

# **Microplastics, human health and the environment**

**Second meeting of the Ad Hoc Open-Ended  
Expert Group on Marine Litter and Microplastics  
3 December 2018**

**Bruce Gordon and Jennifer De France**



**World Health  
Organization**

# Microplastics, human health and the environment

## Background

- Emerging contaminant generating public concern
- Intense media coverage
- Potential health impact?



World Health Organization

# Microplastics: Context to WHO response

---

- WHO regularly issues health-based guidelines on health and environment
- GPW13: the areas of environment and climate change have been prioritized.
- WHO cooperates with key partners, such as UN Environment, through recent strategic agreements.
- Emerging issues, such as plastics are identified as important issues in the health and environment department

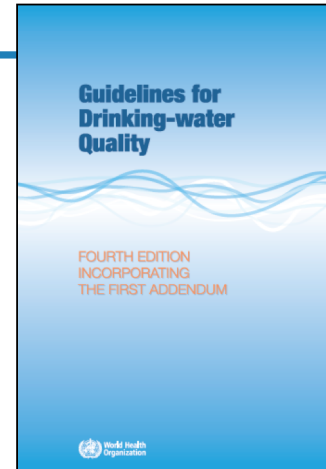


World Health  
Organization

# Microplastics: Context to WHO response

## WHO Guidelines for Drinking-water Quality

- Supports countries in developing drinking-water quality regulations and standards
- 500+ pages covering, chemical, microbial, radiological and protection and control aspects
- Includes an assessment of ~150 chemicals
- Guideline values are established for chemicals when there is credible evidence of occurrence in drinking-water and evidence of actual or potential toxicity



World Health  
Organization

# Microplastics: WHO Technical Work

---

- Expert meeting on Microplastics in Drinking-water (July 2018 in Singapore)
- WHO Review of Microplastics and Drinking-water (for March 2019)
- Systematic review of data quality (Microplastics in Freshwaters and Drinking Water – forthcoming journal article)
- Broader human health risk assessment covering additional environmental exposure routes (air, food, etc.), to be fully initiated in 2019



World Health  
Organization

# Outline for WHO Report on Microplastics in Drinking-water

---

- **Introduction**
- **Uses of plastics**
- **Occurrence of microplastics in water**
- **Health effects and risk assessment for microplastics in drinking water**
- **Removal in drinking water and wastewater treatment**
- **Preventing microplastic contamination in water sources**
- **Conclusions, recommendations (including related to research) and knowledge gaps**
- **References**



**World Health  
Organization**

# WHO Report on Microplastics in Drinking-water

---

- **Target audience**

- Drinking-water regulators, policy makers and water suppliers

- **Scope**

- Focus on human health (limited information on ecotoxicity)
- Relative contribution from drinking-water compared to other exposure routes



World Health  
Organization

# Concentration of microplastics in water

---

## Systematic review

- Quantitative quality assessment of sampling, extraction and detection methods of water studies
  - Assessed bottled, tap, surface, ground and wastewater studies
  - Assessed against nine quality criteria
- Summary of information on polymers identified, shape and size



World Health  
Organization



# Concentration of microplastics in water

---

## Systematic review

- Quantitative quality assessment of sampling, extraction and detection methods of water studies
  - Assessed bottled, tap, surface, ground and wastewater studies
  - Assessed against nine quality criteria
- Summary of information on polymers identified, shape and size

## Outlook

- Improvements are needed in sampling, extraction and analysis, including consideration of standard methods
- Data gaps:
  - Concentrations in drinking-water
  - Information on size, shape, composition, source



World Health  
Organization

# Health effects assessment

---

No information on the impact to human health



World Health  
Organization

# Health effects assessment

---

**No information on the impact to human health**

**Multiple elements of risk to consider**

- Monomers, additives and adsorbed toxins
- Small particles
- Biofilms



**World Health  
Organization**

# Health effects assessment

---

## Pathogens in biofilms

- Plastics provide an ideal substratum for biofilm formation in the environment
- Limited evidence suggests microplastics provide an ideal condition for the collection, transport and dispersion of microorganisms
- Occurrence of microplastic associated biofilms and related health risks unknown



World Health  
Organization

# Health effects assessment

---

## Small plastic particles

- Limited data on toxicity
  - No human studies
  - Most testing has been limited to aquatic organisms
- Limited data on bioavailability
  - Microplastics: absorption unlikely for particles > 150 µm
  - Microplastics: limited absorption ( $\leq 0.3\%$ ) for smaller microplastics?
  - Nanoplastics: up to 7% uptake (PS) with widespread distribution in the body
- Limited data on particle characteristics that are most predictive of toxicity



# Health effects assessment

---

## Monomers, additives and adsorbed toxins

- Additives of toxicological concern:
  - Phthalates (plasticizer)
  - PBDE (flame retardant)
  - BPA (antioxidant)
  - Lead (colorant, stabilizer)
- Adsorbed toxins
  - Hydrophobic nature of plastic particles encourages adsorption of hydrophobic chemicals, e.g. POPs including PAHs



# Health effects assessment

---

## Monomers, additives and adsorbed toxins (cont.)

- Limited data on
  - Release of monomers and additives from plastic upon aging and weathering
  - Release of monomers and additives in the GI tract
  - Desorption of adsorbed toxins in the GI tract
- Exposure assessment to be conducted
  - Conservative assumptions given significant data gaps



World Health  
Organization

# Next Steps

---

- Finalize draft report with Expert Group
- Targeted peer review
- Publication + preparation of fact sheet/executive summary
- Literature review and scoping meeting for broader assessment on microplastics in the environment and human health
- Possible update of drinking-water assessment



World Health  
Organization