Cost-benefit analysis of policy measures reducing unintentional release of microplastics

Stakeholder Workshop

February 17th, 2022

Draft Agenda

14.30	Introduction – DG ENV
14.30-14.50	Additional Sources of microplastics – project team - (10 min presentation + 10 min Q&A)
14.50-15.20	Paints – project team – (15 min presentation + 15 min Q&A)
15.20-15.50	Laundry and Dishwasher capsules – project team – (15 min presentation + 15 min Q&A)
15.50-16.20	Geotextiles – project team – (15 min presentation + 15 min Q&A)
16.20-16.25	IA/Consultation process – DG ENV – 5 min
16.25-16.30	Next steps – project team – 5 min

Objectives of the study

- To provide environmental, techno-economic analysis and support the Commission on possible actions to reduce the presence of unintended microplastics in the environment, in particular from plastic paints, laundry and dishwasher capsules and geotextiles (along with pellets, textiles and tyres, the initial focus of this study):
  - Define state of play
  - Identify the main problems and their drivers
  - Establish the baseline
  - Identify objectives and develop policy measures to address the problems identified
  - Consider policy options and assess them from economic, social and environmental perspectives
  - Compare the options against the baseline scenarios to identify the best option or combination of options
  - Undertake various stakeholder consultation activities

Project Team

Multidisciplinary team with complementary skills

Paints

EA Earth

Laundry and Dishwasher capsules

UMons

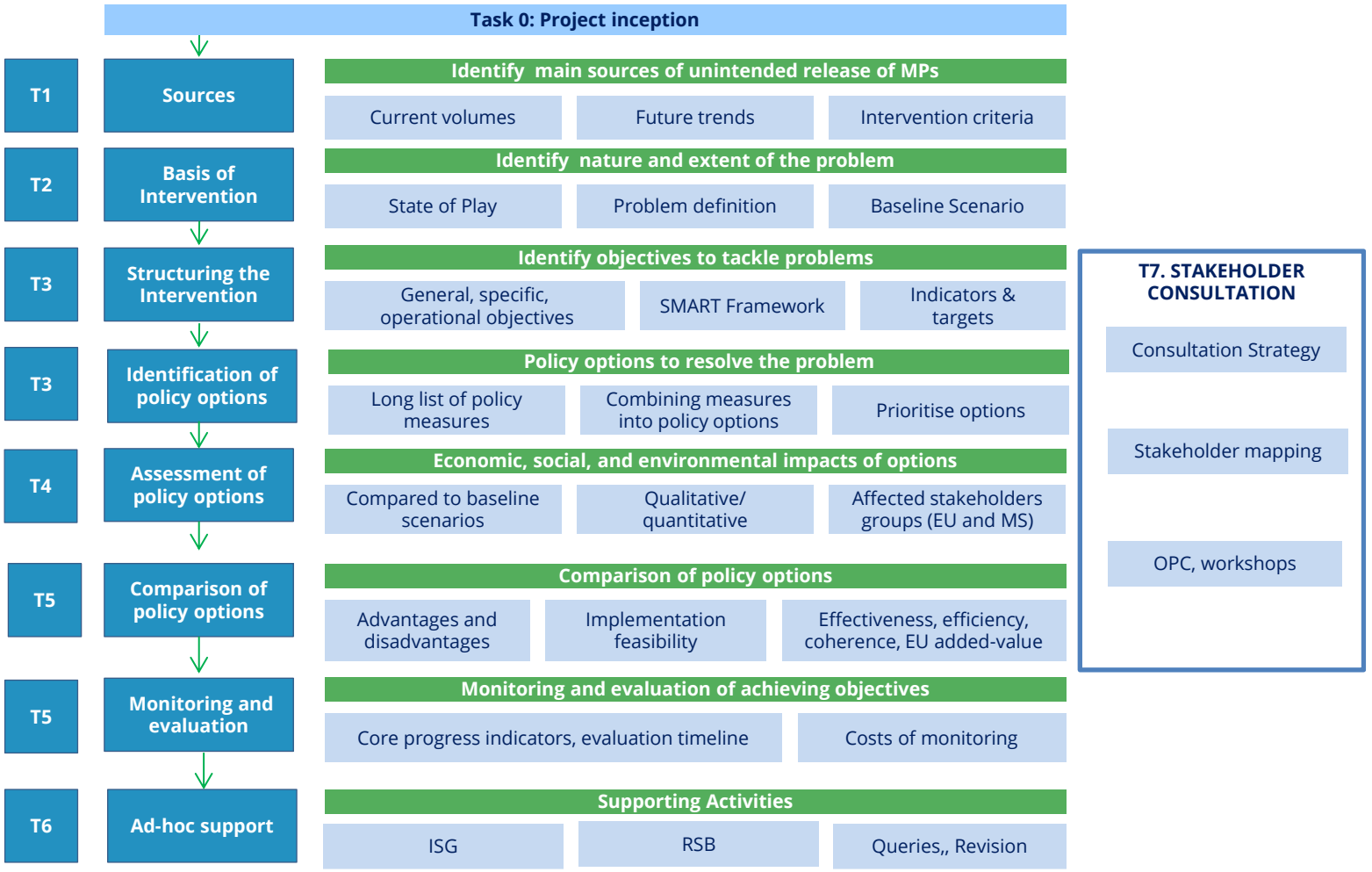
Geotextiles

BioIS

Policy Evaluation (BioIS and AQC)
EA Earth & UMons (Technical expertise)
UoPEL (Advisory)

Approach and Methodology

Task Structure



Introduction

What are microplastics and why are they problematic?

Microplastics are plastic particles of size 1 µm to 5 mm	
Primary microplastics	Secondary microplastics
Intentionally manufactured to microplastic size, they can be intentionally added to product (e.g., exfoliating beads) and lost or unintentionally released (e.g., pellet losses)	Are the result of the physical, chemical or biological degradation of macroplastics in the environment (e.g., tyre, garments)

- Microplastics are ubiquitous in the environment
- Microplastics can contain a variety of toxic chemicals and develop biofilms containing bacteria/microbes on their surface and transport them over long distances
- Potential negative effects on animals due to false satiety because microplastics are mistaken for food and ingested
- Potential adverse effects in humans

Paint

Dr Paola PARUTA
Dr Julien BOUCHER

Paint microplastic - Definition

- Paint is in large part made of plastic polymers (on average 37% of dry paint).
- Microplastic leakage of paint to the environment occurs during:

Application

Wear & Tear

Removal

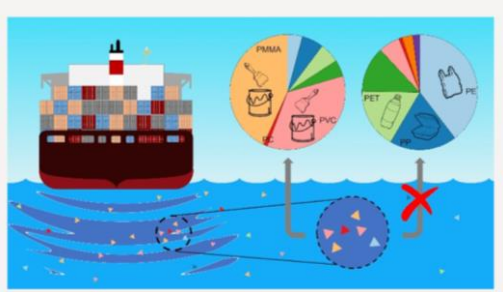
or it can be associated with Unused paint or the End- of-Life of the painted object (macro-leakage).

Quantification of paint microplastic emissions

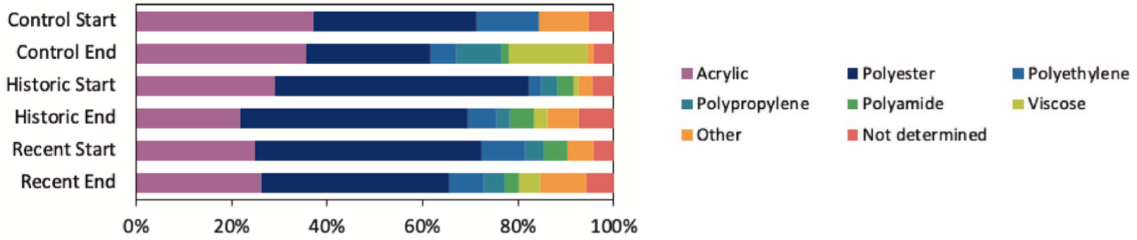
Analytical approach:

“Paint particles are often undetected, deliberately overlooked or evade classification in the pool of micro-debris” (*Turner, 2021*). Nonetheless:

> Paint is found in harbours (Dibke et al, 2021)



> Paint (acrylic) is found in sludges applied to agricultural soil (Schell et al. 2021):



> Paint is found at the effluent of wastewater treatment plants (*Schell et, al, 2021*)

> Paints is found in plankton (30% of the plastic content) (*Lima et al. 20*)

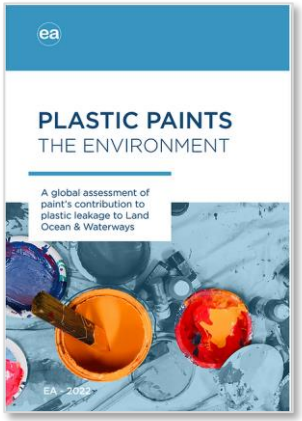
Quantification of paint microplastic emissions

Top-down approach:

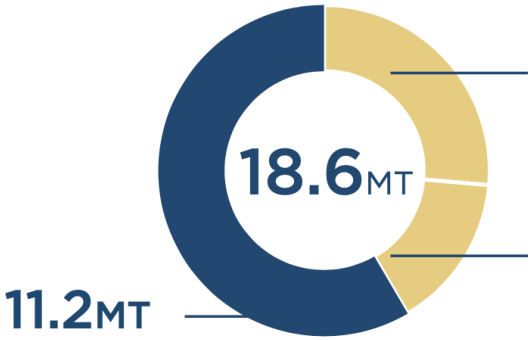
Source	Geography	Sectors	Paint microplastic leakage (kt/yr)	Per capita equivalent (g/cap/yr)	Paint share of micro-plastic leakage (%)
IUCN *Boucher & Friot, 2017*	Global	• Marine • Road markings	156 (to ocean & waterways)	23 (to ocean & waterways)	10,7%
EUNOMIA *Hann et al, 2018*	EU	• Architectural • Marine • Automotive • Road markings	20 (to ocean & waterways)	40 (to ocean & waterways)	11.6%
MEPEX *Sundt, Schulze & Syversen, 2014*	Norway	• Architectural • Marine • Road markings	1.1 (to environment)	214 (to environment)	14%
UNEP *Ryberg et al., 2018*	Global	• Architectural • Marine • Road markings	640 (to environment)	84 (to environment)	21%
Swedish EPA *Magnuson et al., 2016*	Sweden	• Architectural • Marine • Road markings • General Industrial	1.8 (to environment)	186 (to environment)	9.6%
EA *Paruta et al. 2021*	Global	• Architectural • Marine • Road markings • General Industrial • Automotive • Industrial wood	1’857 (to ocean & waterways)	612 (to environment) 267 (to ocean & waterways)	58%
Our estimate	**EU-27**	• Architectural • Marine • Road markings • General Industrial • Automotive • Industrial wood	~ **394** (to environment) ~ **217** (to ocean & waterways)	~ **881** (to environment) ~ **485** (to ocean & waterways)	-

Values for EU currently being modelled / subject to change

Key findings from the EA report
PLASTIC PAINTS THE ENVIRONEMMNT



PLASTIC IN PAINT and TOTAL LEAKAGE



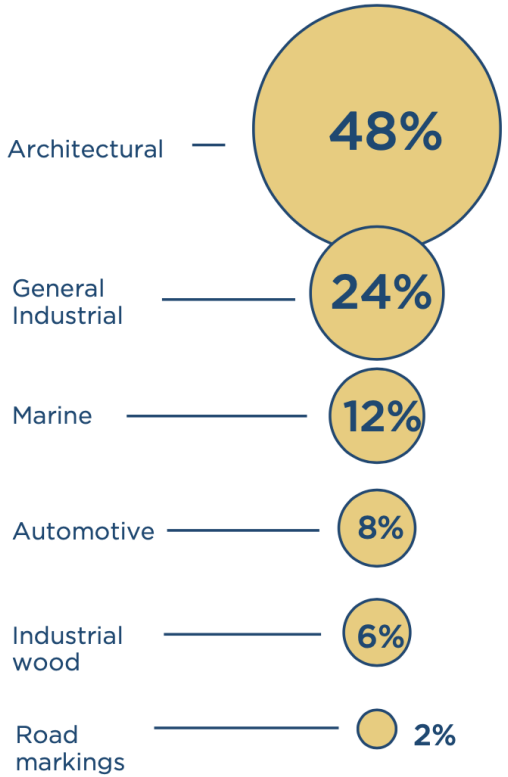
4.7MT
Leaked to Land

2.7MT
Leaked to Ocean & Waterways

11.2MT
Well Managed & Embedded in new products

MICROPLASTIC LEAKAGE in Ocean & Waterways

1.9MT



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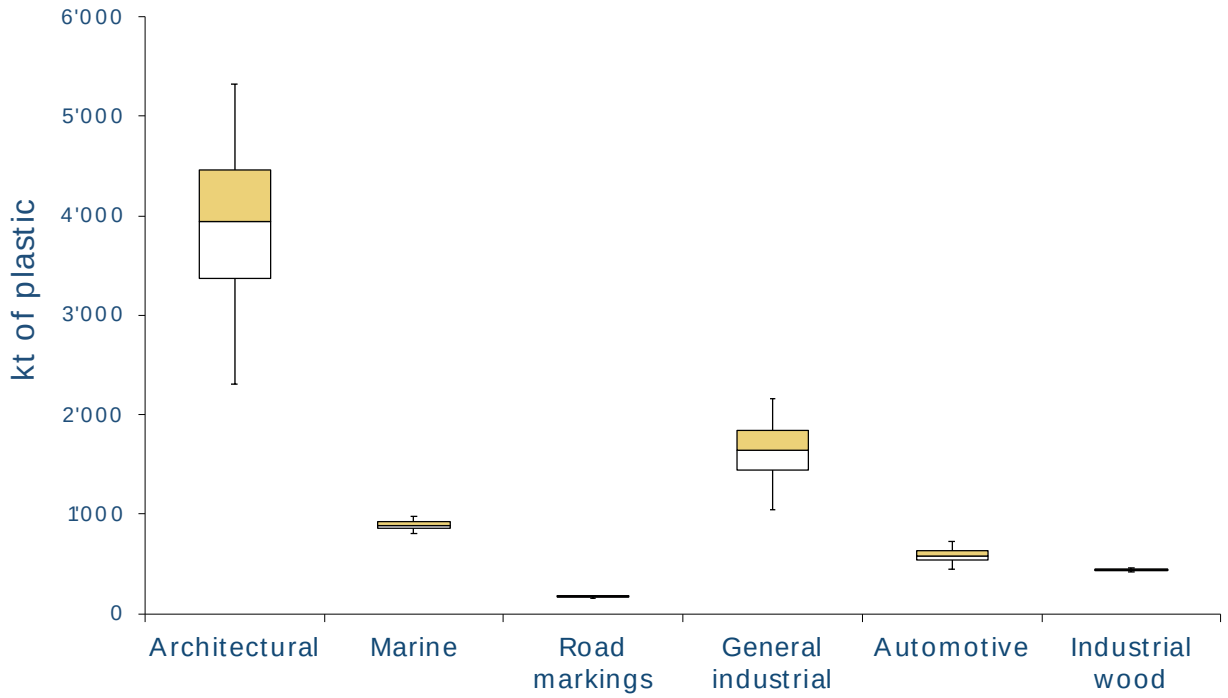


Influencing factors and key parameters

Input of plastic in paint by sector

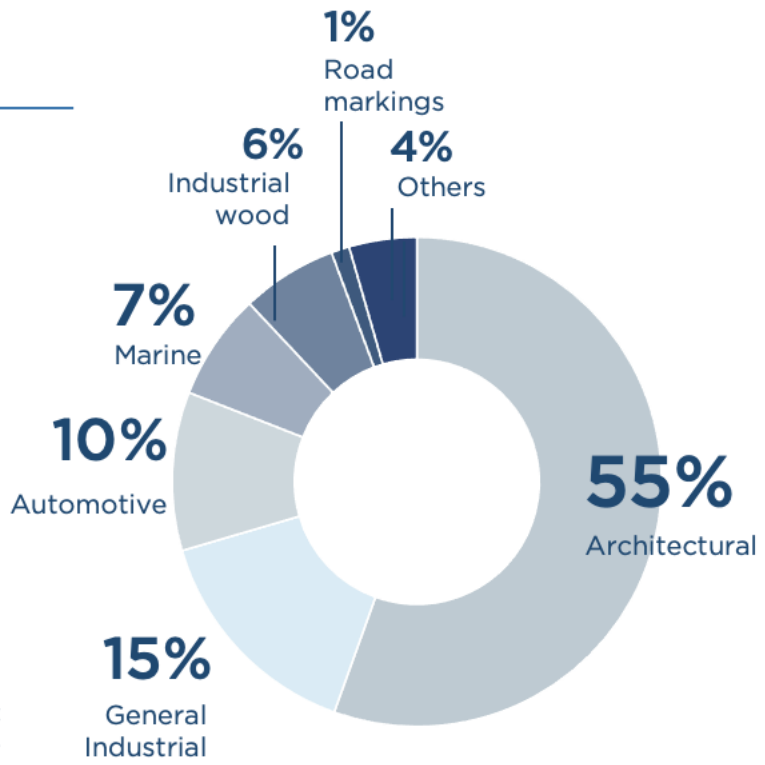
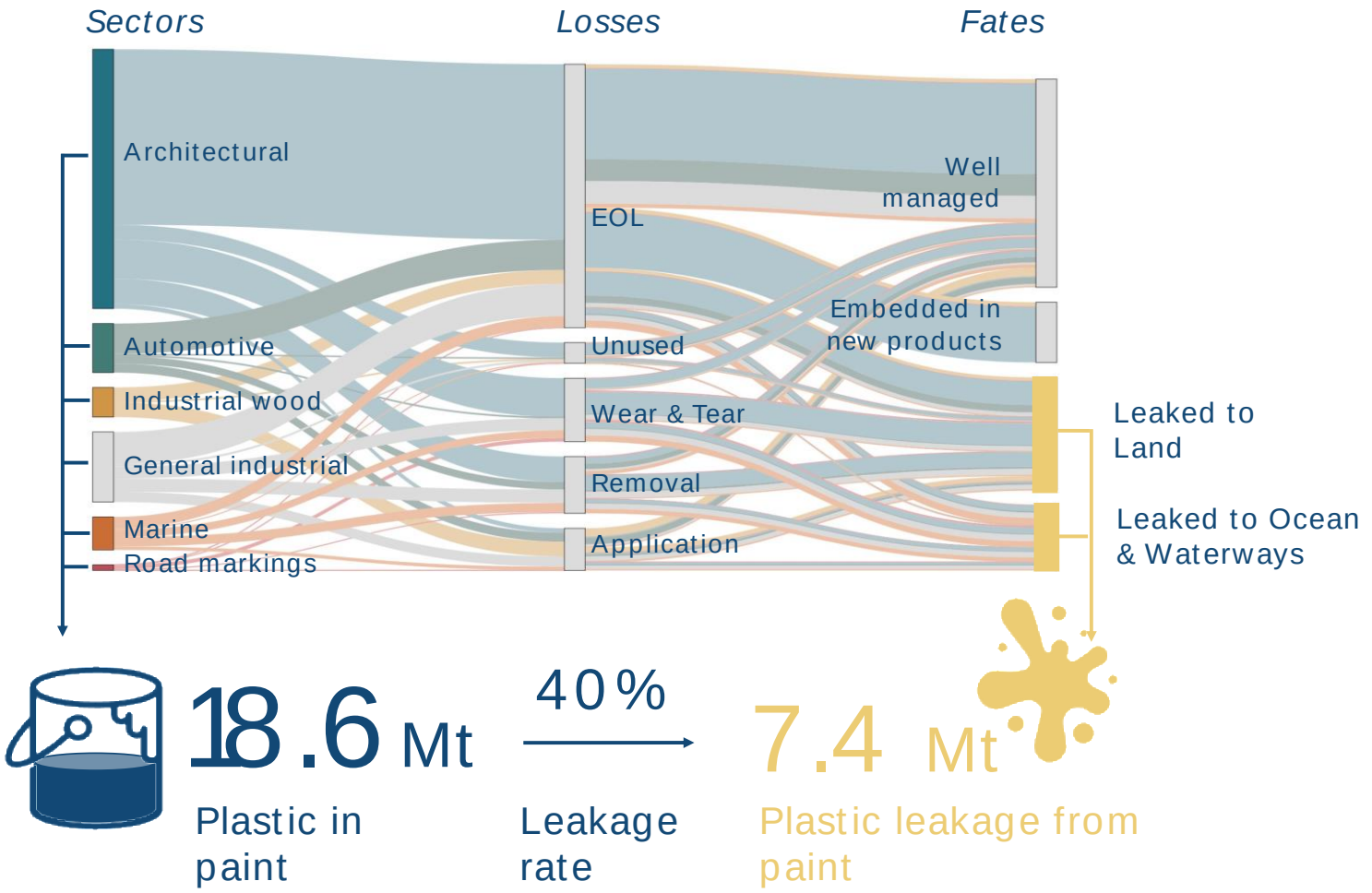
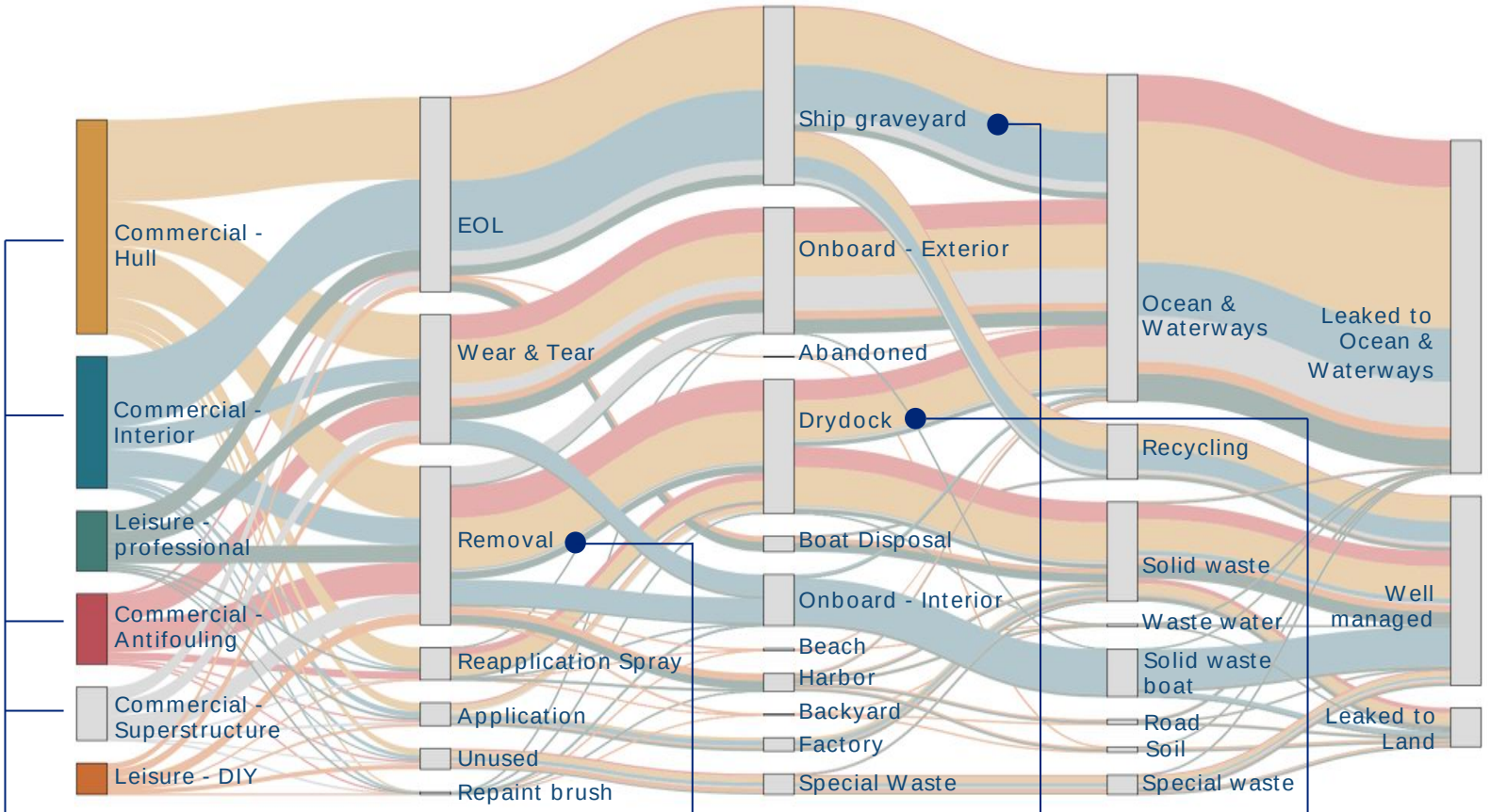


Figure 4. The pie chart shows the yearly input of plastic in paint by sector, data for 2019.

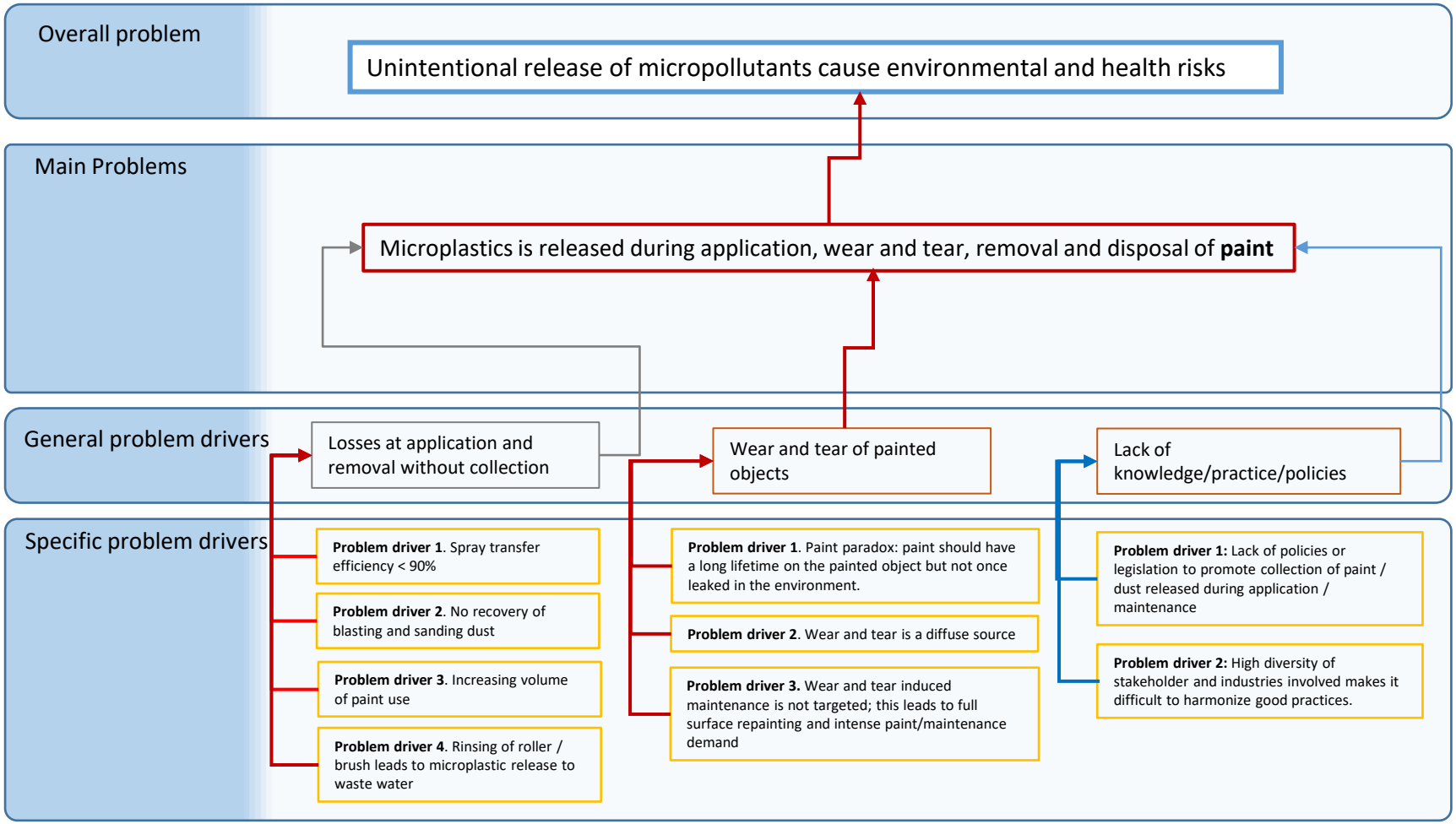
Methodology



Example of Marine Sector



Problem drivers



Data gaps

- How does the paint global **demand by sector** is translated at EU level?
- How to attribute the **responsibility** of paint leakage from assets that are produced or undergo maintenance or disposal abroad?
- How does the **Wear & Tear** process differ between sector and/or based on whether wear & tear is caused by weathering, corrosion, environment, abrasion? Is Wear & Tear exponential or linear in time?
- Should the leakage happening at end of life of boats at **ship-breaking** sites be considered micro-leakage?

Problem definition:
Laundry and Dishwasher capsules

Problem definition: Laundry and Dishwasher capsules

What is the problem and why is it problematic?

- Laundry and dishwasher capsules are protected by a **shell made of a water-soluble plastics** that get dissolved during washing cycle
- **Laundry and dishwasher capsules consumption in Europe** is increasing and the share of **water-soluble plastics is also increasing in other domains** (e.g., chlorine tablets for the garden pond)
- **Water-soluble plastics** are mostly made from polyvinyl alcohol (PVOH) as obtained after hydrolytic deprotection of polyvinyl acetate (PVA). **If the degree of hydrolysis is above 99%,** PVOH can be considered **biodegradable** even whether **its complete biodegradation** needs to be experimentally demonstrated in natural conditions, particularly at low temperature (oceans). Other PVOH grades (between 80 and 98%) **remain water-soluble** but **are not prone to be biodegradable** at all.
- Not all adverse effects have been identified at present but as being water-soluble the impact could be potentially high if any action is taken

Problem definition: Laundry and Dishwasher capsules

Magnitude and EU dimension of the problem

- **In Europe**, the market for dishwasher tabs with water-soluble films represents more than 400,000 tonnes per year (i.e., 20 billion tabs of 20 g each). Out of these dishwasher tabs, **20,000 tonnes of water-soluble plastics used as protective films** are directly released through washing cycle.
- The environmental impact remains ascertain as the PVOH grades can stay as dissolved PVOH polymer in different natural compartments **without being metabolized to ultimately form carbon dioxide** (complete biodegradation).

Problem definition: Laundry and Dishwasher capsules

What are the drivers

- **Increase in production** and use water-soluble plastics
  - Increased demand for laundry and dishwasher capsules
  - Increased in the use of water-soluble plastics for other applications
- **Legislative failure**
  - No legislation pushing the implementation of 100% biodegradable water-soluble plastics
  - Gaps in existing legislation: the current methods to assess biodegradation in natural compartments remain unsatisfactory/absent when applied to natural conditions found in oceans (i.e., 4°C)
- **Lack of knowledge/practice**
  - Insufficient knowledge/tools to demonstrate the complete biodegradation of water-soluble plastics in natural conditions
  - Current best practices not having a verified positive effect on these water-soluble plastics in water waste treatment
  - Insufficient awareness of the issue within the supply chain and the general public

Problem definition: Laundry and Dishwasher capsules

Who are the relevant stakeholders

- **EU Authorities** and **Member State** authorities: they will enforce the legislation
- **Detergent manufacturers**: they can enforce the use of biodegradable water-soluble plastics
- **Plastic manufacturers**: they can innovate in the field
- **Public water managers:** they can apply adapted (enzymatic) treatments to enforce the full biodegradation and/or to avoid the release of water-soluble plastics in natural compartments (rivers, seas, oceans). (end-of-pipe)
- **NGOs and the general public**: they could bring more awareness on this issue as it could affect on ecosystems.

Problem definition: Laundry and Dishwasher capsules

How is the problem likely to evolve with no EU intervention

- The use of water-soluble plastics is likely to **increase** in Europe without policy intervention as a result of the increased plastic demand.
- **Industry initiatives** have **not yet proven to be efficient** for lack of precise baseline data on the complete biodegradation of PVOH films
- The issue will likely **worsen** without policy action at EU level

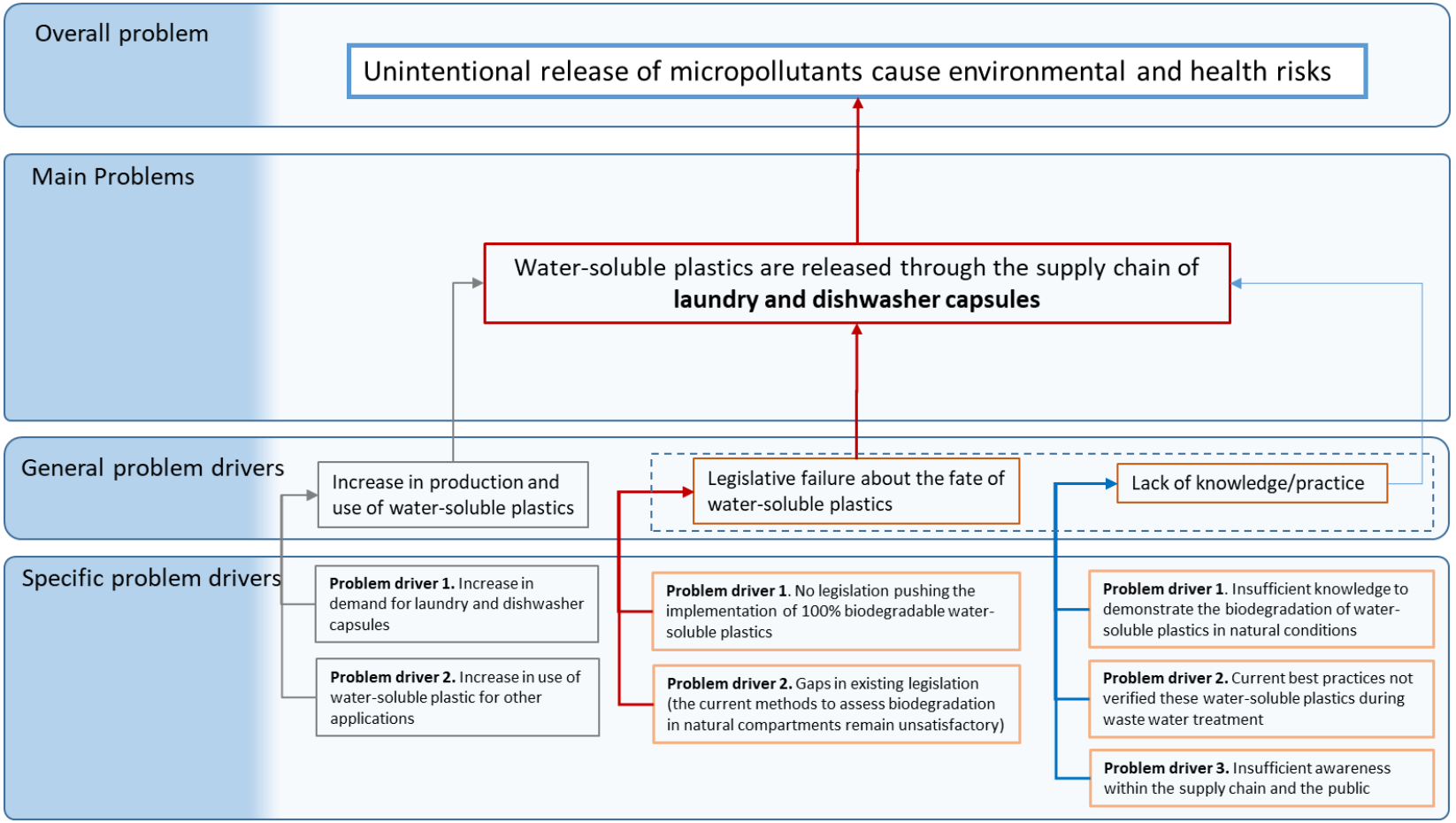
Problem definition: Laundry and Dishwasher capsules

What measures could be taken?

- Setting the **relevant conditions/labelling** for confirming the full biodegradation of water-soluble plastics in natural conditions (4°C)
- Strengthening of **reporting requirements** to ensure reliable and verifiable data on the biodegradation of water-soluble plastics in natural conditions
- Some **other measures** will be considered but not enough information is currently available to assess their technical feasibility and relevance:
  - **Implementing other solutions** than the current used PVOH
  - **Limiting the use of water-soluble plastics** for laundry and dishwasher capsules
  - **Evaluating the real impact** of water-soluble plastics that are not biodegradable in our ecosystem

Problem definition: Laundry and Dishwasher Capsules

What are the drivers



Problem definition: Geotextiles

Problem definition: Geotextiles

What is the problem and why is it problematic?

- Geotextiles (or geosynthetics) are materials used in civil engineering and construction work. They come in a variety of materials (PET, PP, Natural fibres, etc.) and are used in a wide range of applications (coastal erosion reduction, road construction, drainage, etc.)
- The **EU represents 20% of the geotextile market**, which was estimated to **between 1.4 billion square metres[1] and 4.3 billion square metres[2]**.
- The increase in extreme climatic events associated with rising sea levels increase the demand for geotextile for erosion control properties.[3]
- During use, geotextiles wear and can release microplastics into the environment.[4]

1. Wu, Hao et al. "Review Of Application And Innovation Of Geotextiles In Geotechnical Engineering". Materials, vol 13, no. 7, 2020, p. 1774. MDPI AG, doi:10.3390/ma13071774. Accessed 15 Oct 2021.
2. https://www.estormwater.com/grand-view-research-forecasts-global-geotextiles-market
3. Erosion Management - Coasts - Environment - European Commission. (2022). Retrieved 11 February 2022, from https://ec.europa.eu/environment/iczm/coast.htm
4. Bai, Xue et al. "Weathering Of Geotextiles Under Ultraviolet Exposure: A Neglected Source Of Microfibers From Coastal Reclamation". Science Of The Total Environment, vol 804, 2022, p. 150168. Elsevier BV, doi:10.1016/j.scitotenv.2021.150168. Accessed 15 Oct 2021.

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- **PET Geotextiles** used for coastal reclamation are estimated to release 0.24 to 0.79 million tons worldwide.[4]

1. Wu, Hao et al. "Review Of Application And Innovation Of Geotextiles In Geotechnical Engineering". Materials, vol 13, no. 7, 2020, p. 1774. MDPI AG, doi:10.3390/ma13071774. Accessed 15 Oct 2021.
2. https://www.estormwater.com/grand-view-research-forecasts-global-geotextiles-market
3. Erosion Management - Coasts - Environment - European Commission. (2022). Retrieved 11 February 2022, from https://ec.europa.eu/environment/iczm/coast.htm
4. Bai, Xue et al. "Weathering Of Geotextiles Under Ultraviolet Exposure: A Neglected Source Of Microfibers From Coastal Reclamation". Science Of The Total Environment, vol 804, 2022, p. 150168. Elsevier BV, doi:10.1016/j.scitotenv.2021.150168. Accessed 15 Oct 2021.

Problem definition: Geotextiles

EU Baseline

- EU microplastic emissions from PET geotextiles:

  between 58 000 and 158 000 tons.

- EU Geotextile market (market share are assumed to be the same as in the US):
  - Quantities sold in 2021: **530 712 tons**[5]
  - 62.5% non-woven
  - 27.5% woven
  - 10% other

5. Calculated using a non-woven synthetic textile market size of 1 755 000 tons, an 18.9% share of these used for geotextile applications, and a non-woven geotextile market share in the total geotextile sales of 62.5%

Problem definition: Geotextiles

Magnitude and EU dimension of the problem

- The European geotextile market is expected to grow from 20% to 24% of the world's market in 2024.[6]
- There are no barriers between geotextiles and the environment, any microplastic released is directly released into the environment and cannot be removed.
- Geotextiles' end of life is not considered and they are not disposed of when worn out.

6. Geotextiles Market Share Statistics 2024 | Global Industry Report. (2022). Retrieved 6 January 2022, from https://www.gminsights.com/industry-analysis/geotextile-market

Problem definition: Geotextiles

Data gaps

- What are the types of geotextile manufacturing processes and what share of it are used in the EU?
  - Non-woven
  - Woven
  - Knitted
  - Spunbound
  - Other
- What are the materials used?
  - PET
  - PP
  - Other
- What are the applications of geotextiles?
  - Road construction
  - Drainage
  - Erosion control
  - Filtration
  - Other
- What are the emission rates of the different types of geotextiles depending on the:
  - manufacturing process
  - Material
  - Application

Problem definition: Geotextiles

What are the drivers

- **Increase in use** of geotextiles
  - Increase demand for geotextiles for coastal erosion protection
  - Increase in the use of geotextiles for road construction
- **Legislative failure** as geotextiles are not recognised as an issue
  - No legislation (no BAT definition to prevent microplastic emissions from geotextiles)
  - Gaps in existing legislation (no product design requirements)
  - No end of life requirements for geotextiles
- **Lack of knowledge**
  - Scarcity of data on microplastics loss rates depending on geotextile type and application
  - Not well understood wearing mechanisms
  - Lack of knowledge of what types of materials are used and where

Problem definition: Geotextiles

Who are the relevant stakeholders

- **EU Authorities** and **Member State** authorities: they will enforce the legislation
- **Geotextile manufacturers**: their manufacturing processes can influence the releases of microplastics
- **Geotextile importers**: they can be impacted by restrictions on certain types of geotextiles
- **Local governments**: they could not be able to protect their coasts from erosion or build roads due to potential price increases
- **NGOs and the general public**: they can inform on the presence of damaged geotextiles
- **Tourism associations**: natural areas with worn geotextiles can impact their activity

Problem definition: Geotextiles

How is the problem likely to evolve with no EU intervention

- The issue will likely **worsen** without policy action at EU level
  - Microplastic emissions from geotextiles are likely to **increase** in Europe without policy intervention as a result of the increased geotextile demand.

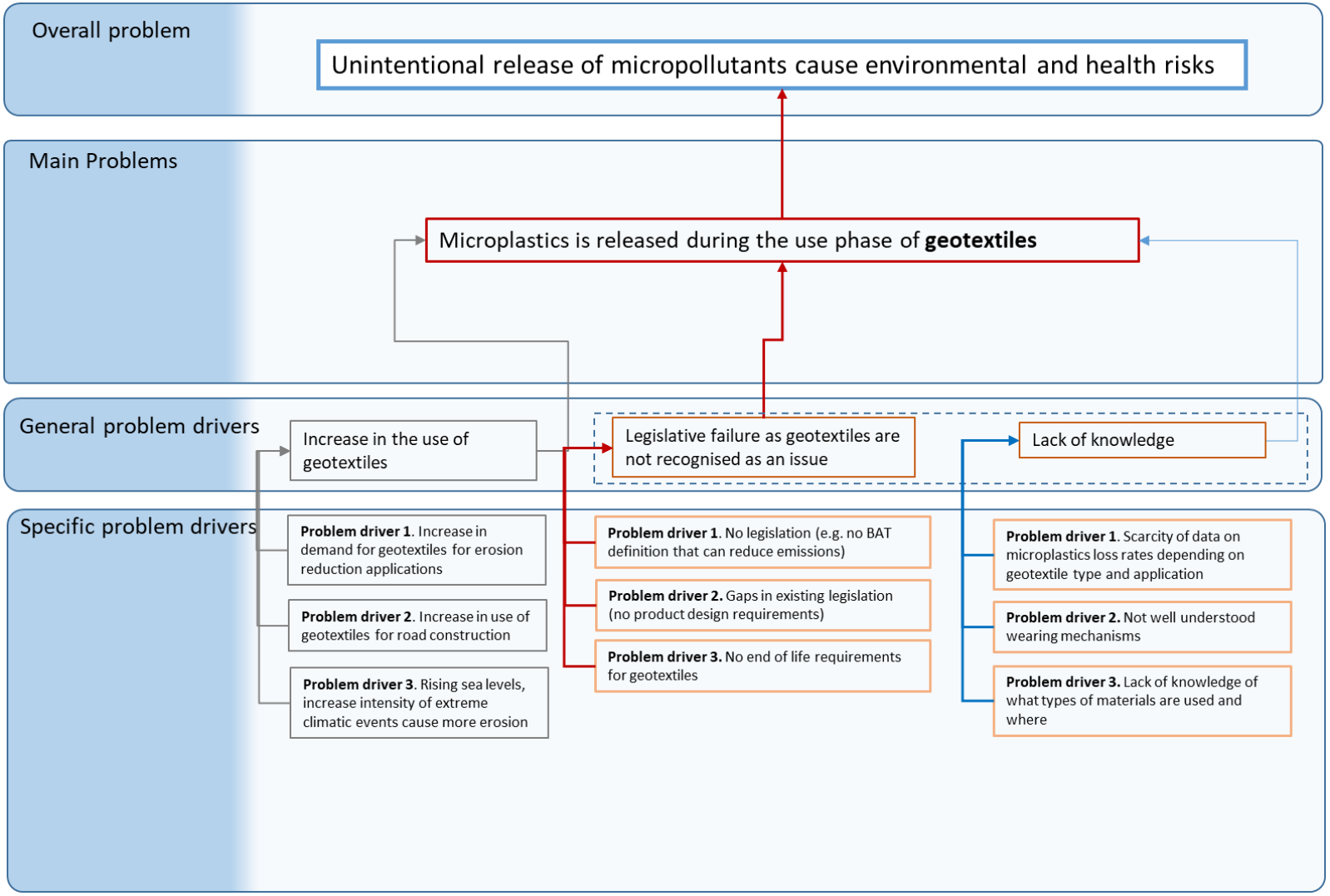
Problem definition: Geotextiles

What measures could be taken?

- **Product design requirements** do reduce microfibre emissions from geotextiles
- **Prevent the use** of certain types of geotextiles **for specific applications** such as erosion reduction.
- Potentially target them through an **EPR** system.

Problem definition: Geotextiles

What are the drivers



Next steps

Thank you

Key contacts

- Study lead and geotextiles : Bio Innovation Service (microplastics@biois.eu)
- Laundry and dishwasher capsules: UMons, Jean-Marie Raquez (jean-marie.raquez@umons.ac.be)
- Paints: EA Earth, Julien Boucher (Julien.boucher@e-a.earth) Paola Paruta (paola.paruta@e-a.earth)
- Cross-cutting issues, Air Quality Consultants, Ben Grebot (bengrebot@aqconsultants.co.uk)