National Institute for Public Health
and the Environment
Ministry of Health, Welfare and Sport

In search of microplastics

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Outline

Introduction

Standardisation issues

Sources and prioritization

Introduction

Potential

Health/ecological effects

Abrasion, obstruction, inflammation

Chemical toxicity

Transfer in food chain

Economic effects

Medical costs, fishery, water treatment

Towards a definition of microplastics

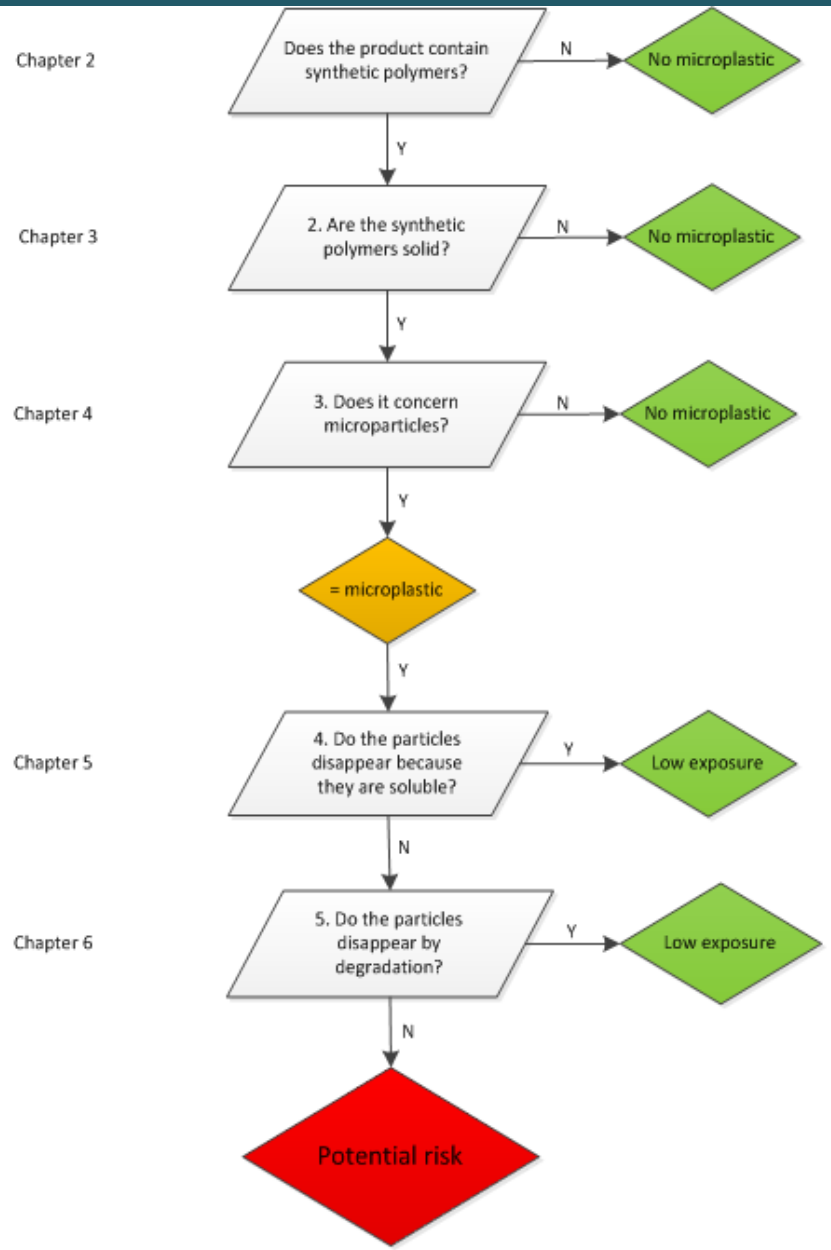
Rapport 2015

- Consistent monitoring
- Transparant risk assessment
- Legal certainty
- Level playing field

Elements of microplastic definition

1. Chemical composition
2. Solid
3. Size < 5mm
4. Solubility
5. Persistence

RIVM rapport: “Towards a defintion of microplastics” link



- What is synthetic?
- What is solid?
- Wat is a microparticle? Size boundaries!
- Boundaries for solubility
- How to measure degradation of solid particles with low solubility? What boudaries should be applied?

Definition of plastic

ISO: “a material which contains as an essential ingredient a high polymer and which, at some stage in its processing into finished products, can be shaped by flow”.

REACH: a polymer material is defined as a substance meeting the following criteria :

- a) Over 50 percent of the weight for that substance consists of polymer
- ….

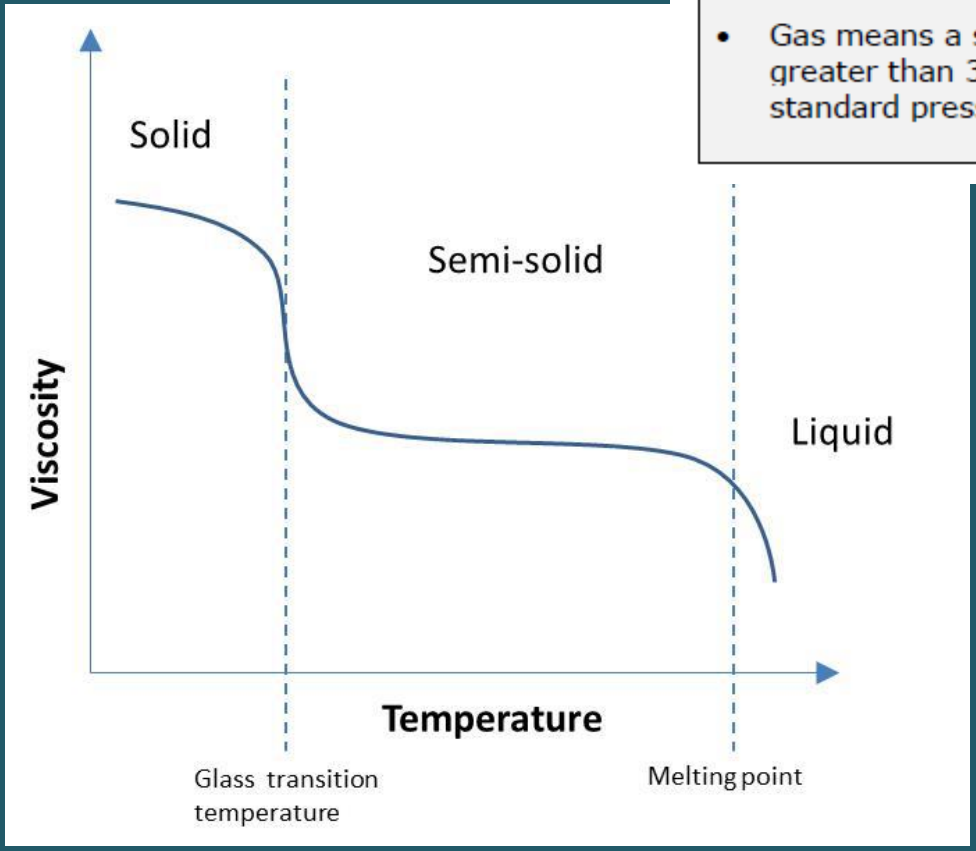
Definition: which polymers?

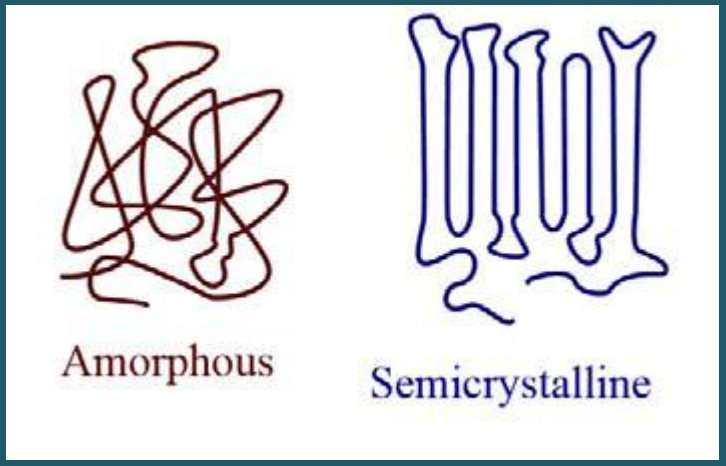
Base material	Description/examples	Typical products	Plastic?
Petro-based polymers	Polystyrene Polyethylene Polyurethane	Insulation Packaging, abrasives Swimwear,floors, matrasses	Yes
Bio-based polymers	Analogues of petro-based polymers made from renewable resources	Same as petro-based	Yes
Mineral-based polymers	Silicones	Breast implants Cookware Hair conditioners	Yes or no?
Natural biopolymers	DNA, proteins, wool, silk, amber, cellulose, natural rubber		No
Artificial biopolymers	Non-natural analogues of biopolymers		No
Modified natural polymers	Nitrocellulose, vulcanized rubber	Printing ink, laquers Car tyres	Yes Yes or no
Composites	Fibre-reinforced plastics	Boats, automotive, aircraft, clothing and fabrics	Yes
Elastomers	Rubber, silicones	Car tyres, roofing, toys, kitchenwear, balloons	Yes or no ?

What is solid ?

Textbox 1 Definitions of solid, liquid and gas according to the Globally Harmonized System for Classification and Labelling of substances and mixtures (GHS).

- A solid is a substance or mixture which does not meet the definitions of liquid or gas
- Liquid means a substance or mixture which at 50 °C has a vapor pressure of not more than 300 kPa (3 bar), which is not completely gaseous at 20 °C and at a standard pressure of 101.3 kPa, and which has a melting point or initial melting point of 20 °C or less at a standard pressure of 101.3 kPa.
- Gas means a substance which (i) at 50 °C has a vapour pressure greater than 300 kPa; or (ii) is completely gaseous at 20 °C at a standard pressure of 101.3 kPa.





Size

- WG-GES of MSFD:
- Large microplastics 1-5 mm
- Small microplastics 20 um-1 mm

- IUPAC
- 0.1-100 um

- EU recommendation nano: 1-100 nm

Solubility

- REACH poorly water soluble: < 1mg/L
- Note the conditions: pH en temperatuur

Persistency

Criteria for persistency according to REACH Annex XIII [45].

Compartment	Half-life (days)
Marine water	>60 days
Fresh- or estuarine water	>40 days
Marine sediment	>180 days
Fresh- or estuarine sediment	>120 days
Soil	>120 days

How to measure or test persistency?

2014
Quick scan and prioritization of microplastic sources

Aim:

Select relevant land-based sources for further investigation and potential measures.

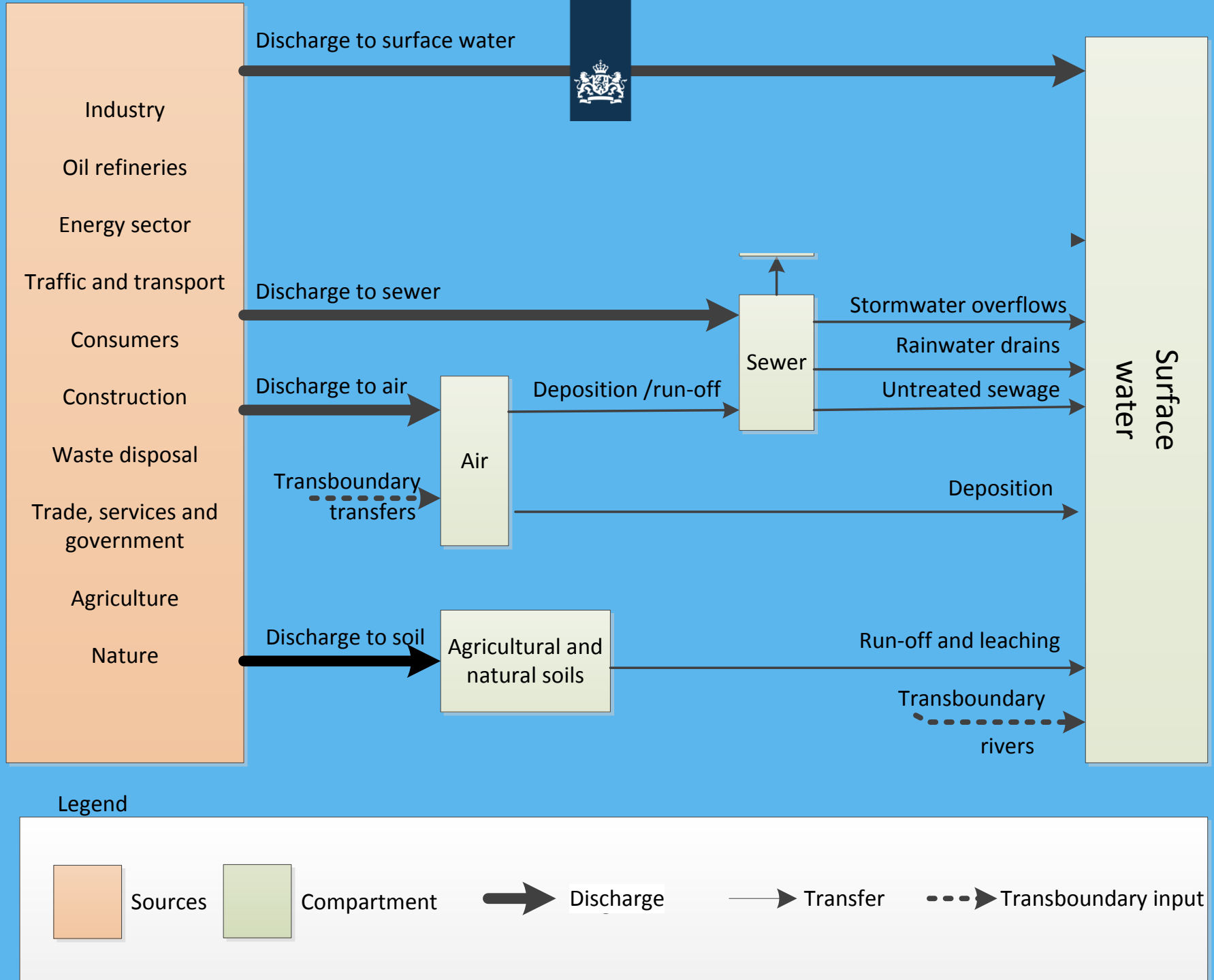
By gentlemanrook - originally posted to Flickr as Plastic Pellets - "Nurdles"

http://tarabethleach.com/remember-you-are-du

Selection of sources

Based on:

- National Emission registration
- Results expert meeting (n=21)
- Literature, internet


Industry
Oil refineries
Energy sector
Traffic and transport
Consumers
Construction
Waste disposal
Trade, services and government
Agriculture
Nature
Discharge to surface water
Discharge to sewer
Discharge to air
Transboundary transfers
Discharge to soil
Air
Agricultural and natural soils
Sewer
Deposition /run-off
Stormwater overflows
Rainwater drains
Untreated sewage
Deposition
Run-off and leaching
Transboundary rivers
Surface water
Legend
Sources
Compartment
Discharge
Transfer
Transboundary input

Prioritization

Multi Criteria Analysis:

1. volume of the emission,
2. Essentiality of the source,
3. Possibility of quick win measures,
4. Social perception of risk
5. Choices for consumers

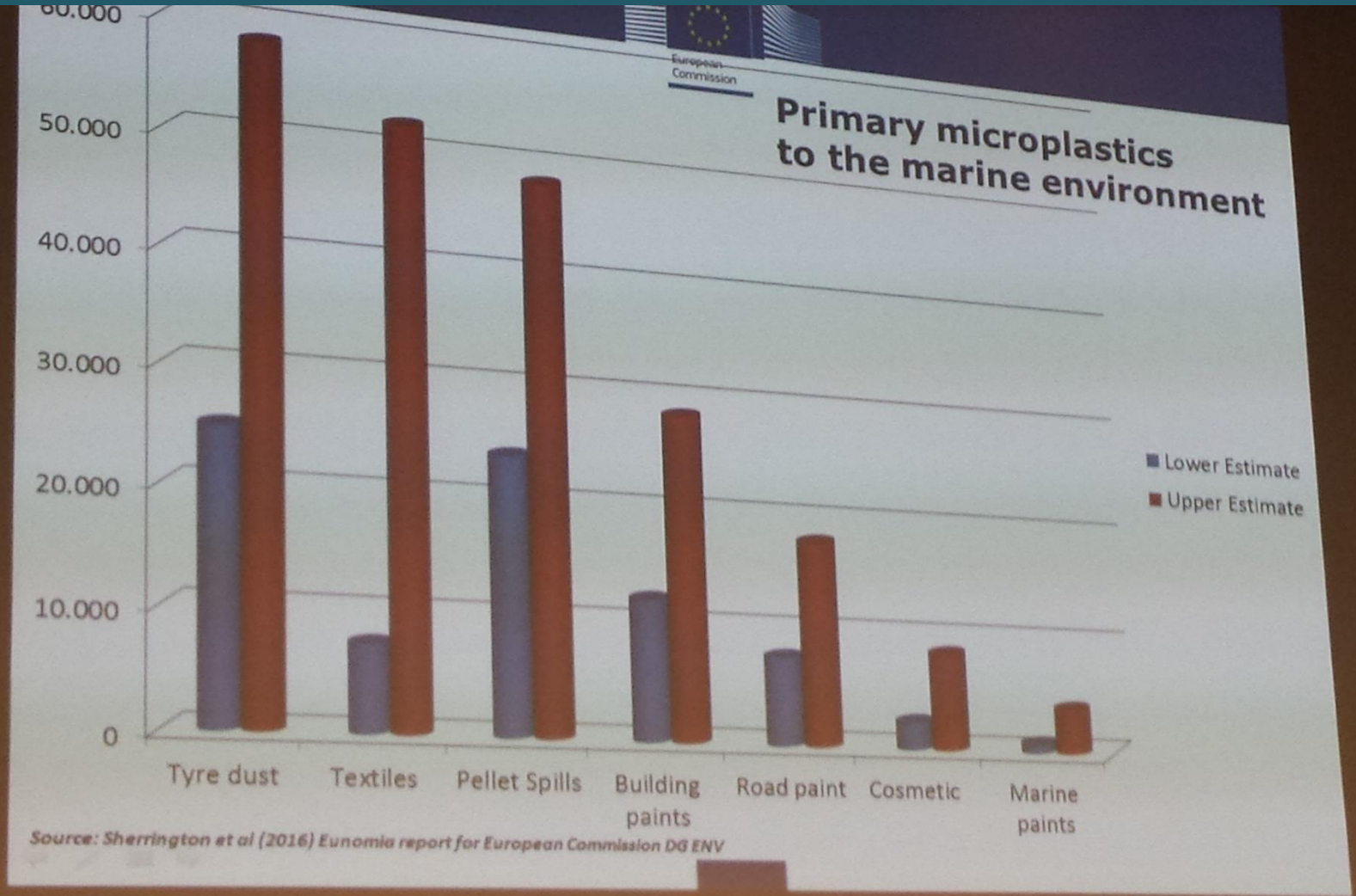
Results

Table 4: Priority scores for sources of microplastics based on five criteria. C1: Scale of emissions, C2: Indispensability, C3: Opportunities for quick wins, C4: Risk perception, C5: Alternatives for the consumer

Activity/product	Sector/actor	Scale	Feasibility		Urgency		Priority
		C1	C2	C3	C4	C5	
Packaging material	Consumers	2	2	2	2	1	9
Litter (general)	Various sectors	2	2	1	2	1	8
Waste collection	Waste disposal	2	0	2	2	0	
Cosmetics	Chemical industry	1	1	2	2	1	
Cosmetics	Consumers	1	1	2	2	1	
Paint, lacquer, dyes	Consumers	2	1	1	1	1	7
Fibres and clothing	Consumers	2	1	1	1	1	
Loading, unloading, transfer	Services	2	0	1	1	2	
Runoff from paved surfaces	Traffic and transport	2	1	1	1	2	
Dust from construction sites	Construction	2	0	1	1	1	
Abrasive cleaning agents	Industry	1	1	2	1	1	
Abrasive cleaning agents	Consumers	1	1	2	1	1	
Agricultural plastics	Agriculture	1	1	2	1	1	
Compost, sewage sludge	Agriculture	1	1	1	1	2	6
Treated water	Sewage treatment plants	1	1	1	1	2	
Overflow and untreated water	Sewage treatment plants	1	1	1	1	2	

link

Estimated emissions (EU)



Take home messages

- Waste, laundry fibres, plastic pellets, tyre wear and paint are considered the most relevant secoundary sources of microplastics
- Cosmetics and abrasive cleaning agents are considered the most relevant primary sources of microplastics
- For product regulation a more detailed defintion is needed.


THANK YOU FOR YOUR ATTENTION