EP

UNITED NATIONS

UNEP/EC/Plastic Pollution/WG.1/2

United Nations Environment Programme

Distr.: General
26 August 2024

Original: English

European Commission

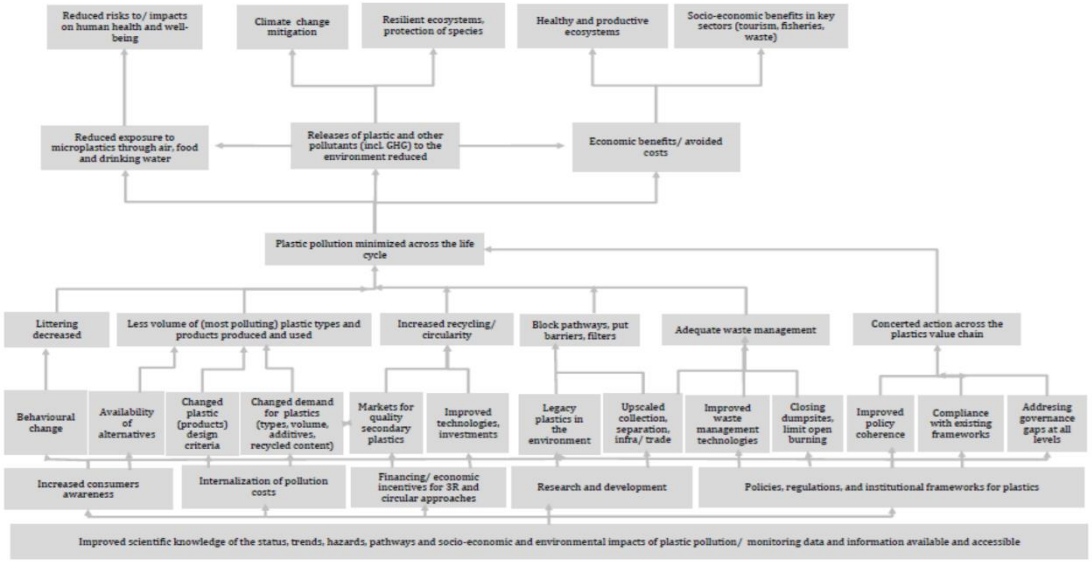
1st Meeting of the UNEP/EC Working Group to develop a toolkit on plastic pollution sources
Brussel, 3-4 September 2024

Scoping paper for the development of a toolkit

Proposed scope of the toolkit

The objective of this toolkit is for the UN member States to identify sources of plastic pollution and quantify the amount which will eventually enter the aquatic environment. The toolkit is not intended to harmonize existing models or methodologies but intended to use the results of application of such models/methodologies to obtain simple estimation formulas to be converted into empirical model (possibly supported by Plastic Leakage Factors/Coefficients), allowing the estimation of plastics entering the aquatic environment.

Considering the many and diverse estimate methodologies and tools that are related to different sources of plastic pollution prompting action of specific sector or human activities, the aim is to develop a simple and practical tool for national and regional assessment of all plastic pollution sources associated with the industrial sectors and human activities, in possible support of decision making to address major plastic pollution sources. Below is the diagram that shows various sectors and human activities associated with the recognised industrial and human activities related to plastic pollution sources:



Source: UNEP

For this purpose, this toolkit will consider all sources of plastic pollution eventually entering the aquatic environment through environmental pathways. Therefore, this toolkit will assess any plastic leakages from the whole lifecycle/circularity of plastic and plastic products into the environment. Throughout the lifecycle of plastic, there are different points where plastics leak to the environment. It is expected that a proposed toolkit can be applied geographically to river basis and associated coastal areas so that major sources of plastic pollution can be addressed through river basin management programmes and coastal zone management programmes. The following are the preliminarily proposed categories of plastic pollution sources, with related methodologies and potential data sources.

Table 1. Synthesis of proposed categories, related methods and potential data sources.

Source category	*Related methodologies*	*Potential data sources*
Plastic production	- Plastics LCA method (JRC), - UNEP/IUCN hotspottinng guidelines BPW/GPAP	Industry Reports and Statistics: National Chambers or Associations of Plastic Producers. National Statistic on Raw Materials (fossil-based plastic products) National Statistical Offices: National reports and databases about production data from key industries, including plastics manufacturing
Production of plastic products and plastic-containing products	- Plastic pollution hot spotting (IUCN/UNEP) World Bank Material Flow Analysis - Basel Convention toolkit - Plastics LCA method (JRC),	Industry Associations: Manufacturing Industry Reports. National Statistical Offices (For National goods production and imp/expo data)
Plastic use in other sectors (agriculture, fisheries, etc.)	- OECD ENV-Linkages - Plastic Leak Project (PLP) - Life cycle inventory of plastics losses from seafood supply chains (Loubet et al) Ghost Gear Watch?	FAO (Data on plastic use in sectors like agriculture (e.g., plastic films for mulching) and fisheries (e.g., fishing nets and gear). (Academia) Research studies from institutions or NGOs focusing on environmental impacts in specific sectors. National Ministries of agriculture, fisheries, and industry.
Households/consumers	- Plastic Leak Project (Qantis) Minderoo	National surveys on household consumption patterns, which may include data on textile purchases and use (e.g., the EUROSTAT Household Budget Surveys). Industry Reports
Plastic recycling	- GPAP (WEF) - ISWA Plastic Pollution Calculator - Plastic pollution hot spotting (IUCN/UNEP)	Waste Management Reports (National – Subnational)

	- Plasteax (Earth Action)	National Recycling Statistics Recycling Industry Associations Reports
Wastewater and urban runoff	- Plastic Leak Project (PLP) Guidelines	Municipal Wastewater Management Reports. Reports from water and sanitation authorities
Solid waste management	- GPAP (WEF) - Waste Flow Diagram (GIZ/The University of Leeds/Eawag-Sandec/Wasteaware) - Plastic Leak Project (Qantis)	Municipal Waste Management Reports. National Statistic on SWM (Mostly in Enviornmental Agencies) Waste Treatment Industry Data from waste management companies.

As a first step, we carried out an initial compilation of existing methodologies (Report Attached) and the characterization of potential sources and main aspects and issues for the estimation of plastic pollution in each category.

Proposed rationale for the toolkit

Bearing in mind that the proposed toolkit considers the limited availability of data (availability and/or quality) found in many countries, and difficulty to use so many different complicated tools for most of the countries, the ultimate objective of the toolkit is to provide encompassing information for governments and other stakeholders on the sources of plastic pollution. It is proposed the establishment of a calculation method that can turn available data into empirical information that can be easily assimilated by decision makers.

Why a plastic leakage factor

As mentioned above, there are various methodologies for estimating plastic flows and plastic leakages. Many of them address different dimensions of the phenomenon. In parallel, we encounter multiple challenges. One challenge is related to the growing number of existing methodologies. In this regard, it may result very challenging for a national or subnational decision-maker to understand which methodology is the most appropriate for their context and the technical and information resources that each one may require. A second challenge is linked to the availability of good quality and availability of data. Even though relevant improvements are being made in this context, it is often a relevant challenge to count with data to feed complex methodologies. This is why it is important to have elements that help simplifying the estimation of sources of plastic pollution. In this regard, a Plastic Leakage Factor / Coefficient could be a significant help for estimating plastic leakages in several sectors and in conditions of limited data. In the next sections we lay out relevant information concerning the above-mentioned categories, as an initial step for the establishment of calculation rules for each source category.

Source categories proposed to be assessed by the toolkit

1) Plastic production

In the process of producing plastic from petroleum, plastic leaks to the environment. The sources associated with this are plastic production or re-processing factories mainly operated by oil/chemical companies. There must be information on the geographical locations of such factories, in the target catchment and production/re-processing processes where leak to the environment must be estimated through the input-output mass balance (material flow analysis). However, data from the factories are essential.

Related methodologies

- Life Cycle Assessment (LCA) of alternative feedstocks for plastics production (JRC / UE)

The Joint Research Centre (JRC) developed a comprehensive Life Cycle Assessment (LCA) methodology—referred to as the "Plastics LCA method"—to evaluate the environmental impacts of plastic products from various feedstocks, including those with different biodegradability properties. This method aligns with the existing Product Environmental Footprint (PEF) method but includes additional rules specific to plastics. The resulting "Plastics LCA method" aims to ensure consistent, reproducible, and robust LCA studies across the EU, with the ultimate goal of enhancing the environmental sustainability of plastics[1].

2) Production of plastic products and plastic-containing products

It encompasses textile, electronics, vehicles, agricultural/fisheries equipment, building materials, etc. Plastics also leak from the plastic products or plastic-containing products. Several material flow analysis models have been used to identify sector based plastic leakage.

Related methodologies

- National Guidance for Plastic Pollution Hotspotting and Shaping Action (UNEP-IUCN)[2]

The National Guidance for Plastic Pollution Hot Spotting and Shaping Action aims to help countries identify areas where plastic waste is leaking and prioritize effective interventions to reduce this leakage. It includes a country-level assessment of both micro- and macro-plastic leakage, which is specific to different sectors, types of plastic, and products. This assessment highlights the most problematic sectors, types of plastic, products in specific areas, and waste management practices that contribute the most to plastic leakage

[1] https://publications.jrc.ec.europa.eu/repository/handle/JRC125046
[2] https://www.unep.org/resources/report/national-guidance-plastic-pollution-hotspotting-and-shaping-action

- Basel Convention Toolkit for the development of an inventory of plastic waste

The Basel Convention has developed additional practical guidance for creating inventories of plastic waste. This guidance is intended to assist the Convention's parties in their annual reporting. The guidance outlines three practical methodologies for inventorying plastic waste. Two of these methodologies are used to estimate plastic waste generation (the product lifetime approach and survey approach), while the third focuses on mapping the flow of plastic waste (Material Flow Analysis)[3].

- Life Cycle Assessment (LCA) of alternative feedstocks for plastics production (JRC / UE).

This method provides methodological and modelling rules to conduct as far as possible consistent, reproducible, robust, and verifiable LCA studies of plastic products. **(**Mentioned above).

3) Plastic use in other sectors (agriculture, fisheries)

Several sectors are heavily using plastic products, and these sectors are considered to be a major source of plastic pollution. As examples, most agricultural plastic products are single use and can persist in the environment long after their intended use. Degrading into microplastics, they can transfer and accumulate in food chains, threatening food security, food safety and potentially human health[4]. Abandoned, lost, or discarded fishing gear cause considerable damage to marine life. Quantification of plastic waste generation in these industries is scarce or non-existent in the case of fisheries[5] . There are some efforts to track down these products in the environment, such as ghost gear tracking. In this dimension ports activities are also relevant.

Other related sources: The hospitality industry, including hotels, restaurants, food delivery, is based on the use of plastic and could become major sources of plastics pollution.

Related methodologies

- ENV-Linkages Plastic Leakage Model (OECD ENV-Linkages)6

The OECD ENV-Linkage introduces a new method for modeling and predicting plastic usage and waste by using the OECD ENV-Linkages computable general equilibrium model. This approach was utilized for the OECD Global Plastic Outlook (2022). The projections with ENV-Linkages differ from previous studies due to variations in methodology and data sources, including the projected drivers of future economic

[3]https://www.basel.int/Countries/NationalReporting/Toolkitsforwasteinventory/tabid/9043/Default.aspx

[4] FAO. 2021. Assessment of agricultural plastics and their sustainability. A call for action. Rome. https://doi.org/10.4060/cb7856en

[5] Correa-Cano, M.E.; Burton, K.; Mueller, M.; Kouloumpis, V.; Yan, X. Quantification of Plastics in Agriculture and Fisheries at a Regional Scale: A Case Study of South West England. *Recycling* **2023**, *8*, 99. https://doi.org/10.3390/recycling8060099

[6] Modelling plastics in ENV-Linkages | OECD

growth. This modeling approach offers the advantage of considering structural and technological changes, allowing for a more comprehensive analysis of economic variables, such as the growing importance of services in the economy. Uses, as an input data: Plastics production and consumption by economic sector; and as output data: Current rate of Plastics use, waste, and leakage, Rate of plastic leakage to aquatic environment and Projected growth of plastic use, waste, and leakage.

- Plastic Leak Project (PLP) Guidelines[7]

This methodological guide offers a comprehensive framework for assessing plastic leakage throughout the life cycle of products or corporate activities, addressing the growing concern about end-of-life plastic management. It defines plastic leakage as the amount of plastic leaving the technosphere and accumulating in the natural environment, including macroplastics and microplastics. The guide explains how to model plastic leakage by considering loss, transfer, release, redistribution and degradation, key elements for assessing long-term environmental impact. It also details the steps to inventory plastic leakage, identifying sources throughout a product's life cycle and collecting the necessary data. In addition, calculation rules are provided to assess the quantities of plastics leaking at each stage of the life cycle, considering loss and release rates, and the use of sensitivity analysis is suggested to improve the accuracy of the calculations.

- Life cycle inventory of plastics losses from seafood supply chains: Methodology and application to French fish products[8]

This work proposes a methodology for quantifying flows of plastics from the life cycle of the seafood products to the environment. It is based on loss rate and final release rate considering a pre-fate approach as proposed by the Plastic Leak Project. They are defined for 5 types of micro and macro plastic losses: lost fishing gears, marine coatings, plastic pellets, tire abrasion and plastic mismanaged at the end-of-life. The methodology is validated with a case study applied to French fish products for which relevant data are available in the Agribalyse 3.0 database. Results show that average plastic losses are from 75 mg to 4345 mg per kg of fish at the consumer, depending on the species and the related fishing method. The main plastic losses come from lost fishing gears (macroplastics) and tire abrasion (microplastics). Results show high variability: when mismanaged, plastic packaging at the end-of-life (macroplastics) is the main loss to the environment.

- Waste Flow Diagram- WFD (GIZ/ The University of Leeds/ Eawag/ Wastewater)[9]

The Waste Flow Diagram (WFD) is a quick tool used to estimate the amount of municipal solid waste that is leaking into the environment and water from various sources. It uses a Material Flow Analysis (MFA) approach combined with systematic qualitative assessment based on observations, interviews, and data collection from waste management stations. The WFD presents the quantities of municipal solid waste streams within a waste management system in a standardized Waste Flow Diagram and Sankey diagram. This tool allows for the insertion of data based on different scenarios

[7] The Plastic Leak Project Guidelines - Quantis

[8] https://www.sciencedirect.com/science/article/pii/S0048969721051925

[9] Waste Flow Diagram - giz.de

and facilitates comparison of different waste management assessments for planning purposes.

4) Households/consumers

This category refers to direct plastic pollution from households. Washing of synthetic chemicals produced microfibre to be transferred through the atmospheric movement to be deposited on the aquatic environment. Use of microbeads and other microplastics in households would produce plastics which will move to the aquatic environment through sewage if and when such plastic is not removed in the wastewater treatment systems.

Related methodologies

- Plastic Leak Project (PLP) Guidelines[7]

Within the PLP Guidelines there is a specific section that approaches to plastic leakage to the environment applied to synthetic textile microfibers

5) Plastic recycling

It refers to reprocessing facilities and compacting and transport of plastics within recycling sector.

There are some challenges affecting the effectiveness and feasibility of Plastic Recycling that may increase plastic leakage into the environment.

- Sorting several Plastic Types. Mixed plastics are difficult to separate and often end up being downcycled or sent to landfills.
- Losses During Sorting and Processing: Mechanical sorting systems may fail to capture all recyclable plastics, leading to significant losses that are discarded as waste.
- Microplastic Generation: During the mechanical recycling process, especially shredding and washing, microplastics can be generated and inadvertently released into water systems.
- Infrastructure and Technology Gaps. Without adequate infrastructure, even collected plastics may end up in landfills or incinerators.
- Collection Systems. Inefficient or irregular collection systems can lead to low recovery rates and increased plastic leakage into the environment

Related methodologies

- Global Plastic Action Partnership's National Analysis and Modelling tool (GPAP) NAM (WEF)[10]
- ISWA Plastic Pollution Calculator [11]
- National Guidance for Plastic Pollution Hot Spotting and Shaping Actions (IUCN-UNEP): Recycling of plastic by polymer (As an input data)[12]
- Plasteax[13]: Recycling of plastic by polymer (As an input data). Domestic recycling (as an output data)

6) Wastewater and urban runoff

Wastewater normally contains plastic but may be removed through the municipal wastewater treatment systems depending on the technologies employed.

Pathways of Plastic Pollution via Wastewater

- **Wastewater Discharge**: Wastewater treatment plants (WWTPs) are significant sources through which microplastics and other plastic debris enter marine environments. Not all plastics are effectively removed during wastewater treatment, especially microplastics, which are often too small to be filtered out completely. As a result, treated wastewater can carry these plastics into rivers, streams, and ultimately the ocean.
- **Microplastics in Wastewater:** Microplastics enter wastewater systems from various sources, including synthetic fibers from washing clothes, microbeads in personal care products, and fragments from larger plastic items. These microplastics are resistant to degradation and are often not entirely removed in wastewater treatment processes.

Related methodologies

- Plastic Leak Project (PLP) Guidelines[14] (Mentioned above). Contains guidance to estimate Plastic Leakages from Waste Management

[10] https://www.globalplasticaction.org/tools
[11] www.iswa.org/blog/press-release-iswa-launches-innovative-calculator-to-manage-marine-litter/
[12] https://www.unep.org/resources/report/national-guidance-plastic-pollution-hotspotting-and-shaping-action
[13] https://plasteax.earth/
[14] The Plastic Leak Project Guidelines - Quantis

7) Solid waste management

It refers to waste collection, sorting, transport, and final disposal on dumpsite/landfill. Plastic pollution is closely linked to the broader issue of solid waste management, encompassing various stages such as waste collection, sorting, transport, and final disposal at dumpsites or landfills. Each stage in the solid waste management process plays a crucial role in either mitigating or exacerbating plastic pollution.

Issues and dimensions of plastic waste to be considered related to waste management:

(Stages/dimensions)

1. Waste Collection (Gathering of plastic waste from households, businesses, and public spaces)

- Coverage and Accessibility: Effectiveness and comprehensiveness of waste collection systems.
- Separation at Source: Rates of separation at source (of all types of waste, and particularly plastics)

2. Sorting

Data on types of starting practices and volume:

Manual and Mechanical Sorting (Types of mechanical sorting):

3. Transport:

Environmental Considerations: Information of environmental challenges related to plastic waste transportation (both from the collection stages as well as other stages). Special relevance to GHG emissions.

4. Dumpsite/Landfill Management:

Information of volumes and types of waste in Dumpsites and Landfills.

An important classification could be between managed and mismanaged (collected) plastic waste. Specific attention should be given to data of uncollected (plastic) waste and its potential consequences: (Dumping, Burn, Garbage burial, Disposed into water, etc.).

5. Leakage from the incineration or thermal treatment systems

Understanding the scale and nature of any plastic leakage from these systems can inform improvements in technology and regulation

Related methodologies

- Global Plastic Action Partnership's National Analysis and Modelling tool (GPAP) NAM (WEF)15

GPAP is an approach used to assess national plastic pollution and estimate the amount of plastic waste entering the oceans. It is based on the BPW methodology and allows users to customize the baseline. The model can predict plastic waste flows and stocks, as well as their impact, up to 2040. It includes preloaded data from Breaking the Plastic Waste (which maps countries to three income archetypes) and from PLASTEAX data for some countries. The model calculates 5 different scenarios (Business as Usual, Upstream, Downstream, System change, Custom scenario) by combining different levers from the following categories: Reduce & Substitute, Redesign, Collection & Sorting, Trade control, Recycle, Disposal, and Mismanaged

- Basel Convention Toolkit for the development of an inventory of plastic waste

As mentioned before, the Basel Convention has developed additional practical guidance for creating inventories of plastic waste. This guidance is intended to assist the Convention's parties in their annual reporting. Two of these methodologies are used to estimate plastic waste generation (the product lifetime approach and survey approach), while the third focuses on mapping the flow of plastic waste (Material Flow Analysis)[16]

- Plastic Leak Project (PLP) Guidelines (Mentioned above). Contains guidance to estimate Plastic Leakages from Solid Waste Management
- Waste Flow Diagram- WFD (GIZ/ The University of Leeds/ Eawag/ Wastewater)[17] (Mentioned above)

Issues to be considered for the development of a toolkit

1. Geographical distance between the sources and the aquatic environment

Some sources of pollution may be geographically located away from the aquatic environment (except water-based sources of plastics pollution). From the sources to the aquatic environment, there may not be environmental pathways for the plastic pollutants to reach the aquatic environment. In order to estimate the amount of plastic entering into the aquatic environment, a factor should be introduced to consider the relationship between the sources and the aquatic environment. The other question is how to consider environmental pathways from sources to the aquatic environment in the toolkit.

---

[15] Tools (globalplasticaction.org)

[16] https://www.basel.int/Countries/NationalReporting/Toolkitsforwasteinventory/tabid/9043/Default.aspx

[17] Waste Flow Diagram - giz.de

2. Timescale of pollutant transfer from sources to the aquatic environment

Plastics are released to the environment from sources (please see the proposed source categories). Plastics released from some sources reach the aquatic environment more quickly than those from other sources. Plastics in the soil may reach the aquatic bodies over a long period. What timespan does this toolkit should consider so that some sources from which plastics reach aquatic environment slowly may not be considered in this toolkit.

3. Types of polymers

For some sources, the types of polymers can easily be identified. For others, they are not easily identified (such as waste sources). The toolkit may include an element to identify types of plastic polymers, so that such information would be attached to the results of the toolkit application.