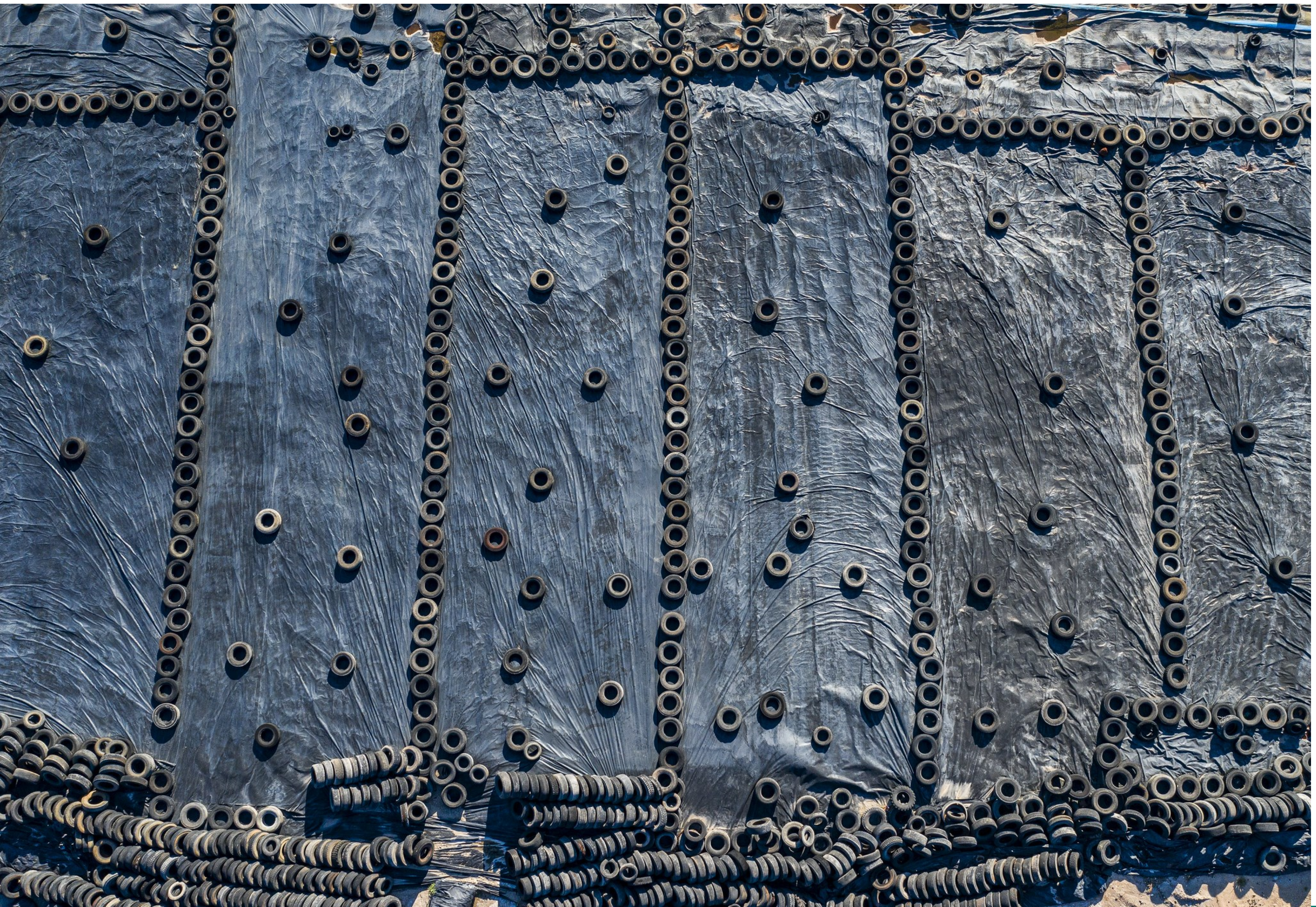
ETC HE Report 2024/15

Microplastic releases in the European Union



Authors:
Pierre Boucard (Ineris), Cynthia Denize (Ineris), Mustafa Aydin (EEA)

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Summary

The aim of this study is to provide an initial assessment of the progress made towards achieving the Zero Pollution Action Plan (ZPAP) objective of reducing releases of microplastics into the environment by 30% by 2030, compared with the baseline situation in 2016.

Monitoring progress towards the ZPAP target calls for indicators for the environmental emissions of microplastics. However, the absence of regular EU scale monitoring data and harmonised analytical methods makes it difficult to define such indicators. Besides, estimates of flows and emission factors are uncertain and generally affected by knowledge gaps.

Based on the literature and the European Commission's Impact Assessment Report “Combatting microplastic pollution in the European Union”, this report circumvents this difficulty by carrying out a study of the main sources of microplastics in the environment.

For each source, the main drivers are identified and associated with trends over the period 2015-2022. The assessment of these trends is mainly based on Eurostat data which were analysed and normalised in relation to 2016 (baseline).

The indicator for microplastic emissions from tyre abrasion, which is based on traffic data from 13 European countries and specific vehicle characteristics, increases from a (normalised) level of 100 in 2016 to 112.3 in 2022; the indicator for plastic pellet emissions, which is based on polymer production data in EU-27, increases from 100 to 107; the indicator for paint emissions, which is based on production and import data of paints in EU-27, increases from 100 to 105. Several scenarios are envisaged for microplastic emissions from textiles.

Based on these results, a methodology was proposed and agreed upon to provide a simplified indicator for microplastic emissions to the environment. The resulting trend shows a 7.5 to 8.6% increase between 2016 and 2022.

Considering the scientific uncertainties (discussed in this report), but also additional analyses based on sectoral datasets, this report concludes that a stable or increasing trend is observed, meaning that emissions of microplastics to the environment have not decreased since 2016.

This work tends to confirm the importance of recent or forthcoming European initiatives to reduce microplastic emissions into the environment (REACH restriction on intentionally added microplastics, limits on tyre abrasion, etc.).

1. Aim of the study

The aim of this study is to provide an information base enabling an initial assessment of the progress towards the Zero Pollution Action Plan (ZPAP) target to reduce releases of microplastics into the environment by 30% by 2030 against a baseline of 2016.

Monitoring progress towards the ZPAP target calls for indicators of environmental emissions of microplastics. Nonetheless, in the absence of monitoring programmes (and standardised sampling and analytical methods) specifically dedicated to this target, it is necessary to evaluate which data would be likely to provide a qualitative assessment.

This report initially presents the key sources of microplastic emissions to the environment. Subsequently, it offers an analysis of the available data on these major sources. Several criteria such as data availability and geographical coverage/representativeness are considered in the analysis. The final part of the report summaries the results. In the absence of solid information allowing us to define a robust indicator, a proxy indicator, based on a methodology discussed with DG ENV and JRC, is proposed.

2 Inventory of the sources and their estimated share in microplastic emissions

For the sake of consistency between this work and the most recent work carried out on microplastics by the European Commission, the Staff Working Document (SWD) "Impact Assessment Report - Combatting microplastics pollution in the European Union" (EC, 2023a) will be used as a reference.

Nevertheless, other studies have been published on this topic, and evaluating the consistency or inconsistency of their results may be useful for developing robust indicators.
This section is thus a simplified summary of the results of leading studies on inventories of microplastic emissions to the environment in Europe. The contexts of these studies vary (national or European scale), and they may use different methodologies (estimates, modelling), which means that a comparison of their results should be considered with caution. For this reason, this section does not aim to provide a detailed presentation of their quantitative results, but to take a qualitative look at the consensual results likely to shed light on the diagnosis of the primary sources of microplastics in the environment.
Table 2.1 below presents an inventory of the main sources identified in the various reports studied. For the sake of simplicity, only the sources associated with at least 1% of the emissions in at least one publication are mentioned. Table A.1 in appendix provides a more exhaustive overview of the results.

Table 2.1 Share of microplastic emissions due to the main sources in different references

Reference	Impact Assessment Report (EC, 2023a)	Eunomia (Hann et al., 2018)	IVL (Unsbo et al., 2022)	TNO (Urbanus et al., 2022)
Geographical scope	**EU28**	**EU28 + Norway and Switzerland**	**Sweden**	**The Netherlands**
Tyres	36%	62%	64%	50%
Pellets	9%	11%	3%	
Paints (including building paints and road markings)	43%	15%	6%	
Artificial turf		6%	17%	
Packaging				29%
Agriculture				15%
Textiles	3%	4%	4%	2%
Geotextiles	1%		0.1%	
Wear from boat hulls			4%	
Other plastics				2%
Automotive breaks		1%		1%
Electronic equipment				1%
Buoys and floating jetties			1%	
Personal care products			1%	
Detergent capsules	0.4%			

Note: In this table colours are given by a simple conditional formatting rule, dark green referring to the lowest values, dark red to the highest.

Of these four studies, the first three (EC, 2023a; Hann et al., 2018; Unsbo et al., 2022) use similar methodologies consisting of i) identifying potential sources of unintentional releases of microplastics, and ii) assessing their emissions on the basis of specific sectoral studies. The TNO whitepaper is based on the Material Flow Analysis (MFA) methodology, which involves assessing the environmental fate of certain products throughout their life cycle. Comparing these methodologies in detail, their complementarities or possible contradictions are beyond the scope of our work. However, it is worth noting that they lead to the identification of significantly different sources. As the MFA starts from the primary uses of plastics ([1]), it naturally considers packaging and concludes that it is a major source of microplastics in the environment, particularly as a result of poor waste management. Conversely, the first studies do not include emissions linked to the degradation of poorly managed waste in the environment due to environmental constraints.

Interestingly, results for sources that are identified both in Urbanus et al. (2022) and in one (or more) of the three other studies are consistent (tyres, textiles and automotive breaks).

Packaging (+ “other plastics” ([2])) and pellets are important sources whereas they are surprisingly not considered together in the cited studies.

Based on results from Table 2.1 it is possible to provide a simplified map of sources of microplastics, depending on whether they are generally considered in inventory studies, and whether they may be considered as a major source. Those sources can be categorised as illustrated in Table 2.2, in which the arbitrary threshold of 10% is taken to discriminate major sources from minor ones.

([1]) See for instance 3.8 below for a presentation of a MFA model from Schwarz et al. (2023).

([2]) Although imprecise, the category is cited as such in Urbanus et al. (2022). Household products are cited as examples.

Table 2.2 Mapping of the primary sources of microplastics to the environment

Major sources		Minor sources	
Documented as such in most studies	**Documented as such in some studies**	**Documented as such in most studies**	**Documented as such in some studies**
Tyres	Pellets Packaging Paints Artificial turf Agriculture	Textiles Geotextiles Automotive brakes	Wear from boat hulls Other plastics Electronic equipment Buoys and floating jetties Personal care products Detergent capsules

In what follows, the analysis will mainly focus on the four of the six primary sources identified by the Impact Assessment Report (referred to hereafter as "main sources") namely tyres, pellets, paints and textiles.

Although it is estimated as a major source, agriculture could not be assessed as we could not identify any data source likely to be used for the development of a (proxy) indicator during the timeframe of this work. Concerning the two remaining sources from the Impact Assessment Report - geotextiles and detergent capsules – no robust data could be found. They will only be shortly presented, as well as the case of artificial turfs.

3. Potential indicators for the main sources

The aim of this report is to propose indicators for the main sources that may be used to annually, or at least regularly, provide an estimation on microplastic releases in Europe.
Among other constraints, this objective of regular estimation of emissions requires representative and robust data, which are available and updated on a regular basis ([3]).
In the following sections (3.1 Tyres to 3.5 Artificial turfs), the main sources, namely tyres, pellets (and plastic production), paints, textiles will be described, and so will be their main drivers. Each section includes:

i) a general description of the source and its main drivers, and

ii) propositions for indicators for their release. Identified data sources will be referenced and a first interpretation of trends on the 2016-2022 period will be provided. Uncertainties and limitations will also be discussed.

([3]) This approach may be enriched with indicators on the pathways, which may require available and robust sampling- and analytical methods. See Unsbo *et al.* (2022).

3.1 Tyres

3.1.1 General presentation

Tyre wear is caused by the friction occurring between the vehicle tyres and the road surface, during normal use of tyres. Therefore, tyre particles are emitted wherever vehicles travel. The amount of tyre wear particles emitted during vehicle driving may be typically estimated using one of the two following approaches: (1) using tyre particles emission factors (EFs) and multiplying by the total distance driven; or (2) determining the loss of mass per tyre during its lifetime and multiplying it by the number of tyres used. Here, the first approach will be followed as more reliable data are available.

The distance driven (also called “mileage” or “road traffic” and measured in vehicles.km, Vkm) has a direct and proportional effect on the amount of tyre material released to the environment. In other words, the more the vehicles travel in terms of distance covered, the higher the amount of tyre material released to all environmental compartments.

The amount of tyre material released to the environment and subsequently the tyre particles emission factors depend on various parameters. These are summarised in Table 3.1 along with a short description of a possible indicator that could be used to monitor each of these parameters. Finally, the expected impact of the parameters on the amount of tyre material released to the environment is estimated in qualitative terms (i.e. low, medium, high).

Table 3.1 Parameters impacting tyre wear

Parameter	Impact and evidence	Comments (possible indicator)
Tyre characteristics	High / Medium	Tyre abrasion rate (mg/km/t) – Reports the amount of tyre material released per km travelled and per tonne of vehicle. When normalised to the load, allows for rating tyres based on their environmental impact
Vehicle characteristics	High / High	Vehicle weight (t) – For the same tyre, the amount of tyre material in mg released per km travelled depends on the vehicle weight. For the same type of tyre, the heavier the vehicle, the higher the amount of tyre material released.
Road characteristics	Medium / Low	Not enough data – Currently, there is not enough robust data to quantify the effect.
Driving style	High / Low	Indicator Not Available – Not enough robust data available
Environmental conditions	Medium / Medium	Indicator Not Available – Impact assumed the same over the year

Source: Estimations based on Jekel (2019) and the ongoing work at the UNECE Task Force on Tyre Abrasion (TFTA).

The tyre characteristics (e.g. construction, structure, size) or parameters (e.g. pressure) can have an important impact on the tyre wear. Studies have shown that for the same tyre dimension (e.g. 205/55 R16), a wear factor of >2 can be measured. Actual data are scarce and not comparable. For this reason, a constant value will be assumed from 2016 until 2022. After 2024, this value should be revised based on the market assessment of the Task Force on Tyre Abrasion of the United Nations Economic Commission for Europe (UNECE). In 2025, a limit on tyre abrasion will be set out at the TFTA level. The limits will apply from 2028 in the context of the upcoming Euro 7 standards regulation. Thus, improvements are expected already from 2026.

Vehicle characteristics (e.g. weight and load, toe and camber angles) play an important role. Some are difficult to quantify (e.g. vehicle alignment). For the vehicle weight (mass) and load, there is enough evidence to indicate an almost linear relationship.

The road characteristics have an impact on tyre wear. Furthermore, new road materials can capture tyre wear. At the moment, there is not enough data on the impact of road characteristics on tyre wear release. For example, road material that reduces tyre wear *via* capturing mechanisms might induce higher tyre wear due to the nature of the interface. Road material that captures tyre particles might be saturated or need road cleaning. The data on road infrastructure and materials across Europe are limited. Finally, road materials have not been reported to significantly alter since 2016; therefore, the overall impact is not expected to change.

The driving behaviour plays a key role in tyre wear emissions. For example, harder accelerations, continuous braking, and other "aggressive forms of driving" increase tyre wear. However, there is not enough data to derive a correlation using a specific metric (e.g. number of accelerations per distance, standard deviation of accelerations etc). Future assumptions could have the average speed and or standard deviation of accelerations as indicators of the driving style. Guidance for vehicle users is considered as a potential lever to decrease tyre wear and thus microplastic emissions.

3.1.2 Potential indicators

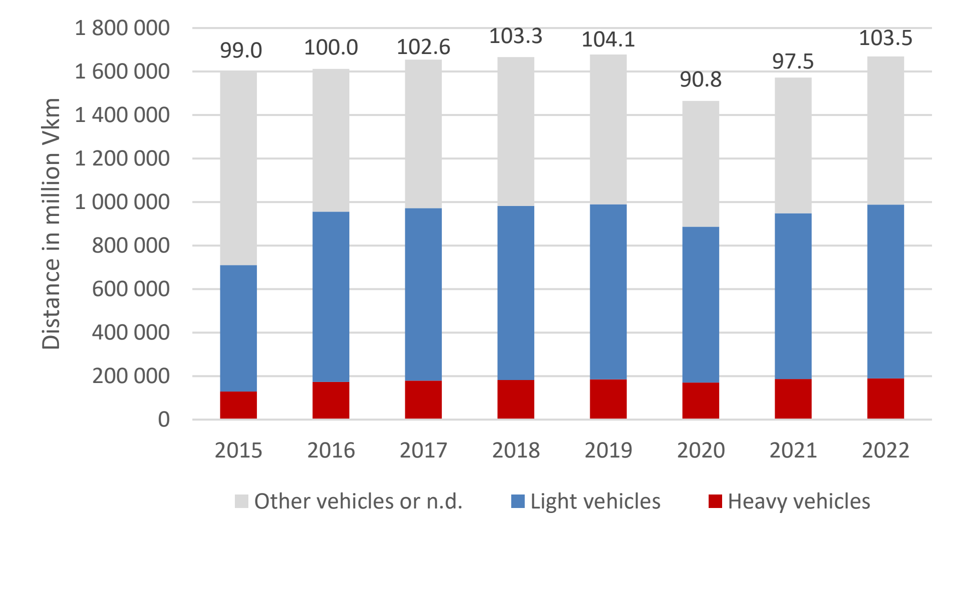
Table 3.2, Table 3.3 and Table 3.4 present the data (and data gaps) that can be used as indicators for microplastic emissions from tyres.

Table 3.2 Indicator for distance driven

Data source	Eurostat
Annual updates	Yes
Geographical coverage	Limited to 13 out of 27 countries in EU-27 (Belgium, Czechia, Estonia, Ireland, Spain, France, Croatia, Hungary, Netherlands, Poland, Romania, Slovenia, Finland)
Warnings	The database may be heterogeneously filled and incomplete: - Some countries, like Belgium or Poland, have not reported data for every year leading to inconsistencies when considering the total mileage. In that case, either those countries must be overlooked, or some basic analysis (e.g. linear extrapolation) can be done to fill the data gaps. - Other countries, like Germany, Spain or Italy have not reported data. In that case, the data gap may be either ignored (as done hereafter) or filled using complementary national databases. The database provides the different distances driven per country, but heterogeneously provides the type of vehicle involved (car, motorbike, lorry, etc.). This uncertainty may have an impact on the final indicator.

Results

Figure 3.1 Distance driven, in million vehicles.km (Vkm) per year



Note: Sum for the 13 countries for which traffic data are provided in Eurostat. Figures on top are the yearly normalised total distance driven with reference to 2016 (2016 = 100). Heavy vehicles include the Eurostat categories “Lorries”, “Public transport”, “Buses”, “Motor coaches”, “Trolley buses”, “Mini-buses and mini-coaches”, “Road tractors”, Light vehicles include the Eurostat categories “Passenger cars”, “Motor cycles”, “Mopeds”; Other vehicles or n.d. include the Eurostat category “Other motor vehicles” and those for which the category is not available.

Source: Adapted from Eurostat 2024.

Interpretation Figure 3.1 illustrate trough distance driven data that road traffic has increased every year since 2011, except for 2020, a year of substantial Covid-19 pandemic lockdowns, when a significant drop was observed. By 2022, road traffic had returned to pre-pandemic levels, reaching a level 3.5% higher than in 2016.

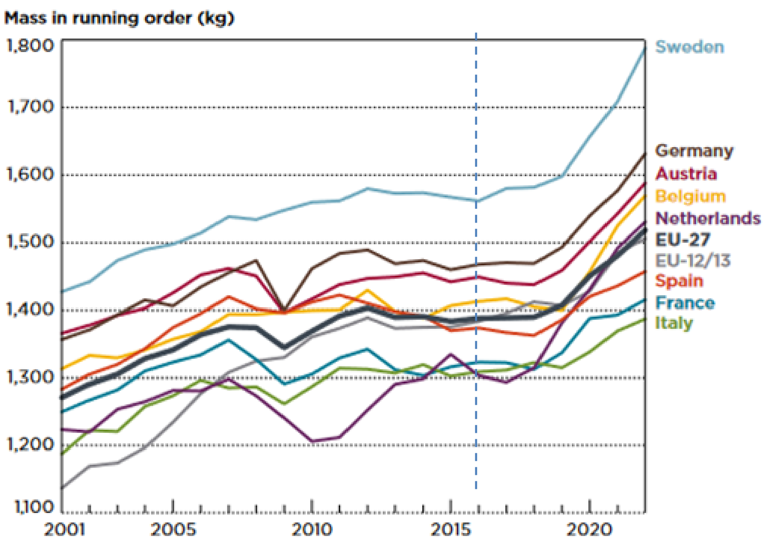
Source: Eurostat (2024a) - Road traffic by type of vehicle (million Vkm) - Motor vehicle movements on national territory (irrespective of registration country)

Table 3.3 Indicator for vehicle weight of light vehicles

Data source	ICCT
Annual updates	Yes The International Council on Clean Transportation (ICCT) regularly provides the European Vehicle Market Statistics Pocketbook including an annual statistical portrait of the states of the EU car, van, truck, and bus markets.
Geographical coverage	EU-27 available
Results	See figures below

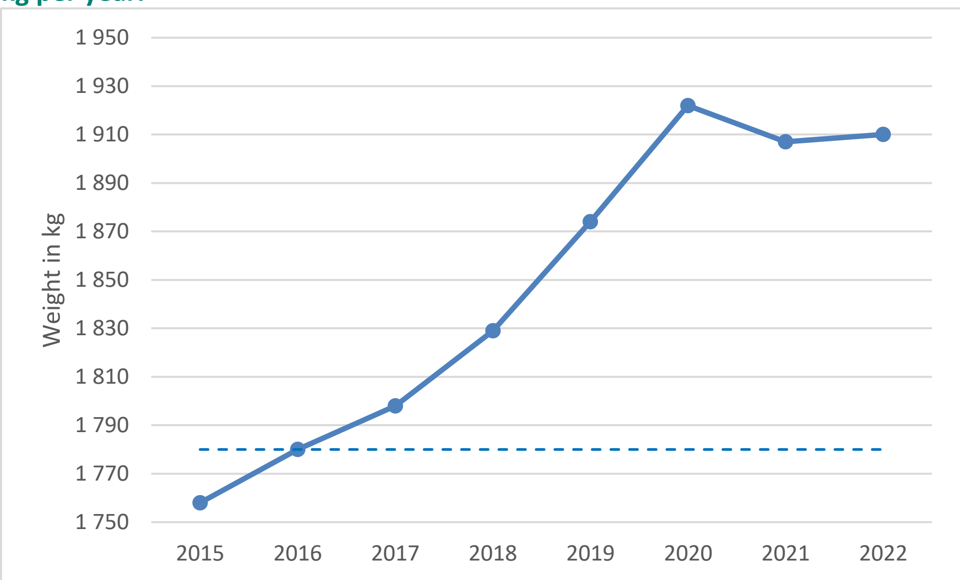
Results

Figure 3.2 Passenger cars. Average mass of new vehicles in running order by country



Source: Reproduced from ICCT, 2024.

Figure 3.3 Average vehicle weight of new light commercial vehicles in EU-28, in kg per year.



Note: Data for year 2021 and 2022 refer to EU-27.
Dashed line = 2016 level.

Source: Author's compilation based on data from ICCT, 2024.

Interpretation	Average vehicle weight of new passenger cars (representing 87% of the market in 2022) has increased by 9.0% between 2016 and 2022 in EU-27, and more generally increased by more than 6% in all reported countries (see Figure 3.2). Average vehicle weight of new light commercial vehicles (representing 10% of the market share in 2022) has increased by 7.3% between 2016 and 2022 in EU-28 (see Figure 3.3).
Warnings	Data on vehicle weight of trucks and buses >3.5 t, representing 3% of the market in 2022 (see ICCT 2024, Fig. 2-9) are not available. Data on their loads which could be relevant are not available either.

Source: ICCT (2024) (Figure 4-16 and Tables page 52 et sq.)

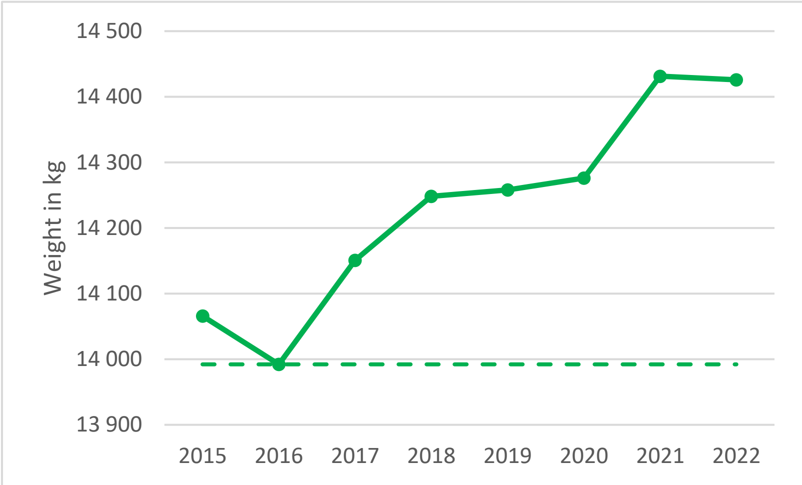
As vehicle weight has an influence on microplastic emissions, it is important to consider also the weight of the heaviest vehicles. In the absence of ICCT data available on this aspect, Eurostat data we explored in order to define a possible indicator. Freight statistics are useful in this respect. Indeed, Eurostat data on freight provide both the distance driven by freight vehicles in million vehicles.km (Vkm, number of vehicles*distance) and the weights in million tonnes.km (tkm, laden weight of vehicles*distance) at the EU-27 scale. This allows to calculate the average laden weight of vehicles at the EU-27 scale.

The following table provides details and results about this new parameter.

Table 3.4 Indicator for vehicle weight of heavy vehicles

<table>
<tr><td>Data source</td><td>Eurostat</td></tr>
<tr><td>Specific requests</td><td></td></tr>
<tr><td>Annual updates</td><td>Yes</td></tr>
<tr><td>Geographical coverage</td><td>EU-27 available</td></tr>
<tr><td>Results</td><td>

Figure 3.4 Average laden weight of freight vehicles in EU-27, in kg.



Note: Dashed line = 2016 level.

Source: Author's compilation based on data Eurostat, 2024b.

</td></tr>
<tr><td>Interpretation</td><td>The average laden weight of freight vehicles in EU-27 has increased by 3.1% between 2016 and 2022</td></tr>
<tr><td>Warnings</td><td>/</td></tr>
</table>

Source: Eurostat (2024b) - Road freight transport by axle configuration of vehicle (tkm, Vkm, journeys) - annual data

3.1.3 A simplified indicator for tyres' emissions

All the parameters for which data could be obtained are increasing over the period 2016-2022, which at least qualitatively indicates an increase in emissions of microplastics from tyres into the environment. In this section, based on discussions with experts involved in the TFTA - UNECE, we propose to aggregate this information into a single simplified indicator, specific to tyre emissions.

According to what was presented above, the annual emissions $E_{tyre,\,y}$ can be modelled as follows:

$$E_{tyre,y} = \sum_{i} EF_{i,y} \times DD_{i,y} \times W_{i,y} \; (1)$$

With : *y* indicating the year
i indicating the different types of vehicles
EF_i, the average emission factor of microplastics from tyres used for vehicles in category *i* (in mg/km/t), in year *y*
DD_i, the distance driven by vehicles in category *i* (in Vkm), in year *y*
W_i, the average weight of vehicles in category *i,* in year *y*

As the ZPAP target is defined with reference to 2016, the indicator $I_{tyre,\,y}$ used is:

$$I_{tyre,y} = E_{tyre,y}/E_{tyre,2016} \quad (2)$$

As presented in this section on tyres' emissions, not all data are available to calculate this indicator. That's why the following assumptions are made:

- In order to use Eurostat data on distance driven and ICCT data on vehicle weights, three categories of vehicles must be considered: Heavy vehicles (including lorries, buses, road tractors, etc.); Light vehicles (including the passenger cars, motor cycles, etc.), and Other vehicles or n.d. (including other motor vehicles and those for which the category no is not available in traffic data.
- Given the data available in Eurostat, Light commercial vehicles will be included in the Light vehicle category. The average mass of this category is then established on the basis of a weighted average of the weights of Passenger cars and Light commercial vehicles. As they represent respectively 87% and 10% of the market for new vehicles over the period 2015-2022 according to ICCT data, we will consider that:

$$W_{light\ vehicles} = \frac{87}{87+10} W_{passenger\ cars} + \frac{10}{87+10} W_{Light\ commercial\ vehicles} \quad (3)$$

- As the tire abrasion limits brought by Euro7 will apply after 2028, EF_i are considered to be constant over the period 2015-2022. The emission factors are calculated based on data provided by experts from TFTA-UNECE and presented in the following table.

Table 3.5 Emission factors

	Weight, in t	Emission factor, in mg/km	Emission factor EF_i, in mg/t/km
Passenger cars	1.65	100	62.5
Light commercial vehicles	2.5	200	80
Light vehicles	See (3)	/	62.6*
Heavy vehicles	27.5	800	29.1

Note: (*: weighted average based on market share, see also (3)).

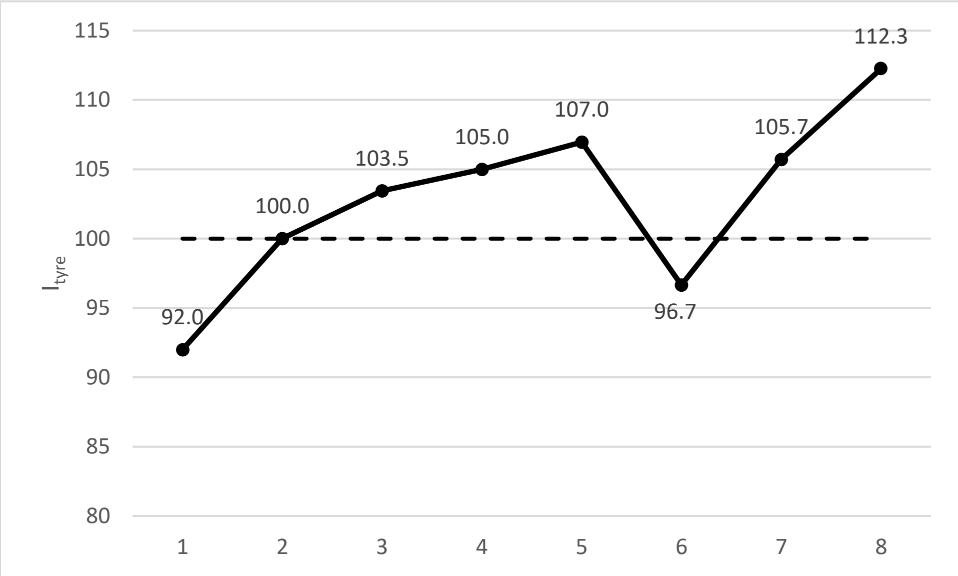
- In the absence of data, distances associated with no type of vehicle, or with the Other vehicles category, will be associated with Light vehicles.

Finally, the model is:

$$E_{tyre,y} = 62.6 \times (DD_{light\ vehicles,y} + DD_{other\ vehicles\ or\ n.d,y.}) \times W_{light\ vehicles,y} + 29.1 \times DD_{heavy\ vehicles,y} \times W_{heavy\ vehicles,y}$$

Figure 3.5 below presents the evolution of the simplified indicator I_{tyre} between 2015 and 2022, showing a 12% increase between 2022 and the reference year 2016. This indicator is further used for the final composite indicator (see section 4.3 Simplified composite indicator)

Figure 3.5 Simplified indicator for tyres' emissions of microplastics over the period 2015-2022.



Note: Dashed line = 2016 level.

Source: Author's compilation based on data from Eurostat (2024a, 2024b) and ICCT (2024).

3.2 Plastic pellets

3.2.1 General presentation

In Europe, approximately 80% of all plastic raw materials produced are in the form of plastic pellets (EC, 2023a). Material losses of plastic pellets can occur as point emissions to water and air, both from plants that manufacture pellets (production) or plants that use pellets as inputs (conversion, recycling). Transport and storage operations can be sources of microplastics losses.

Following the approach developed in the Impact Assessment Report (EC, 2023a), it is possible to consider that emissions of microplastics due to plastic pellets are primarily dependent on the demand for plastics in Europe. But logistical factors are also likely to influence emissions.

The plastic pellet production and use in Europe is assumed to be the main driver. An increase in the production and use of pellets as raw materials for plastic products leads to increasing potential releases to the environment. Strictly speaking, both production and imports must be considered for virgin and recycled pellets.

Pellet spills and potential losses happen during loading, reloading and transportation. This is why the number of steps during the value chain can be seen as another parameter impacting potential emissions. The amount of microplastic pollution directly correlates with the number of handling operations between the production of pellets and their processing. It is estimated that pellets are handled four times on average between their production and processing stages[4].

([4]) See the Impact Assessment Report (EC (2023) p178 *et seq.*) for a more comprehensive description. The quantity of production and transport losses for pellets manufactured and processed in EU are between 90kt and 154kt, whereas the quantity of production and transport losses for exported and imported pellets are estimated to 44kt.

Beyond the number of steps in the value chain, the awareness about potential spills in the value chain or other regulatory constraints could influence the emission factors. This is why introducing a reporting requirement for microplastic emissions for producers of plastic pellets is foreseen as a mitigating measure. In that perspective, the European Commission adopted:

- the REACH restriction ([5]) of intentionally added microplastics on 25 September 2023 (EU, 2023);
- a Proposal for a Regulation on preventing plastic pellet losses to reduce microplastics pollution in October 2023 (EC, 2023b).

Although they have not yet had an impact, these measures could become important parameters in the near future.

3.2.2 Potential indicators

In the absence of precise reporting on pellets use and losses in the EU, market data on the quantity of pellets used in the EU can be utilised as indicators. This type of data was used to estimate the baseline scenario in the Impact Assessment Report and represents the entry point for all modelling studies on potential emissions of microplastics to the environment.

Furthermore, for any given pellet use, the number and nature of the logistical steps (handling, transport, etc.) influence potential emissions of pellets to the environment. In the study supporting the Impact Assessment Report, the EC presents a simplified study of the potential logistical circuits depending on whether pellets are produced and processed within the EU, exported outside the EU, or imported. Without going into the details of the study, the conclusion is that domestic production has a predominant influence on logistics routes outside Europe. For this reason, we propose to sequence the indicator by first considering EU production (Table 3.6), then import and export levels (Table 3.7).

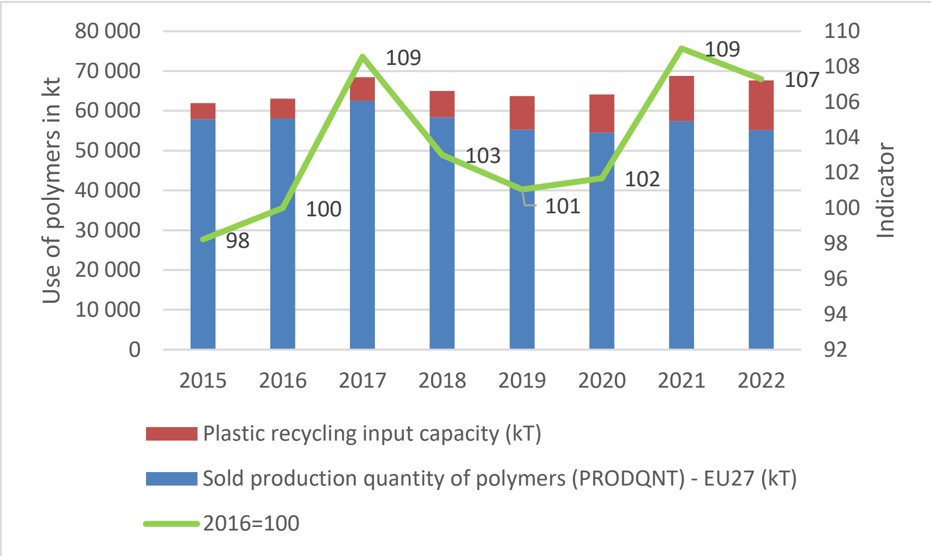
Table 3.6 Indicator for production and use of plastic pellets in EU-27

Data source	Eurostat (virgin polymers) and Plastics Recyclers Europe (recycled polymers)
Annual updates	Available for Eurostat Probable for Plastic Recyclers Europe
Geographical coverage	EU-27 is available for virgin polymers Only EU-27+3 for recycled polymers
Warnings	Virgin polymer and recycled polymer data are not fully comparable as 3 more states are considered for recycled polymers.

([5]) Commission Regulation (EU) 2023/2055 of 25 September 2023 amending Annex XVII to Regulation (EC) No 1907/2006 of the European Parliament and of the Council concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH) as regards synthetic polymer microparticles.

Results

Figure 3.6 Production of polymers in EU per year



Note: Data are attached in annex, Tables A.2-A4.
Dashed line = 2016 level.

Source: Author's compilation based on data from Eurostat 2024c) and Plastics Recyclers Europe (2022).
Table A.2 Sold production of polymers in EU-27, in kt

Interpretation If we consider only the production of virgin plastics, increases and decreases have been observed between 2015 and 2022. The 2022 level is 4% lower than the 2016 level.
When data on recycled plastics is added, the increase is significant (7%).

Assuming the absence of voluntary, legal or binding measures along the value chain to manage emissions, the increase of the indicator on plastic production in Europe (virgin and recycled) is assumed to lead to an increase in releases of plastic pellets to the environment for the 2016-2022 period in Europe.

Warnings Insufficient data and high complexity of microplastic releases due to pellets at different steps of the value chain.

Source: Eurostat (2024c) – Sold production in PRODCOM for specific polymers ([6]) (online data code: PRODQNT).
Plastics Recyclers Europe (2022) – Installed plastics recycling input capacity in EU-27+3.

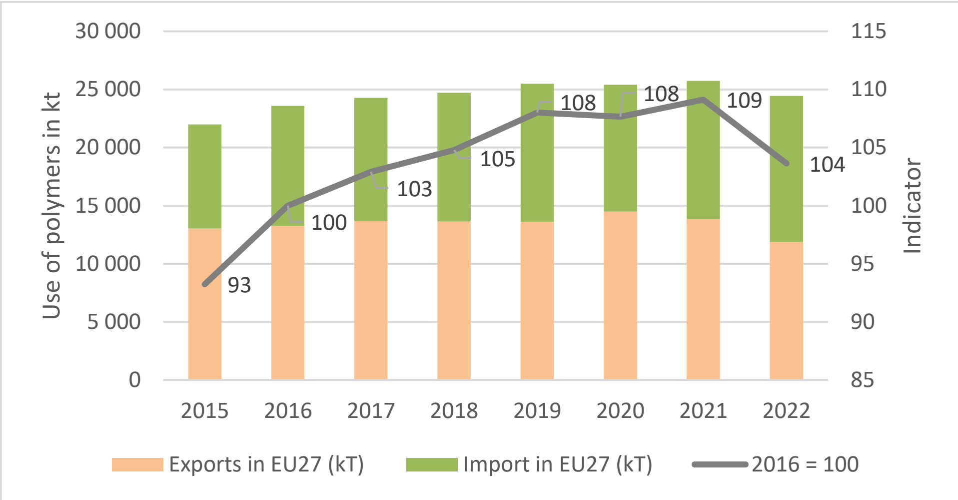
As explained above, logistic routes of plastic pellets may lead to significant though lower losses than those of the domestic market. Hence, imports and exports of virgin polymers are regarded as a secondary indicator in Table 3.7.

([6]) For this study, we used the same codes as those used in the Impact Assessment Report (EC, 2023a). See Table A.2-A.4 in annex.

Table 3.7 Indicator for imported and exported polymers

Data source	Eurostat
Annual updates	Yes
Geographical coverage	EU-27 available
Warnings	Data for imported and exported recycled polymers are not available.
Results	

Figure 3.7 Imports and exports of polymers in EU-27, in kt



Source: Author's compilation based on data from Eurostat (2024c).

Interpretation	As exports and imports of virgin polymers have increased by 4% between 2016 and 2022, it seems reasonable to assume that pellet emissions have also risen along their own logistics routes.

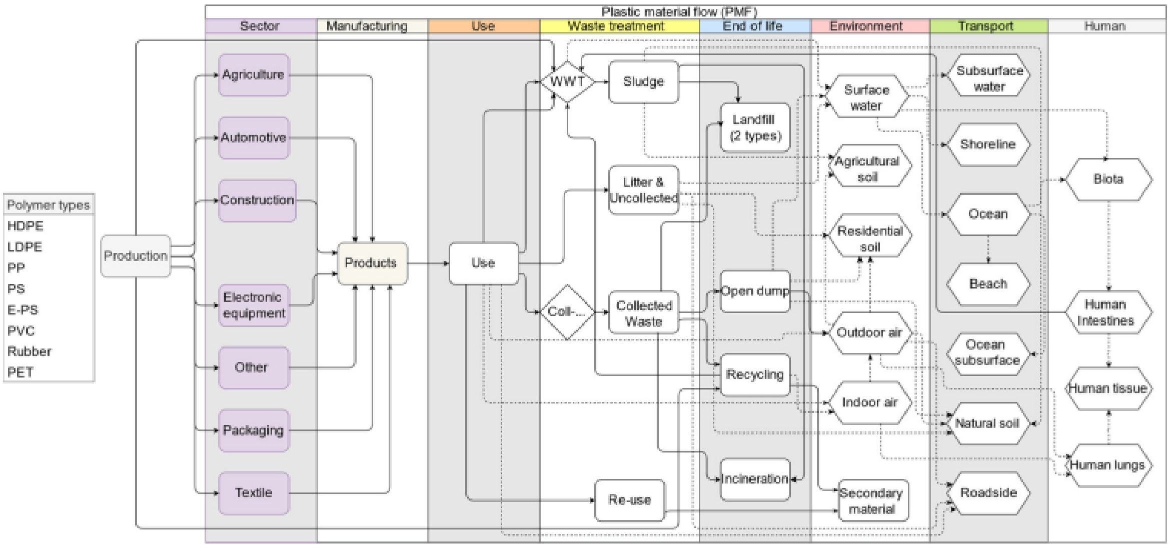
Source: Eurostat (2024c) – Sold production in PRODCOM for specific polymers ([6]). (online data code: EXPQNT and IMPQNT).

In the absence of robust information on the proportion of emissions due to losses associated with production and transport-related losses in the EU compared to losses due to import and export of polymers, no indicator aggregating the main indicator and the secondary indicator is proposed. Later in the report, these two indicators are considered in a qualitative analysis, but only the main indicator is included in the final composite indicator.

3.2.3 Comment on using data on plastic use as indicators for microplastic emissions

It is worth mentioning that beyond the case of pellets, plastic use can be considered as the main driver for other sources. Most material flow analyses (e.g., Kawecki et al., 2019, Schwartz et al., 2023) are first based on plastic use statistics which are divided into sectors like agriculture, textile, packaging, etc. (see Figure 3.8). Plastic use remains the first explanatory variable of macroplastic and microplastic emissions to the environment in MFA models as explained in section 2 Inventory of the sources and their estimated share in .

Figure 3.8 Mass Flow Analysis model of plastics and their littering pathways to the environment and potential human exposure(7)



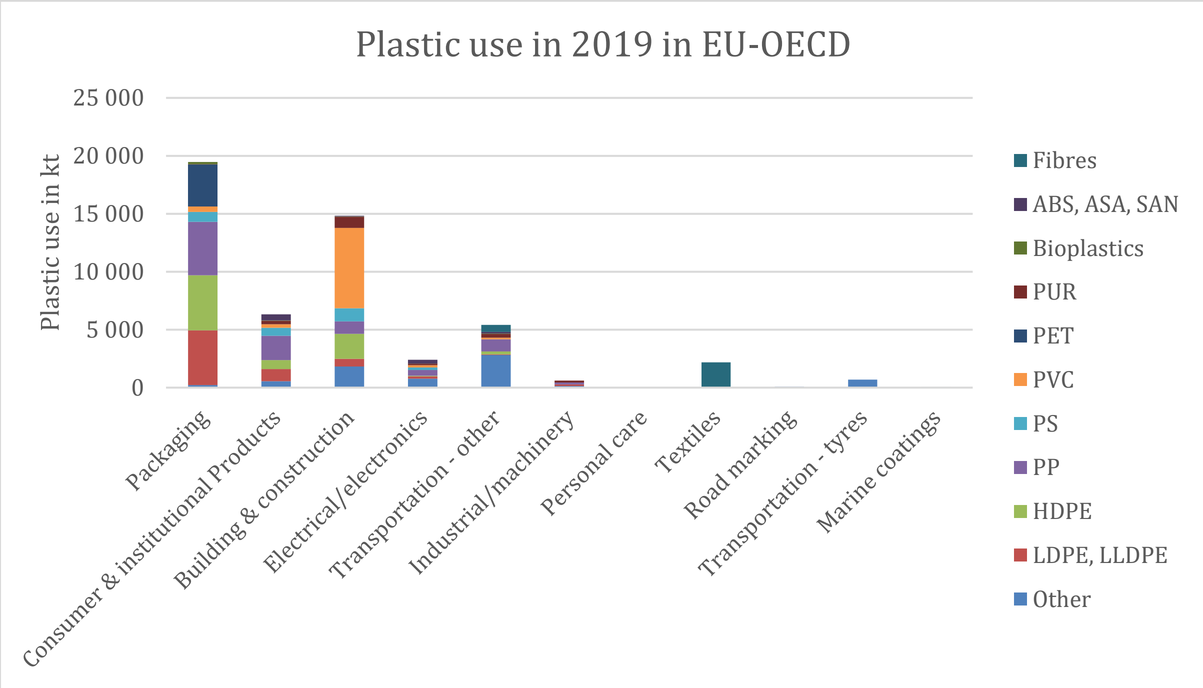
Source: Reproduced from Schwarz et al. (2023).

An increase in the production or use of plastics is not a sufficient condition for an increase in emissions into the environment since management measures can obviously limit these emissions. Nevertheless, in the absence of new measures[8] significantly modifying the emission factors specific to each use, it can be reasonable to use these data as indicators of emissions over a period of a few years.

Coming back to the main sources identified at the beginning of the report (see Table 2.2), plastic production in EU-27 refined with data on imports and exports appears as a relevant indicator for pellet emissions, and further for emissions indirectly linked to packaging, as packaging is the most important use of plastics in the EU (see Figure 3.9).

(7) This figure is here to illustrate the general concept of MFA. Discussing it in details (for instance the lack of environmental emissions foreseen in the landfill scenario) is beyond the scope of this report.
(8) See below, Chapter 4 for a short overview of European initiatives likely to reduce microplastic emissions in a near future.

Figure 3.9 Plastic uses in 2019, in OECD-EU, in Mt



Source: Author's compilation based on data from OECD (2019).

Although the approach seems relevant in the frame of this study, it could be refined in future work by integrating a packaging-specific indicator.
Even if time-series for plastic use as packaging are not directly available *via* the OECD platform, some are available for the different polymers. So, using basic assumptions on consumption, it seems possible to build an indicator for packaging.
Furthermore, the EEA has recently published the report "From source to sea — The untold story of marine litter" (EEA, 2022a) including an estimation of plastic waste leakages to the environment (based on a material flow analysis). It would certainly be appropriate to use the results and methods of this study.

3.3 Paints

3.3.1 General presentation

Paints, which are used in numerous sectors to protect, decorate and/or extend objects' lifetime (buildings, boats, cars, etc.), or to provide indications (road marking), contain polymers (most commonly a synthetic resin) as binders ([9]). All along the life cycle of paints, microplastic particles can be emitted: during application, or paint flakes/particles can be released into the environment due to weathering. Emissions can further originate from the voluntary removal of paints from objects, from unused paints, or from poor waste management of unused paints, painted objects or painting tools.

There is a general lack of knowledge about the total contributions of the emission of microplastics from paint. Estimations are often based on theoretical calculations, while loss rates are poorly documented both in scientific and grey literature.

([9]) As explained in Unsbo et al. (2022), common binders are alkyls and epoxies, but paint might also contain polyurethanes, polyesters, polyacrylates and polystyrenes.

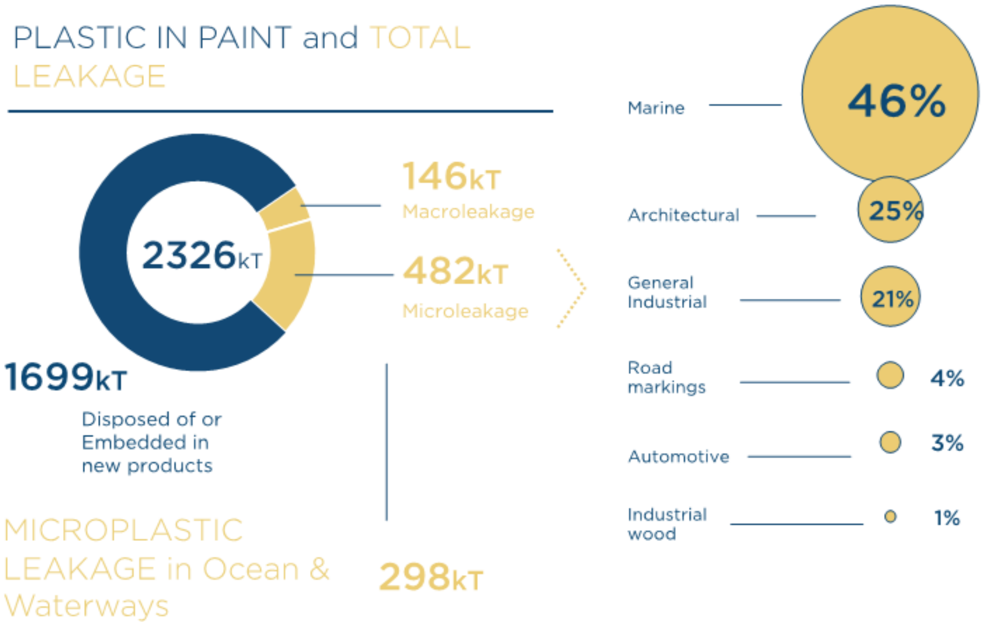
In the absence of specific actions devoted to mitigating microplastic emissions from paints, the amount of microplastics released to the environment can be assumed to be proportional to the total amount of polymers used in paints. Assuming a constant share of polymer content in paints ([10]), an increased demand of paints should lead to increased emissions. As microplastic releases occur during the service life and end-of-life, imports and domestic production have to be considered.

It should be noted that Paints can be used in a wide range of sectors and applications with different potential emissions to the environment. As presented in the Impact Assessment Report (see Figure 3.10), three sectors, namely marine, architectural and general industrial sectors represent more than 90% of microplastic emissions from paints to the environment. As those sectors are unlikely to have the same emission factors, a sectoral approach should be considered for a robust estimation of microplastic emissions from paints to the environment. In the Impact Assessment Report, the baseline scenario for microplastic emissions due to paints is based on sectoral figures. However, the source of this data is *MarketsandMarkets Research Limited,* which is not open. Their unavailability prevents us from investigating the possibility of evaluating trends for the recent period ([11]). A more promising approach is being proposed for Sweden by Unsbo et al. (2022), which distinguishes between different sectors for their potential to release paints and therefore microplastics. Focusing their analysis on two sectors (buildings and boats), they suggested an indicator combining the weight of polymers in architectural, anti-fouling paint and hull paint available on the Swedish market. This indicator is based on annual figures for the volume of paint (total weight in kg) placed on the Swedish market which can be compiled from the annual product registration in the Swedish Product register, provided by manufacturers and importers to the Swedish Chemicals Agency (KemI). The possibility to develop such an indicator comes from the legal requirements in Sweden obliging all businesses manufacturing or importing notifiable chemicals above 100 kg/year to report specific information to KemI, namely the chemical composition, the application area, the function, and the annual amounts. Unfortunately, the SPIN database providing these data is available only in Scandinavian countries. As we are looking for information available on a scale close to that of Europe, we did not look any further into the possibility of using this data.

([10]) The Impact Assessment Report (EC, 2023a) states that ‘out of the 52Mt of paint produced globally in 2019, 19.5Mt are synthetic polymers (MarketsandMarkets Research Private Limited), representing 5% of total world polymer production (368Mt - PlasticsEurope, 2020)’.

([11]) Estimations are done according to MarketsandMarkets Research Limited data on the total amount of plastic used for architectural paint globally (10 801kt), on boats and vessels paint globally, for general industrial paint globally (2 915kt), for road markings globally (234kt), and for automotive paint globally (2 041kt).

Figure 3.10 Estimation of sectoral leakages of microplastics to the environment in the EU-27



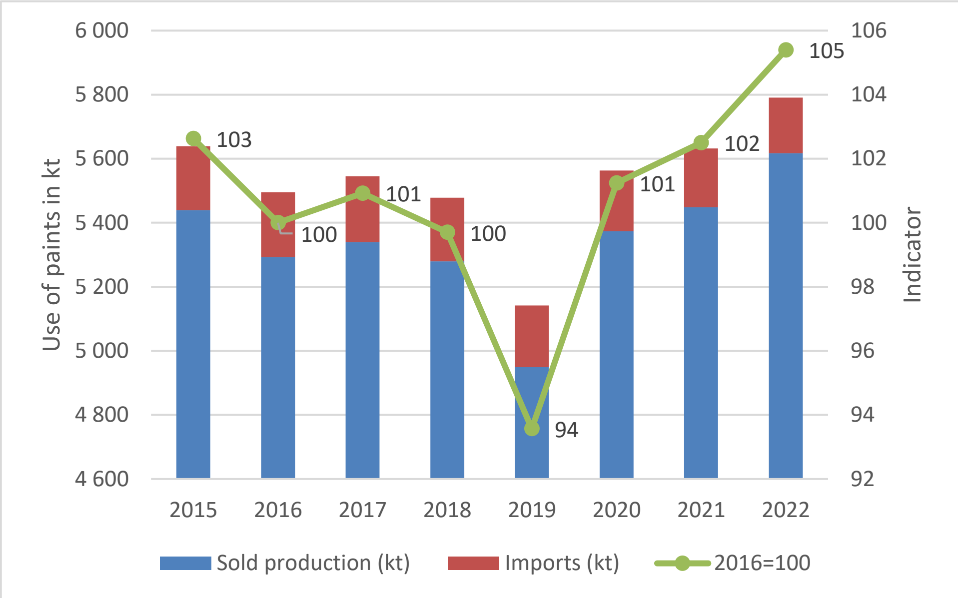
Source: Reproduced from (EC, 2023a), original source uncited.

Finally, the end-of-life of paints and painted objects is very likely to account for a significant proportion of discharges into the environment, which is why good practice in waste management is generally considered to be a lever for action that should be studied. The promotion of the collection of paints and dusts released during application and maintenance, or during demolition and recycling practices of the support material is a driver for microplastic emissions from paints. However, no data is available to develop an indicator and elicit trends.

3.3.2 Potential indicator

Table 3.8 below presents the indicator for microplastic emissions from paints. As explained in the previous section, in the absence of available data on sectoral uses of paints, only the domestic use of paints in Europe is considered.

Table 3.8 Indicator for microplastic emissions from paints

Data source	Eurostat
Annual updates	Yes
Geographical coverage	EU-27 available
Warnings	As we saw earlier, discharges can vary greatly from one sector to another. An increase in overall paint consumption may conceal a drop in a particularly emitting sector (such as marine paints). The result should therefore be treated with caution.
Results	**Figure 3.11 Use of paints (sold production + imports) in EU-27.**  **Source:** Author's compilation based on data Eurostat (2024c).
Interpretation	Domestic consumption of paint (production sold + imports) is 5% higher in 2022 than in 2016.

Source: Eurostat (2024c) - Sold production, exports and imports in PRODCOM for paints
Sold production and imports are considered (See data in annex, Table A.5.).

3.4 Textiles

3.4.1 General presentation

Synthetic textiles are prone to release microplastics into water during washing due to abrasion. Even though wastewater treatment plants (WWTPs) are efficient in removing microplastics from water, microplastics are retained in sewage sludges that can be spread on agricultural lands. Furthermore, microplastic releases can occur during the textile's life cycle, including production, wearing, drying and end-of-life (EC, 2023a (Annex 15, section 4.2); EEA, 2023; OECD, 2021). The amount of microplastics emitted depend on various parameters. To simplify the approach, the quantity of particles emitted by textiles can be estimated using microplastic emission factors and multiplying them by the number of items of clothing worn. These are summarised in Table 3.9.

Table 3.9 Parameters impacting microplastic emissions from textiles

Parameter	Comments (possible indicator)
Emission factor	The emission factor reports the amount of microplastics released per quantity of textile used. Various parameters can impact this factor, among which: - Use of plastic as raw materials for textiles: some data are available - Washing frequency: no data source identified. Only estimations in literature. - Design considerations: no data source identified
Quantity of textile	There is no immediately available indicator for the quantity of textiles likely to emit microplastics. There are several possible options: - Textile consumption: data are available - Demographics: data are available

Since microplastics from textiles are emitted during production as well as during use, an increase in textile production and consumption necessarily implies a bigger release of microplastics from textiles. Demographics could also be considered as a proxy for the quantity of textiles likely to emit microplastics as it reflects the quantity of clothes in service. A growing population in Europe implies an increase in the use of textiles, but also leads to more microplastic emissions in the air (due to wearing and drying) and water because more washing cycles will be performed. It should therefore be distinguished from textile consumption and could in fact be considered as the main driver of textile emissions. However, as it seems that microplastic emissions are higher when clothes are washed for the first time, it seems appropriate to consider consumption as the main indicator.

The fibres emitted when textiles are washed are microplastics if the fabrics are made of polymers. As a consequence, the use of plastic as raw material for textiles is an important parameter.

The composition but also the weave of clothes have a strong influence on their environmental impact in general and microplastic emissions in particular. That's why eco-design considerations can be relevant.

Finally, the washing frequency can be important. The more a garment is washed, the more likely it is to wear out and emit microplastics into grey water. However, as mentioned above, the rate of emission can change along the life cycle of a garment.

3.4.2 Potential indicators

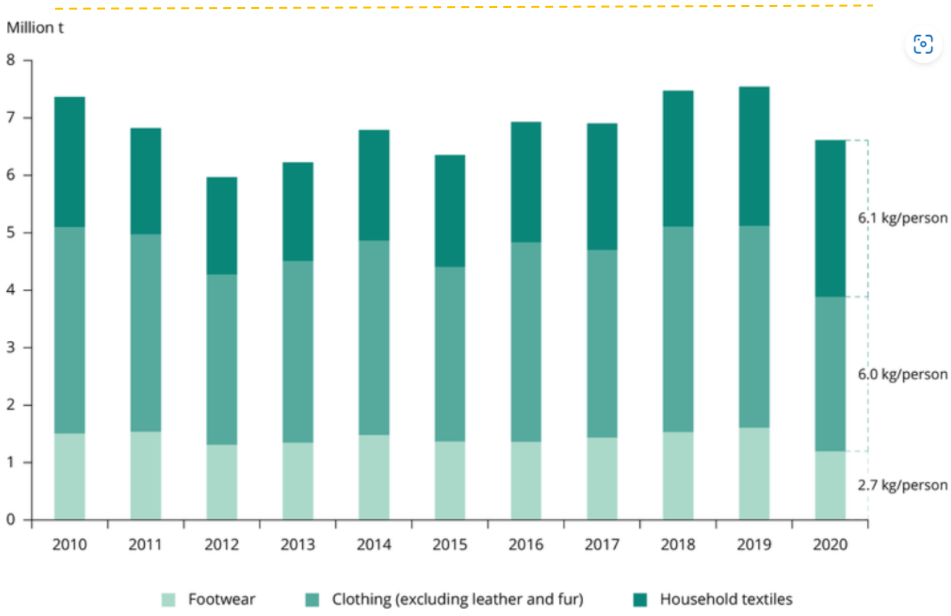
The indicator for textile consumption is based on the estimated consumption of textiles developed by EEA in 2022. It is based on the Eurostat Prodcom database, and as such could be updated. However, only the results by EEA are used here due to lack of time. A more in-depth analysis with the authors would be necessary for a more precise description of this indicator (see Table 3.10).

Table 3.10 and Table 3.11 describe potential indicators for plastic content of textiles and demographics.

Table 3.10 Main indicator for textiles as a source of microplastics

<table>
<tr><td>Data source</td><td>EEA</td></tr>
<tr><td>Annual updates</td><td>Uncertain from EEA. Potential follow-up by EEA to be checked.
Feasible through Eurostat, but the methodology should be further analysed. The description of the methodology on the EEA webpage is not sufficient to reproduce the work.</td></tr>
<tr><td>Geographical coverage</td><td>EU-27 available</td></tr>
<tr><td>Warnings</td><td>Data for 2021 are not provided.
The EEA analysis includes footwear. A priori irrelevant for microplastic emissions.</td></tr>
<tr><td>Results</td><td>

Figure 3.12 Estimated consumption of clothing, footwear and household textiles (excluding fur and leather clothing) in EU-27



Source: Reproduced from EEA, 2022b.

</td></tr>
<tr><td>Interpretation</td><td>The estimated consumption of clothing, footwear and household textiles has increased by 9% between 2016 and 2020 and decreased by 4.5% in 2020.
Analysing the data for subsequent years is needed to assess whether the downward trend of 2020 is continuing.</td></tr>
</table>

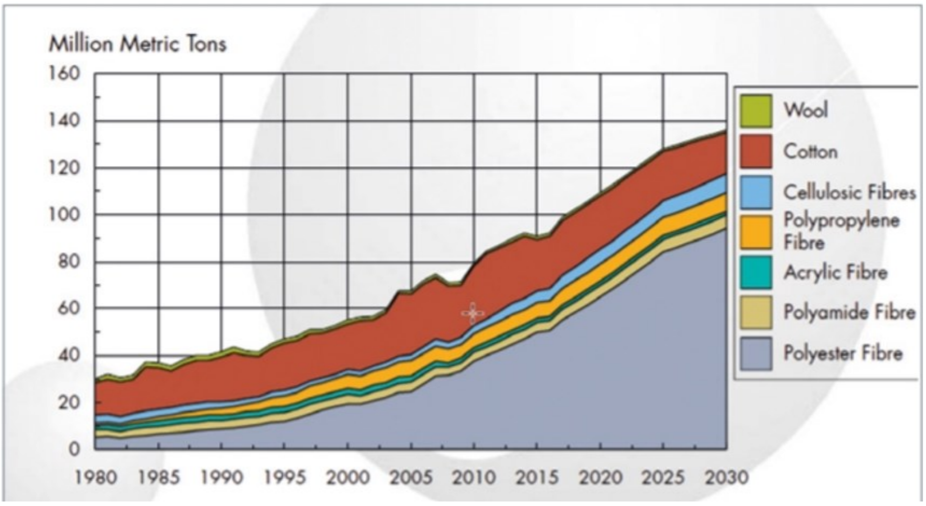
Source: Reproduced from EEA (2022b).

Table 3.11 Indicator for the use of plastic as raw material for textiles

Data source	Tecnon OrbiChem via EC (2023a)
Specific requests	/
Annual updates	Very uncertain
Geographical coverage	Results presented here refer to the world fibre production between 1980 and 2030
Warnings	The original source of the data is not available. It is therefore difficult to assess its limitations. In addition, as they include prospective data, it would be useful to know the working hypotheses. Finally, the possibility of updating this information annually is highly uncertain.

Results

Figure 3.13: Share of synthetic fibers in textiles on a global basis

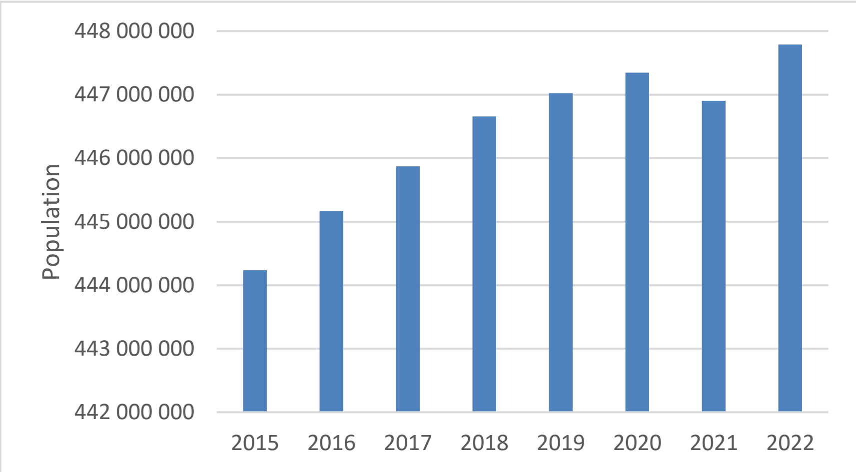


Source: Tecnon OrbiChem via EC (2023a).

Interpretation	The share of synthetic fibers in textiles has risen steadily. For a given level of textile consumption, and without the implementation of mitigation measures at the washing machine and/or WWTP level, microplastic emissions would continue to increase.

Source: Tecnon OrbiChem via EC (2023a).

Table 3.12 Indicator for demographics

Data source	Eurostat
Specific requests	Population change - Demographic balance and crude rates at national level (online data code : demo_gind)
Annual updates	Yes
Geographical coverage	EU-27 available
Warnings	/
Results	**Figure 3.14: EU-27 population**  **Source:** Author's compilation based on data from Eurostat (2024d).
Interpretation	EU population has increased by 0.6% between 2016 and 2022.

Source: Eurostat (2024d) - Population change - Demographic balance and crude rates at national level.

In this section, we do not propose a semi-quantitative analysis, such as the one presented in the section on tyres, which would have allowed an aggregation of the indicators. Indeed, the numerical data available to us is insufficient and this would have required a more complex analysis of the correlation between the indicators, which it was not possible to carry out at the time of the study.

3.5 Artificial turfs

Microplastics are released during the use and maintenance of the pitches and originate mainly from the infill and the artificial grass fibres. Table 3.13 below summarises the parameters likely to have an influence on microplastic emissions from this source (EC, 2023a (Annex 14, Section 2.4); ECHA, 2019).

Table 3.13 Artificial turfs as a source of microplastic releases

Parameter	Comments
Number of pitches	The number of artificial pitches in use is the main factor in the potential emissions of microplastics into the environment. However, no relevant data stream has been identified during this study.
Climate conditions	Among other reasons, the spread of artificial grass fibres or infill particles can be due to snow removal or heavy rainfall leading to runoff.
Management measures	Some countries have developed management measures to prevent releases from artificial turfs like certification systems in Sweden. The REACH restriction on intentionally added microplastics adopted in September 2023 is also relevant to that issue (see below).

During the course of this study, it was not possible to identify regular and robust data sources that could be used to report directly or indirectly on microplastic emissions associated with artificial turfs. Nevertheless, the methods used in some studies offer avenues that could be further explored to define an indicator. It was for instance assumed that the amount of replenished infill corresponds to the infill lost from the pitch. Using this approach, the Swedish EPA estimated that approximately 475 tonnes of such microplastics are released each year in Sweden. This indirectly means that those quantities may be monitored and serve as indicators.

Another and simpler approach would consist of collecting the data on the number and total area of synthetic pitches in the EU. Although it seems feasible to gather data at a national scale ([12]), we have not identified available aggregation of data in the EU scale.

It should be noted that the REACH restriction on intentional microplastics agreed in 2023 includes measures specifically relating to synthetic pitches. After a transition period of eight years, the placing on the market of polymer infill materials will be banned. Consequently, from 2031 on it will no longer be permitted to buy or sell (place on the market) polymer infill.

3.6 Detergent capsules and geotextiles

Detergent capsules and geotextiles are two of the six sources identified in the Impact Assessment Report (EC, 2023a).

3.6.1 Detergent capsules

Detergent capsules, used in washing machines and dishwashers, are small pouches containing concentrated detergent, typically enclosed in a dissolvable plastic film made of polyvinyl alcohol (PVOH). These films are designed to dissolve during the washing cycle, releasing the detergent. However, there are concerns about the biodegradability of PVOH, as its full degradation has not been proven in all environments (particularly in wastewater treatment or natural media like rivers, seas, and oceans) and may cause microplastic pollution (see EC (2023a), Annex 15, section 4.4).

Based on different assumptions on the quantity of PVOH used for detergents in Europe and biodegradability rates in waste water treatment plants and in natural media, the Impact Assessment Report concludes that 4 140 – 5 980 tonnes of microplastics coming from PVOH of detergent capsules would be directly released into the environment, which represents 0.2 to 0.8% of total microplastic releases to the EU environment (see EC (2023a), Annex 15, section 5.4).

Consequently, detergent capsules represent a small share of the emissions of microplastics. Furthermore, no robust data were found to define annual indicators. That's why this source is not considered in the rest of the report.

([12]) In France, for example, the number of artificial pitches has been increasing by around 200 units a year since 2016.

3.6.2 Geotextiles

Geotextiles are a type of geosynthetics used in various civil engineering applications like road construction, coastal protection, and flood control. They are typically made of synthetic polymers like polypropylene or polyester and are produced in woven or nonwoven forms. While designed to endure harsh conditions, geotextiles often fail to meet these demands, especially under environmental stressors like temperature shifts, water exposure, UV light, and storms. These failures, coupled with the lack of proper disposal, lead to microplastic pollution (see EC (2023a), Annex 15, section 4.5).

Estimating microplastic emissions from geotextiles is difficult due to the small amount of data available on emission factors. Acknowledging that they are relying on studies of questionable quality, the authors of the Impact Assessment Report estimate that emissions are between 6 000 and 19 750 tonnes, which represents 0.3 to 2.7% of total microplastic releases to the EU environment (see EC (2023a), Annex 15, section 5.5).

Considering that geotextiles represent a small share of the emissions of microplastics, that uncertainties are high, and that no more robust data were found to define annual indicators, this source is not considered in the rest of the report.

4. Synthesis

4.1 Foreword on recent EU regulatory initiatives

This report introduces the available data and indicators on key sources of microplastic emissions into the environment. Regulatory measures aimed at reducing microplastic emissions are being put in place in the EU, though it is still too early to observe their tangible effects, as implementation and/or monitoring has not taken place yet. Future release estimates should account for these newly implemented measures and monitoring efforts. This report aims to estimate trends in microplastic emissions since 2016, noting that few regulatory initiatives were established early enough to produce noticeable impacts before 2024.

The REACH restriction on intentionally added microplastics was adopted on 25 September 2023 (EU, 2023).

According to the restriction dossier, around 42 000 tonnes of intentionally added microplastics are estimated to be released into the environment every year and this restriction is expected to prevent the release of around 500 000 tonnes of microplastics over a twenty-year period ([13]). Among other measures, the restriction ([14]):

- Restricts the sale and use of microplastics in such products as cosmetics, detergents, fabric softeners, fertilisers, plant protection products, toys, etc.
- Includes a ban on the use of microplastics as an infill material for synthetic pitches after a transition period of 8 years, i.e., by 2031.
- Requires estimated microplastic emissions to be reported to the European Chemicals Agency (ECHA) on an annual basis for all uses derogated from the sale ban, including paints, pellets and other industrial uses of microplastics. Furthermore, manufacturers will have to provide instructions on how to use and dispose of the product to prevent microplastic emissions.

The Euro 7 regulation ([15]) is part of the European Commission's 2020 Sustainable and Smart Mobility Strategy. It establishes rules for the exhaust emissions of road vehicles, but also for other types of emissions. Indeed, by establishing a legal framework for the EU to enact abrasion limits for tyre particle emissions, the Euro 7 regulation contains provisions to tackle microplastic pollution from tyres used by different types of vehicles.

Methods to test tyre abrasion—which are currently being developed by the UN World Forum on Harmonisation of Vehicle Regulations—will be used to introduce binding emission limits for tyres sold on the EU market. There's a goal of agreeing to limits in June 2026 for passenger car tyres; March 2028 for light commercial vehicles; and March 2030 for heavier commercial vehicles, lorries and buses. If the UN process is delayed beyond these timelines, the EU would be empowered to adopt abrasion limits for all vehicle types at the EU level before the end of 2030.

The EU Commission published in October 2023 a proposal for a Regulation on preventing pellet losses to reduce microplastic pollution (EC, 2023c). This regulation would be expected to reduce pellet release by up to 74% by ([16]) :

- Making operators manufacturing and handling pellets to comply with mandatory best handling practices. These have already been implemented by the industry's Operation Clean Sweep® certification scheme.

([13]) Between 0.7 and 1.8 million tonnes of microplastics are estimated to be unintentionally released into the environment every year in the EU according to the Impact Assessment Report.

([14]) https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4581

([15]) https://ec.europa.eu/commission/presscorner/detail/en/ip_22_6495

([16]) https://ec.europa.eu/commission/presscorner/detail/en/ip_23_4984

- Implementing mandatory certification and self-declarations: To assist national competent authorities in verifying compliance, larger operators should obtain a certificate issued by an independent third party, while smaller companies should make self-declarations of their conformity.
- Developing a standardised methodology to estimate losses and to facilitate data and reporting requirements (including those in the REACH restriction on intentionally added microplastics).

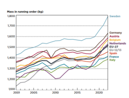
Finally, it should be noted that monitoring microplastics in the environment is, in itself, essential to reduce existing uncertainties/knowledge gaps and track progress in implementing measures to reduce their emissions. Existing and proposed European legislation provides for such monitoring in the following areas:

- The Marine Strategy Framework Directive introduced monitoring of microplastics along coastlines, on the surface of the sea and in seabed sediment.
- The recast of the Drinking Water Directive (EU, 2020), the update of the Groundwater Directive and the Environmental Quality Standards Directive introduced, subject to developing standardised measurement and monitoring methodologies, monitoring in surface and ground water, along with a corresponding Environmental Quality Standard.
- The proposed revisions of the Urban Wastewater Treatment Directive introduce monitoring of microplastics at the inlets and outlets of urban wastewater treatment plants and in sludge (EU, 2022) ([17]).
- The proposed EU rules on soil monitoring and resilience introduce voluntary monitoring of microplastics in soil.

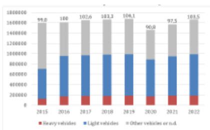
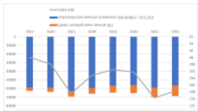
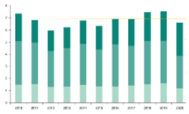
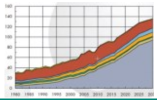
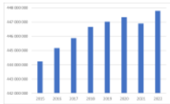
4.2 Summary and general mapping

Table 4.1 below summarises the results obtained during this study. For each of the main sources, it shows the trends of the main indicators over the period 2016-2022, as well as those for the secondary indicators. This table presents a qualitative analysis that shows whether the secondary indicators are evolving in the same direction as the main indicators, thereby reinforcing the trend conclusions associated with the main indicators. Conversely, if the trends are opposite, we can simply conclude that the overall trend is uncertain. A more sophisticated aggregation allowing a semi-quantitative analysis could only be carried out for emissions linked to tyre wear with the support of experts from TFTA-UNECE and due to the fact that no correlation is expected between the indicators.

Table 4.1 Summary of the main results of the report

Sources and indicative share (*)	Main indicator	Trend 2016 - 2022	Secondary indicator	Trend 2016 - 2022	Conclusion (**)
Paints (43%)	Production and imports of paints, from Eurostat	↗ 	/	/	↗
Tyres (36%)	Distance driven from Eurostat. Potentially complemented with national	↗	Vehicle weight	↗ 	↗

([17]) https://environment.ec.europa.eu/topics/water/urban-wastewater_en

Sources and indicative share (*)	Main indicator	Trend 2016 - 2022	Secondary indicator	Trend 2016 - 2022	Conclusion (**)
	databases for missing countries (DE, IT, ES, etc.)				
Pellets (9%)	Production of polymers from Eurostat, and potentially recycled polymers from Plastic Recyclers Europe	↗ 	Imports and exports of polymers from Eurostat	↗ 	↗
Textiles (3%)	Estimated consumption of clothing, footwear and household textiles, from EEA	?-↘ (but 2021 and 2022 are missing) 	Share of synthetic fibers in textiles Population	↗  ↗ 	?

Notes: (*) Only average shares in the Impact Assessment Report are reported here. See EC (2023a), figures are calculated based on results presented in Table 2.1 of the report.
(**) The colour code is consistent with the EEA methodology of assessing the outlook of meeting the 2030 target of the 8th EAP. Dark green: It is very likely that the objective will be met – i.e. it answers 'yes' with high confidence to the question: are we on track to meet the objective by 2030
Light green: It is likely but uncertain – i.e. it answers 'maybe yes' to that question
Light red: It is unlikely but uncertain – i.e. it answers 'maybe no'
Dark red: It is very unlikely – i.e. it answers 'no' with high confidence
Uncoloured "?": It is unclear – i.e. it means that we cannot determine the prospects (e.g. insufficient data/evidence, no correlation between indicator and selected objective).

Without proposing a method for aggregating the specific information of each source, the results indicate that the EU is unlikely to be on track to meet the objective of a 30% decrease of microplastics by 2030. Indeed:

- Main and secondary indicators for pellets show an increasing amount of releases. Thus, a decrease in microplastic releases from pellets is very unlikely for the 2016-2022 period.
- Concerning tyres, a drop in driven distance was observed in 2020. However, this decrease, most probably linked to lockdowns in 2020, was offset in 2022, and the secondary indicator (vehicle weight) is undoubtedly associated with an increase in emissions. Therefore, a decrease in microplastic releases from tyres is very unlikely for the 2016-2022 period.

- The main indicator for paints shows an increase in production and imports. However, a more detailed study of sectoral uses would be necessary to conclude with a high level of confidence. A decrease in microplastic releases from paints is unlikely but uncertain for the 2016-2022 period.

- The data for the main indicator for textiles, estimated consumption of clothing, shows a decrease between 2016 and 2020 (but an increase between 2016 and 2019). However, a more precise study would be needed to assess whether this is not the result of a Covid-19 effect. It would be useful to carry out an analysis of textile consumption data for 2021 and 2022 (Eurostat) in order to harmonise the results and perhaps reach an unambiguous conclusion.

The secondary indicator on the share of synthetic fibres in textiles is also increasing. And so is the demography.
Although it might be justified to consider demography as the main indicator (reflecting the quantity of textiles in use which are therefore washed frequently), the final conclusion is conservatively considered unclear.

However, as textiles seem to be a marginal source of microplastics to the environment (<5% in mass in cited studies), this conclusion does not contradict our general conclusion.

4.3 Simplified composite indicator

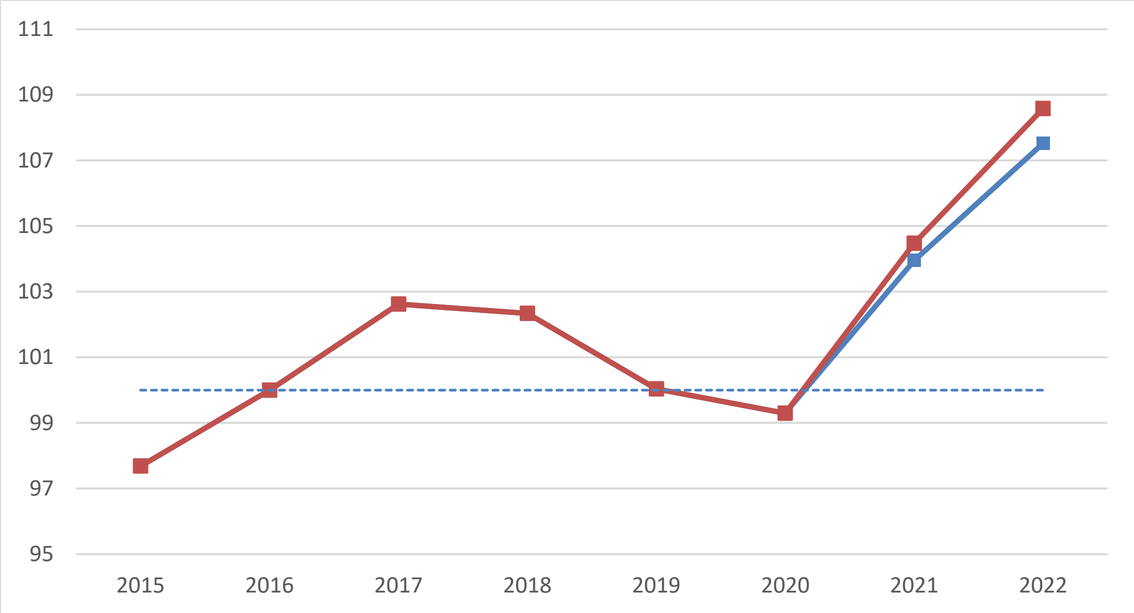
The summary proposed in the previous section has the advantage of presenting a relatively precise mapping of the issues but makes it difficult to aggregate the information into a single score.
One way of overcoming this difficulty may be to propose a simplified composite indicator based on the normalised values of the main indicators, weighted by their shares in the global emissions of microplastics, as estimated in the Impact Assessment Report ([18]).
Table 4.2 below presents the raw data and final estimation of this simplified indicator, using 2016 as the reference year (=100). As we did not have available data for textiles in 2021 and 2022, we proposed two scenarios, namely an annual decrease of 10% and an annual increase of 10% from 2020. The actual figure will most likely be included in this range.
Figure 4.1 charts the evolution of this simplified indicator for the 2016-2022 period.

([18]) For the sake of simplicity, the weightings are based on emissions from the four main sources only. Thus, even if on average tyres account for 35% of the emissions calculated in the Impact Assessment Report, they represent 39% when only the 4 main sources are considered. Therefore, the weightings considered in this simplified indicator add up to 100%.

Table 4.2 Normalised evolution of the main indicators for the main sources and final estimation for the simplified indicator

Main sources	EC (2023a) average estimate (t/yr)	Share of emissions among the main sources (Weighting factor)	Proxy	2015	2016	2017	2018	2019	2020	2021	2022
Paints	547 000	48%	Imports and sold production of paints in EU-27. Eurostat	102.6	100.0	100.9	99.7	93.6	101.2	102.5	105.4
Tyres	450 000	39%	Road traffic. Eurostat	92.0	100.0	103.5	105.0	107.0	96.7	105.7	112.3
Pellets	112 215	10%	Sold production of polymers in EU-27. Eurostat	98.2	100.0	108.6	103.0	101.1	101.7	109.0	107.3
Textiles	31 364	3%	Estimated consumption of clothing, footwear and household textiles. EEA	91.6	100.0	99.4	107.9	109.0	95.5	[86.0 – 105.0]	[77.4-116.0]
Simplified indicator				**97.7**	**100.0**	**102.6**	**102.3**	**100.0**	**99.3**	**[104.0 – 104.5]**	**[107.5 – 108.6]**

Figure 4.1 Simplified indicator of microplastic releases



Note: Red: scenario corresponding to a 10% increase in the textile indicator in 2021 and 2022. Blue: corresponding to a 10% decrease in the textile indicator in 2021 and 2022.

Although this indicator is simplified and needs to be used with caution, it leads to a similar overall conclusion as the previous section. The indicator does not show a downward trend between 2016 and 2022. Since there are no regulatory measures that could bring about a very significant change in emission factors in the very short term, this suggests, despite a certain degree of uncertainty as pointed out throughout the study, that the EU is off track to achieve the target in 2030.

4.4 General conclusion

The absence of regular EU scale monitoring data and harmonised analytical methods makes it impossible to establish a robust indicator for monitoring emissions of microplastics into the environment. Besides, estimates of flows and emission factors are uncertain and generally affected by knowledge gaps.

However, the available studies make it possible to draw up a list of the main sources of microplastic emissions to the environment. For most of them, the main drivers likely to influence the level of emissions are known, and proxy indicators can be proposed based on these studies.

The work presented in this report involved studying the available data sets associated with these drivers and analysing the trends since 2016. Despite obvious uncertainties, all proxy indicators, showed an increasing trend in the amount of microplastic releases, leading us to hypothesise that emissions of microplastics to the environment have not decreased since 2016.

The study is therefore conclusive and provides a basis for developing a shared proxy indicator specific to the ZPAP target on microplastics. Expected data generated by the new European legislation (declarations from the REACH restriction on intentionally added microplastics (EU, 2023 (paragraphs (26), (37), (56), (57)); microplastics monitoring in the UWWTD ([17]) will not be available before 2027. In addition, a robust trend will also not be available after at least a few years of official monitoring.

In the long term, the mapping and the simplified indicator we have established cannot be completely satisfactory for the realistic monitoring of microplastic emissions into the environment as they cannot account for efficiency gains in the management of microplastic emissions associated with each source. For this reason, other indicators should be developed based on the monitored presence of microplastics in the environment or on measures to minimise/reduce emissions.

List of abbreviations

Abbreviation	Name
ABS, ASA, SAN	Styrene-based plastics
DG ENV	Directorate-General for Environment – European Commission
EAP	Environment Action Programme
EC	European Commission
ECHA	European Chemicals Agency
EEA	European Environmental Agency
EF	Emission factor
EU	European Union
HDPE	High-density polyethylene
ICCT	The International Council on Clean Transportation
IVL	Swedish Environmental Research Institute
JRC	Joint Research Centre – European Commission
KemI	Swedish chemicals agency
km	Kilometre
kt	Kilotonne
LDPE	Low-density polyethylene
LLDPE	Linear low-density polyethylene
MFA	Material Flow Analysis
mg	Milligram
Mt	Megatonne
OECD	Organisation for Economic Co-operation and Development
PET	Polyethylene terephthalate
PP	Polypropylene
PS	Polystyrene
PUR	Polyurethane
PVC	Polyvinyl chloride
PVOH	Polyvinyl alcohol
REACH	Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH)
SWD	European Commission - Staff Working Document
t	Tonne
TFTA - UNECE	Task Force on Tyre Abrasion from the United Nations Economic Commission for Europe (Transport Division)
TNO	Netherlands Organisation for Applied Scientific Research
UWWTD	Council Directive 91/271/EEC of 21 May 1991 concerning urban waste-water treatment
Vkm	Vehicle.kilometre
WWTP	Waste water treatment plant
ZPAP	Zero Pollution Action Plan

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Annex

Table A.1 Estimates of microplastic emissions to the environment and their sources according to different reports

Reference	Scope	Global estimation med (t/yr)	Main sources considered	Estimation med (t/yr)	Estimation lower	Estimation upper	Share in the reference
Impact Assessment Report (EC, 2023a)	EU	1 401 920	Building paints	**547 000**	231 000	863 000	43%
			Tyres	**450 000**	360 000	540 000	35%
			Pellets	**112 215**	52 140	184 290	9%
			Textiles	**31 364**	1 649	61 078	3%
			Detergent capsules	**18 009**	4 140	5 980	0.4%
			Geotextiles	**12 875**	6 000	19 750	1%
Eunomia (Hann et al., 2018)	EU, 2016	807 268	Tyres	**503 586**			62%
			Road markings	**94 358**			12%
			Pellets	**92 160**	16 888	167 431	11%
			Artificial turf	**45 000**	18 000	72 000	6%
			Textiles	**32 303**	18 430	46 175	4%
			Building paints	**28 000**	21 100	34 900	3%
			Automotive breaks	**8 833**	505	17 161	1%
			Marine paints	**400**			0%
			Fishing gear	**2 629**	478	4 780	0%
TNO whitepaper (Urbanus et al., 2022)	NL	5 389	Tyres	**2 687**			50%
			Packaging	**1 562**			29%
			Agriculture	**812**			15%
			Textiles	**106**			2%
			Other plastics	**119**			2%
			Automotive breaks	**56**			1%
			EEE	**31**			1%
			Pellets	**16**			0%
IVL (Unsbo et al., 2022)	SW	12 029	Tyres	**7 670**			64%
			Artificial turf	**2 050**	1 640	2 460	17%
			Textiles	**538**	10	1 065	4%
			Road markings	**504**			4%
			Wear from boat hulls	**450**	160	740	4%
			Pellets	**420**	310	530	3%
			Building paints	**190**	130	250	2%
			Buoys and floating jetties	**89**	2	176	1%
			Personal care products	**66**			1%
			Fishing gear	**25**	4	46	0%
			Geotextiles	**17**	2	32	0%
			Household dust from the use and wear of plastic	**10**	1	19	0%

Table A.2 Sold production of polymers in EU-27, in kt

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20161035-Linear polyethylene having a specific gravity < 0.94, in primary forms	2168312190	2179807450	2427148429	2292591491	1839610198	2207979215	2306127251	3499549432
20161039-Polyethylene having a specific gravity < 0.94, in primary forms (excluding linear)	4058751171	4145466560	5559054561	4134673299	3804711583	3830908074	4054261398	3598317018
20161050-Polyethylene having a specific gravity of >= 0.94, in primary forms	5808370478	5681987868	6231943523	5692885945	5550745548	5686560389	5882460149	5994823403
20161070-Ethylene-vinyl acetate copolymers, in primary forms	492080605	496736296	562271120	546953453	583095624	400000000	540000000	500000000
20161090-Polymers of ethylene, in primary forms (excluding polyethylene, ethylene-vinyl acetate copolymers)	960512307	1159131091	1291559418	1287203206	1466948303	1247767090	1183777686	1046723455
20162035-Expansible polystyrene, in primary forms	1177867745	1225193352	1526537407	1487024923	1646119041	1633555317	1500000000	1653561947
20162039-Polystyrene, in primary forms (excluding expansible polystyrene)	1714344575	2239341607	1934254121	1782834869	1737955578	1566976615	1769166661	1493655384
20162050-Styrene-acrylonitrile (SAN) copolymers, in primary forms	198427081	178652973	139013081	179732260	217569974	261146017	240000000	151280223
20162070-Acrylonitrile-butadiene-styrene (ABS) copolymers, in primary forms	701521009	736368652	969119584	860381372	697933888	691279509	787564095	619589037
20162090-Polymers of styrene, in primary forms (excluding polystyrene, styrene-acrylonitrile (SAN) copolymers, acrylonitrile-butadiene-styrene (ABS) copolymers)	538535190	664155152	827887586	780080661	750000000	773384112	835478078	734151759
20163010-Polyvinyl chloride, not mixed with any other substance, in primary forms	5242672108	5288754069	4988628635	4838135207	4953910010	4972955023	5186598048	4301369369
20163023-Non-plasticised polyvinyl chloride mixed with any other substance, in primary forms	348617025	320527942	415306311	304209476	330277306	300189374	293191069	270293489
20163025-Plasticised polyvinyl chloride mixed with any other substance, in primary forms	1016626553	990148262	932803996	770193577	749221008	675373731	900000000	880000000
20163040-Vinyl chloride-vinyl acetate copolymers and other vinyl chloride copolymers, in primary forms	357864780	336778195	356016435	295369247	393609155	426184894	422654665	453353088
20163090-Polymers of halogenated olefins, in primary forms, n.e.c.	104695422	94484650	112695750	101997456	94739954	96598694	98806258	84270987
20164013-Polyacetals, in primary forms	300000000	339523471	362789526	329559197	180000000	100000000	180000000	198169063
20164015-Polyethylene glycols and other polyether alcohols, in primary forms	1939272756	2078771957	2100000000	1972199943	1977533010	1609147799	1600000000	1600000000
20164020-Polyethers, in primary forms (excluding polyacetals, polyether alcohols)	247318564	233559832	234906061	192397070	157111850	118290481	143606156	134636486
20164040-Polycarbonates, in primary forms	1193963313	1134645381	1461122168	1424969794	1343848775	1316905989	1500000000	1184255649
20164062-Polyethylene terephthalate in primary forms having a viscosity number of >= 78 ml/g	2847680041	2513416174	2419121506	2689337850	2517574915	2596289916	2400000000	2200000000
20164064-Other polyethylene terephthalate in primary forms	1599639419	417398014	444945288	328447678	398927284	404216568	420000000	480000000
20164080-Unsaturated polyesters, in primary forms (excluding liquid polyesters, polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate)	291488106	560000000	238708586	165415062	161440568	139960428	161000000	202694974
20164090-Polyesters, in primary forms (excluding polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate, other unsaturated polyesters)	1202081698	1184427259	1432587662	1423031516	1372840870	1285929242	1350000000	1219625296
20165130-Polypropylene, in primary forms	9359309108	9780319130	11253841595	9960226758	9673911407	9332585047	10118557954	9563444842
20165150-Polymers of propylene or of other olefins, in primary forms (excluding polypropylene)	2377304215	2413558347	2546031839	2425356530	2271366674	2365531863	2242051091	2389176496

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20165250-Polymers of vinyl acetate, in primary forms (excluding in aqueous dispersion)	400000000	400000000	200000000	400000000	200000000	200000000	200000000	200000000
20165270-Polymers of vinyl esters or other vinyl polymers, in primary forms (excluding vinyl acetate)	220952791	228777418	231512268	208240940	161644241	155777212	187050495	169135268
20165350-Polymethyl methacrylate, in primary forms	180000000	176704717	174680650	164724798	88203890	157291090	120000000	70000000
20165390-Acrylic polymers, in primary forms (excluding polymethyl methacrylate)	3314999305	3082490572	3603530858	4010696275	3338385824	3200000000	4256261598	4122972400
20165450-Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	2109485784	2158017074	2381018909	2183086422	1859082545	2328019913	2400000000	2030000000
20165490-Polyamides, in primary forms (excluding polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12)	256759121	281758834	328450255	313853216	267901555	238198163	270000000	260000000
20165670-Polyurethanes, in primary forms	3361372209	3362814182	2549770374	2860291060	2344181214	2100000000	1800000000	1800000000
20165920-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms	555779332	555183227	589715459	527917715	508000000	628000000	520695203	440000000
20165945-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					30076410	28000000	24000000	26000000
20165950-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					342232085	327440426	360906128	345348859
20165955-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					134000000	116000000	125000000	154158484
20165960-Natural and modified natural polymers, in primary forms (including alginic acid, hardened proteins, chemical derivatives of natural rubber)	226321896	289400062	362666195	293172101				
20165965-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					100000000	152008279	160000000	180000000
22191000-Reclaimed rubber in primary forms or in plates, sheets or strips	86383204	103046872	88089298	122832402	118259109	91159493	138007636	138000000
22192019-Other compounded rubber, unvulcanised, in primary forms or in plates, sheets or strip	1009332388	1052737231	1204184438	1031127247	889883742	785462780	800000000	800000000

Source: Eurostat.

Table A.3 Imports of polymers in EU-27, in kt

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20161035-Linear polyethylene having a specific gravity < 0.94, in primary forms	1026173200	1328107900	1118801200	984106168	791305255	680482054	762015105	791347159
20161039-Polyethylene having a specific gravity < 0.94, in primary forms (excluding linear)	790891300	896971300	968597100	857929817	846552896	705975163	802746757	910415457
20161050-Polyethylene having a specific gravity of >= 0.94, in primary forms	1341178400	1652149200	1551555300	1599506301	1953474415	1803936305	1771226086	1639989902
20161070-Ethylene-vinyl acetate copolymers, in primary forms	74891700	95472700	104292100	117157713	100002531	95257613	69513121	93508287
20161090-Polymers of ethylene, in primary forms (excluding polyethylene, ethylene-vinyl acetate copolymers)	528772800	540069700	649317100	869457099	1119589784	1230384460	1223571349	1296489537
20162035-Expansible polystyrene, in primary forms	51301600	40743300	45127500	83699253	100586452	112429582	173364832	211159890
20162039-Polystyrene, in primary forms (excluding expansible polystyrene)	125673500	158238200	125156200	113921162	199187391	92872093	83391749	108980799
20162050-Styrene-acrylonitrile (SAN) copolymers, in primary forms	37125300	33933400	29817700	39384259	40377919	36214289	44609032	41747006
20162070-Acrylonitrile-butadiene-styrene (ABS) copolymers, in primary forms	206834000	242754900	245262000	256924562	237981477	181908435	225443123	241219030
20162090-Polymers of styrene, in primary forms (excluding polystyrene, styrene-acrylonitrile (SAN) copolymers, acrylonitrile-butadiene-styrene (ABS) copolymers)	78605000	102172000	99333900	107965252	103541438	81540327	87836166	80986116
20163010-Polyvinyl chloride, not mixed with any other substances, in primary forms	333537000	466283700	477562400	588092548	504513532	373712013	490974074	536608966
20163023-Non-plasticised polyvinyl chloride mixed with any other substance, in primary forms	31285800	28651300	30185900	31060656	28512414	28525697	60307543	57657410
20163025-Plasticised polyvinyl chloride mixed with any other substance, in primary forms	55329000	55780400	44919900	49964292	47445766	41716799	48214702	51129131
20163040-Vinyl chloride-vinyl acetate copolymers and other vinyl chloride copolymers, in primary forms	4029100	3722900	4145200	4728812	4973162	5995779	3882876	8308420
20163090-Polymers of halogenated olefins, in primary forms, n.e.c.	6115900	5886700	6608200	9153998	8439834	5842543	7434886	8689890
20164013-Polyacetals, in primary forms	60161100	66189200	70092100	87696388	95890259	86998259	112673367	136222961
20164015-Polyethylene glycols and other polyether alcohols, in primary forms	142853500	112906700	126092400	186808735	216353897	176785573	218839877	259820880
20164020-Polyethers, in primary forms (excluding polyacetals, polyether alcohols)	58451600	60579900	65586400	63106844	60032936	52151686	69125769	73662436
20164040-Polycarbonates, in primary forms	91902800	91905800	83486900	85870844	91307966	102215230	142071880	137391994
20164062-Polyethylene terephthalate in primary forms having a viscosity number of >= 78 ml/g	678220300	750406100	851510600	864306887	1091012060	938498663	780806142	1138403514
20164064-Other polyethylene terephthalate in primary forms	217233700	237745100	256534300	296812521	306319822	254549054	314635941	431970803
20164080-Unsaturated polyesters, in primary forms (excluding liquid polyesters, polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate)	11790300	9066400	8282400	7651812	12026970	10762548	9770830	8728397
20164090-Polyesters, in primary forms (excluding polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate, other unsaturated polyesters)	256743000	283358600	378916300	428328967	381787129	412486418	442192645	458215813
20165130-Polypropylene, in primary forms	1094091600	1293269800	1331821400	1289432478	1366859420	1342179595	1720024708	1514543716
20165150-Polymers of propylene or of other olefins, in primary forms (excluding polypropylene)	437469200	491464200	545838700	577074343	585934061	521103803	582588934	619207875
20165250-Polymers of vinyl acetate, in primary forms (excluding in aqueous dispersion)	33441800	36890400	40952900	42866158	46609390	48626232	53318515	50722569

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20165270-Polymers of vinyl esters or other vinyl polymers, in primary forms (excluding vinyl acetate)	183808500	172983700	163977000	182438311	195790897	156136108	176140796	191054033
20165350-Polymethyl methacrylate, in primary forms	25971800	38453400	37957700	36905097	37740891	51346727	50326759	54300418
20165390-Acrylic polymers, in primary forms (excluding polymethyl methacrylate)	331681500	375960200	412669700	407474486	426646178	473927671	494544743	471635470
20165450-Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	220853100	232870900	262130500	272972860	242946073	211781028	248788193	290036632
20165490-Polyamides, in primary forms (excluding polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12)	67939000	73944100	79915300	87871161	81639434	74645173	90663664	83582651
20165670-Polyurethanes, in primary forms	68551800	65300300	76055800	79729175	81666924	77047367	82381422	77195845
20165920-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms	176092900	196162300	223967200	275708783	262602707	234031666	259372070	278849177
20165945-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					14641706	26177099	14435010	15908973
20165950-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					115215823	107189646	119003411	120419354
20165955-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					6197294	5493149	6472034	7025539
20165960-Natural and modified natural polymers, in primary forms (including alginic acid, hardened proteins, chemical derivatives of natural rubber)	24565600	23786600	26312500	25424100				
20165965-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					20666257	20404068	19520791	19479762
22191000-Reclaimed rubber in primary forms or in plates, sheets or strips	23266200	22523600	21712900	22063517	20302308	15710564	22016418	21037431
22192019-Other compounded rubber, unvulcanised, in primary forms or in plates, sheets or strip	70102800	58771300	53403800	48311689	40929162	35601256	38617330	37861440

Source: Eurostat.

Table A.4 Exports of polymers from EU-27, in kt

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20161035-Linear polyethylene having a specific gravity < 0.94, in primary forms	339860900	363471400	353134100	331869831	318193075	322524634	261041697	207198883
20161039-Polyethylene having a specific gravity < 0.94, in primary forms (excluding linear)	1007212100	1043945400	1106425400	1104877106	935132814	1120900336	1022929028	873462105
20161050-Polyethylene having a specific gravity of >= 0.94, in primary forms	1353949400	1277445900	1373241800	1381635578	1237023590	1419347395	1136050438	1014039348
20161070-Ethylene-vinyl acetate copolymers, in primary forms	200236500	215791900	231168900	207997271	250297867	254336887	209040194	178425305
20161090-Polymers of ethylene, in primary forms (excluding polyethylene, ethylene-vinyl acetate copolymers)	798159900	828818500	778069200	852501203	899402699	1031524153	931273356	848369324
20162035-Expansible polystyrene, in primary forms	127365600	112073400	115489600	95776865	84366432	95644014	77953760	66072345
20162039-Polystyrene, in primary forms (excluding expansible polystyrene)	288128000	298614000	279439000	299928584	316549184	349517838	352583773	240235310
20162050-Styrene-acrylonitrile (SAN) copolymers, in primary forms	8254500	11096200	9628400	10269303	12529966	9000081	10768929	7122854
20162070-Acrylonitrile-butadiene-styrene (ABS) copolymers, in primary forms	155988300	162576900	191622000	200865536	217370525	199462692	267185457	223292637
20162090-Polymers of styrene, in primary forms (excluding polystyrene, styrene-acrylonitrile (SAN) copolymers, acrylonitrile-butadiene-styrene (ABS) copolymers)	297035600	307302100	319586200	323468520	315217813	325425971	341252613	289117794
20163010-Polyvinyl chloride, not mixed with any other substances, in primary forms	1417716700	1399863900	1422088500	1378650811	1425967650	1494287690	1228498081	1124146728
20163023-Non-plasticised polyvinyl chloride mixed with any other substance, in primary forms	68384800	72365700	66226100	59603341	61338986	62215871	84009159	73714532
20163025-Plasticised polyvinyl chloride mixed with any other substance, in primary forms	169024000	171283300	163275100	146648967	147759655	147356619	152553054	138637921
20163040-Vinyl chloride-vinyl acetate copolymers and other vinyl chloride copolymers, in primary forms	89079300	99704500	101253400	81022427	61739475	75520011	74998088	64745438
20163090-Polymers of halogenated olefins, in primary forms, n.e.c.	58781300	47642000	63338500	64359412	60494951	56216507	96311417	95962917
20164013-Polyacetals, in primary forms	38639300	78297600	108756400	112732603	128589004	103187821	119422981	101757876
20164015-Polyethylene glycols and other polyether alcohols, in primary forms	875142700	874665400	865048700	851251150	814904343	843652235	813044294	559493202
20164020-Polyethers, in primary forms (excluding polyacetals, polyether alcohols)	58970000	69755100	68957200	60572743	57638213	59986137	61986352	79132981
20164040-Polycarbonates, in primary forms	261764600	233231200	237063000	240140630	259407520	273502019	279915742	220085347
20164062-Polyethylene terephthalate in primary forms having a viscosity number of >= 78 ml/g	265940000	255667200	208667700	220841265	267056705	303729439	328690432	265543000
20164064-Other polyethylene terephthalate in primary forms	59574300	69690000	83111700	95738115	103354450	103493584	140051787	111264238
20164080-Unsaturated polyesters, in primary forms (excluding liquid polyesters, polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate)	38041700	34469900	32009100	32797960	31829721	27718822	33816431	28535199
20164090-Polyesters, in primary forms (excluding polyacetals, polyethers, epoxide resins, polycarbonates, alkyd resins, polyethylene terephthalate, other unsaturated polyesters)	309516700	338531100	362545800	352797262	353818192	356884672	408216327	353685851
20165130-Polypropylene, in primary forms	1026553400	993689000	1050477300	1044331347	1031526235	1186441491	997512164	841888389
20165150-Polymers of propylene or of other olefins, in primary forms (excluding polypropylene)	1201532800	1247366000	1257871600	1282127251	1190671213	1300134625	1228289943	1094257493

PRODCOM codes used to quantify pellet production, export and imports in the EU	2015	2016	2017	2018	2019	2020	2021	2022
20165250-Polymers of vinyl acetate, in primary forms (excluding in aqueous dispersion)	45955900	49811300	43997800	43884188	42892896	40300020	38870611	37926560
20165270-Polymers of vinyl esters or other vinyl polymers, in primary forms (excluding vinyl acetate)	81177100	82575300	88150600	91715710	82718980	81565882	79806763	74094059
20165350-Polymethyl methacrylate, in primary forms	6880400	5873700	7774800	8729708	8630224	11022969	11405996	11255604
20165390-Acrylic polymers, in primary forms (excluding polymethyl methacrylate)	905376600	955211600	1045462800	1054224353	1068009737	1061575787	1121647847	957189704
20165450-Polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12, in primary forms	473570000	489603400	504830300	498545875	469780544	465480430	500669527	368207367
20165490-Polyamides, in primary forms (excluding polyamide -6, -11, -12, -6,6, -6,9, -6,10 or -6,12)	125410600	139847200	145493000	149867796	137253316	136317822	168791526	151935512
20165670-Polyurethanes, in primary forms	449010200	473069800	503039800	506271291	488138801	465116212	493559901	463732580
20165920-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms	213000500	231855800	249177800	232216836	224633361	212045866	225043144	204985575
20165945-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					61597569	58663821	69652470	70494428
20165950-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					215327703	218338665	230561295	215940163
20165955-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					5423076	5602031	5624076	5467055
20165960-Natural and modified natural polymers, in primary forms (including alginic acid, hardened proteins, chemical derivatives of natural rubber)	22493000	21761400	22981200	23600475				
20165965-Petroleum resins, coumarone-indene resins, polyterpenes, polysulphides, polysulphones, etc., n.e.c., in primary forms					21277604	23080973	26069291	21233420
22191000-Reclaimed rubber in primary forms or in plates, sheets or strips	54905200	47934900	42089000	44307065	37578754	44611782	52136608	48002798
22192019-Other compounded rubber, unvulcanised, in primary forms or in plates, sheets or strip	137669500	143006200	157662900	154121635	151363543	138297511	140457900	142243073

Source: Eurostat.

Table A.5 Imports and sold production of paints in EU-27

Year	2015	2016	2017	2018	2019	2020	2021	2022
Sold production								
20301150-Paints and varnishes, based on acrylic or vinyl polymers dispersed or dissolved in an aqueous medium (including enamels and lacquers)	3 417 795 668	3 251 034 071	3 180 345 918	3 144 291 254	2 900 760 552	3 369 767 535	3 200 000 000	3 344 752 459
20301225-Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium, weight of the solvent > 50% of the weight of the solution including enamels and lacquers	140 542 017	149 596 538	159 965 238	148 281 041	176 332 923	197 127 429	170 000 000	180 000 000
20301229-Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium including enamels and lacquers excluding weight of the solvent > 50 % of the weight of the solution	490 394 393	521 268 010	514 905 837	535 000 268	455 908 741	481 188 552	524 447 194	512 000 000
20301230-Paints and varnishes, based on acrylic or vinyl polymers dispersed/dissolved in non-aqueous medium, weight of the solvent > 50% of the solution weight including enamels and lacquers	104 095 179	114 761 063	126 713 461	121 715 463	138 139 529	111 212 166	139 227 020	205 804 270
20301250-Other paints and varnishes based on acrylic or vinyl polymers	350 281 059	310 491 957	326 065 930	318 254 539	313 794 797	294 000 000	350 000 000	326 938 981
20301290-Other paints and varnishes based on synthetic polymers n.e.c.	935 957 848	945 424 373	1 031 460 882	1 012 027 025	963 787 547	920 000 000	1 064 818 795	1 047 110 111
Total sold production (kt)	5 439	5 293	5 339	5 280	4 949	5 373	5 448	5 617
2016=100	103	100	101	100	94	101	102	105
Imports								
20301150-Paints and varnishes, based on acrylic or vinyl polymers dispersed or dissolved in an aqueous medium (including enamels and lacquers)	51 042 500	49 728 900	59 487 600	58 526 408	59 084 414	64 720 864	66 066 076	56 780 241
20301225-Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium, weight of the solvent > 50% of the weight of the solution including enamels and lacquers	15 165 700	9 566 300	14 526 500	13 545 794	12 275 431	11 558 089	4 178 252	6 076 224
20301229-Paints and varnishes, based on polyesters dispersed/dissolved in a non-aqueous medium including enamels and lacquers excluding weight of the solvent > 50% of the weight of the solution	31 165 500	29 627 500	19 478 700	18 830 691	18 231 569	19 458 942	15 498 639	14 391 742
20301230-Paints and varnishes, based on acrylic or vinyl polymers dispersed/dissolved in non-aqueous medium, weight of the solvent > 50% of the solution weight including enamels and lacquers	8 223 200	13 272 800	13 323 800	13 854 014	13 936 938	11 113 685	13 152 874	12 744 917
20301250-Other paints and varnishes based on acrylic or vinyl polymers	33 268 700	33 689 500	30 933 700	28 340 769	25 860 191	24 218 523	26 947 456	26 452 440
20301290-Other paints and varnishes based on synthetic polymers n.e.c.	61 464 900	66 322 500	68 100 700	65 630 195	63 347 736	58 430 462	57 742 882	58 111 274
Total sold production (kt)	200	202	206	199	193	190	184	175
2016=100	99	100	102	98	95	94	91	86
Sold production + Imports								
Total (kt)	5 639	5 495	5 545	5 478	5 141	5 563	5 632	5 791
2016=100	103	100	101	100	94	101	102	105

Source: Eurostat.

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