Towards the development and application of an environmental risk assessment framework for microplastic particles

Todd Gouin
Acknowledgements
Motivations

- Increasing pressure on assessing the environmental risks, associated with particulates, such as NMs and microplastic
  - Scientific
  - Regulatory

- Challenges towards effective and efficient governance and regulation.
  - Technical/scientific “problems”:
    - (standard) test methods are missing or not applicable;
    - test methods are not always relevant
  - Infrastructure for data management not adequate
    - doubts about quality of data; no facilities for checking or curation
### EU Legislation & Policies - SAPEA ERR

- **Product Legislation**
  - REACH
- **Waste Legislation & Emissions**
  - Waste Framework Directive
  - Packaging & Waste
  - Landfill Framework Directive
- **Environmental Legislation**
  - Water Framework Directive
- **Non-binding strategies**
  - Plastics Strategy
  - Circular Economy

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#### Table 4.5. Overview of EU Legislation and Policies on (Micro-)Plastics

<table>
<thead>
<tr>
<th>Legislation</th>
<th>Date*</th>
<th>Status &amp; Milestones</th>
<th>Concerned environmental compartment</th>
<th>MP* implicitly targeted?</th>
</tr>
</thead>
<tbody>
<tr>
<td>REACH (EC) 2006/767/EC</td>
<td>Implementation in discussion</td>
<td>Soil/Water</td>
<td>Yes</td>
<td></td>
</tr>
<tr>
<td>Single Use Plastics Directive (EU) 2019/904</td>
<td>May 2019</td>
<td>Legislative process ongoing</td>
<td>Water (Marine)</td>
<td>Yes</td>
</tr>
<tr>
<td>Packaging and Packaging Waste (94/62/EC)</td>
<td>May 2018</td>
<td>Revised version to transpose</td>
<td>Soil/Water</td>
<td>No</td>
</tr>
<tr>
<td>Industrial Emission Directive 2013/57/EE</td>
<td>Nov 2019</td>
<td>Ongoing BAT BREPs</td>
<td>Soil/Water</td>
<td>No</td>
</tr>
<tr>
<td>Landfill Directive (1999/31/EC)</td>
<td>May 2018</td>
<td>Revised version to transpose</td>
<td>Soil/Water/Air</td>
<td>No</td>
</tr>
</tbody>
</table>

#### Strategies (non-binding)

- Ambient Air Quality Directive (2008/50/EC)
- The EU Plastics Strategy (COM(2020)268)
- European action plan for the Circular Economy (COM(2020)648)
Problem formulation

- Different instruments appear to address varying aspects related to concerns associated with microplastic
  - Clarity of problem trying to address?

  Reduce risk?
  Reduce harm?
  Reduce release of plastic?
On the question of risk...

“Concentrations detected are orders of magnitude lower than those reported to affect endpoints such as biochemistry, feeding, reproduction, growth, tissue inflammation and mortality in organisms. The evidence for microplastics acting as a vector for hydrophobic organic compounds to accumulate in organisms is also weak. The available data therefore suggest that these materials are not causing harm to the environment.”

Where risk is assessed based on estimating the ratio of PEC/PNEC.
Risk assessment framework
Intrinsic and Extrinsic properties
Linking Exposure to Observed Adverse Effect

\[ OAE = \sum E_{iT} + \sum E_{Pint} \]
Standardized Testing - Challenges and Limitations
Has regulatory action been helpful?

- Actions to date appear to be reactive to public pressure and do not appear to address dominant sources.
  - “Ban the bead”
  - Single-use plastic
    - Plastic Straws
  - Others?

- Do *ad hoc* responses to public pressure help address uncertainties or frustrate advancing scientific and technological solutions to addressing accumulation of plastic in the environment?
  - Precautionary approaches imply that actions can facilitate innovation, but if actions are inappropriate or disproportionate, they may fail to achieve the end-goal?

- Can a more holistic strategy that is supportive of scientific and technological innovation be adopted that enables regulatory decision-making to be science-based, and which can also incorporate informed precautionary measures?
  - EU Plastics Strategy
  - Circular Economy
The Northern Contaminants Program (NCP) works to reduce or eliminate contaminants in traditional foods, and to provide information on contaminants to individuals and communities. It is a multidisciplinary initiative, funded by the Government of Canada, addressing health, science, and communications issues related to contaminants in Canada's Arctic. It was established in 1991 through the Government of Canada’s Green Plan and Arctic Environmental Strategy.

“A Global Plastics Contaminants Program?"

“It’s good to have aspirational goals…”
System-dependent Extrinsic properties