there should be a concerted, multiagency campaign involving environmental, conservation and health bodies to raise awareness and encourage people to undertake simple actions like not dropping litter (of any sort), putting used PPE in household waste, and converted people to reusable face masks is essential. (Allison et al. 2020)
* We ask government to stimulate innovation and research into alternative, environmentally friendly technologies for face mask production and PPE disposal as a matter of urgency.

# Recommendations

1. There is no doubt that mismanaged PPE waste is making a significant contribution to the growing environmental burden of plastic and microplastic pollution and is adding to the threat of marine pollution and a potential threat to human health.
2. Because it is largely single-use and cannot be recycled we believe that there should be additional campaigning to:
   1. Raise awareness of the scale of PPE pollution
   2. Encourage consumers to not litter and dispose of used masks in general household waste
   3. Promote the use of cloth masks as part of COVID exit strategy (especially as the pandemic abates) which can be washed and reused, or easily made at home. Although reusable masks are less effective than single-use masks they do prevent transmission and do not generate the waste stream of PPE.[[4]](#footnote-4)
3. Further research is conducted into safe disposal of non-contaminated PPE (for example by pyrolysis) and manufacture from alternative materials and the health effects of MPs.

Word count 1380

# References

Allison, Ayse Lisa, Esther Ambrose-Dempster, Teresa Domenech Aparsi, Maria Bawn, Miguel Casas Arredondo, Charnett Chau, Kimberley Chandler, et al. 2020. “The Environmental Dangers of Employing Single-Use Face Masks as Part of a COVID-19 Exit Strategy.” *UCL Open: Environment Preprint*. ScienceOpen. https://doi.org/10.14324/111.444/000031.v1.

Blackburn, Kirsty, and Dannielle Green. 2022. “The Potential Effects of Microplastics on Human Health: What Is Known and What Is Unknown.” *Ambio* 51 (3): 518–30. https://doi.org/10.1007/s13280-021-01589-9.

Cunningham, Eoghan M., Sonja M. Ehlers, Jaimie T. A. Dick, Julia D. Sigwart, Katrin Linse, Jon J. Dick, and Konstadinos Kiriakoulakis. 2020. “High Abundances of Microplastic Pollution in Deep-Sea Sediments: Evidence from Antarctica and the Southern Ocean.” *Environmental Science & Technology* 54 (21): 13661–71. https://doi.org/10.1021/acs.est.0c03441.

Dris, Rachid, Johnny Gasperi, Mohamed Saad, Cécile Mirande, and Bruno Tassin. 2016. “Synthetic Fibers in Atmospheric Fallout: A Source of Microplastics in the Environment?” *Marine Pollution Bulletin* 104 (1–2): 290–93. https://doi.org/10.1016/j.marpolbul.2016.01.006.

Eisfeld-Pierantonio, Sonja Mareike, Nino Pierantonio, and Mark P. Simmonds. 2022. “The Impact of Marine Debris on Cetaceans with Consideration of Plastics Generated by the COVID-19 Pandemic.” *Environmental Pollution (Barking, Essex: 1987)*, no. 118967 (February): 118967. https://doi.org/10.1016/j.envpol.2022.118967.

Fukuoka, Takuya, Fumiki Sakane, Chihiro Kinoshita, Katsufumi Sato, Kaoruko Mizukawa, and Hideshige Takada. 2022. “Covid-19-Derived Plastic Debris Contaminating Marine Ecosystem: Alert from a Sea Turtle.” *Marine Pollution Bulletin* 175 (113389): 113389. https://doi.org/10.1016/j.marpolbul.2022.113389.

Geyer, R., K. L. Jambeck, and J. R. Law. 2017. “Production, Use, and Fate of All Plastics Ever Made.” *Science Advances* 3 (e1700782): 1–5. https://www.science.org/doi/10.1126/sciadv.1700782.

Hantoko, Dwi, Xiaodong Li, Agamuthu Pariatamby, Kunio Yoshikawa, Mika Horttanainen, and Mi Yan. 2021. “Challenges and Practices on Waste Management and Disposal during COVID-19 Pandemic.” *Journal of Environmental Management* 286 (112140): 112140. https://doi.org/10.1016/j.jenvman.2021.112140.

Jambeck, Jenna R., Roland Geyer, Chris Wilcox, Theodore R. Siegler, Miriam Perryman, Anthony Andrady, Ramani Narayan, and Kara Lavender Law. 2015. “Plastic Waste Inputs from Land into the Ocean.” *Science* 347 (6223): 768–71. https://doi.org/10.1126/science.1260352.

Jamieson, A. J., L. S. R. Brooks, W. D. K. Reid, S. B. Piertney, B. E. Narayanaswamy, and T. D. Linley. 2019. “Microplastics and Synthetic Particles Ingested by Deep-Sea Amphipods in Six of the Deepest Marine Ecosystems on Earth.” *Royal Society Open Science* 6 (2): 180667. https://doi.org/10.1098/rsos.180667.

Kutralam-Muniasamy, Gurusamy, Fermín Pérez-Guevara, and V. C. Shruti. 2022. “A Critical Synthesis of Current Peer-Reviewed Literature on the Environmental and Human Health Impacts of COVID-19 PPE Litter: New Findings and next Steps.” *Journal of Hazardous Materials* 422 (January): 126945. https://doi.org/10.1016/j.jhazmat.2021.126945.

Laville, Sandra. 2020. “53m Discarded Covid Face Masks in UK ‘Could Be Polluting the Sea.’” *The Guardian*, November 18, 2020. http://www.theguardian.com/world/2020/nov/18/coronavirus-face-masks-could-be-polluting-the-sea.

Lim, Xiaozhi. 2021. “Microplastics Are Everywhere — but Are They Harmful?” *Nature* 593 (7857): 22–25. https://doi.org/10.1038/d41586-021-01143-3.

Prata, Joana Correia. 2018. “Airborne Microplastics: Consequences to Human Health?” *Environmental Pollution*  234 (March): 115–26. https://doi.org/10.1016/j.envpol.2017.11.043.

Ragusa, Antonio, Alessandro Svelato, Criselda Santacroce, Piera Catalano, Valentina Notarstefano, Oliana Carnevali, Fabrizio Papa, et al. 2021. “Plasticenta: First Evidence of Microplastics in Human Placenta.” *Environment International* 146 (January): 106274. https://doi.org/10.1016/j.envint.2020.106274.

Ritchie, H., and M. Moser. 2021. “Plastic Pollution.” Our World In Data. 2021. https://slides.ourworldindata.org/plastic-pollution/#/1.

Roberts, Keiron P., Sui C. Phang, John B. Williams, David J. Hutchinson, Simon E. Kolstoe, Jasper de Bie, Ian D. Williams, and Anne M. Stringfellow. 2021. “Increased Personal Protective Equipment Litter as a Result of COVID-19 Measures.” *Nature Sustainability*, December, 1–8. https://doi.org/10.1038/s41893-021-00824-1.

Rubio-Armendáriz, Carmen, Samuel Alejandro-Vega, Soraya Paz-Montelongo, Ángel J. Gutiérrez-Fernández, Conrado J. Carrascosa-Iruzubieta, and Arturo Hardisson-de la Torre. 2022. “Microplastics as Emerging Food Contaminants: A Challenge for Food Safety.” *International Journal of Environmental Research and Public Health* 19 (3). https://doi.org/10.3390/ijerph19031174.

Sousa, Fabiula Danielli Bastos de. 2021. “Plastic and Its Consequences during the COVID-19 Pandemic.” *Environmental Science and Pollution Research International* 28 (33): 46067–78. https://doi.org/10.1007/s11356-021-15425-w.

Waring, R. H., R. M. Harris, and S. C. Mitchell. 2018. “Plastic Contamination of the Food Chain: A Threat to Human Health?” *Maturitas* 115 (September): 64–68. https://doi.org/10.1016/j.maturitas.2018.06.010.

Yan, Zehua, Yafei Liu, Ting Zhang, Faming Zhang, Hongqiang Ren, and Yan Zhang. 2022. “Analysis of Microplastics in Human Feces Reveals a Correlation between Fecal Microplastics and Inflammatory Bowel Disease Status.” *Environmental Science & Technology* 56 (1): 414–21. https://doi.org/10.1021/acs.est.1c03924.

1. The rest is still in use [↑](#footnote-ref-1)
2. <https://litterati.org/> has over 250,000 members and has logged over 15 million items of litter. Users upload and geotag photographs on picked litter items. [↑](#footnote-ref-2)
3. A technique for characterizing plastic particles [↑](#footnote-ref-3)
4. Home made and cloth masks also have a lower life-time carbon footprint than medical face masks [↑](#footnote-ref-4)