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2nd Meeting of the UNEP/EC Working Group to develop a toolkit on plastic pollution sources
Brussel, 3-4 July 2025

Pre-meeting guide

Pre-Meeting Document

Second Working Group Meeting of the EC/UNEP-IETC Project on Plastic Leakages

Introduction

The joint project between UNEP's International Environmental Technology Centre (IETC) and the European Commission's Directorate-General for Environment aims to develop a practical methodology to identify and quantify sources and leakages of plastic into aquatic environments. For this purpose, a toolkit is being developed that uses leakage factors along the plastic value chain to estimate emissions.

This second Working Group (WG) meeting focuses on validating key technical components of the toolkit, mainly related to the development of source category leakage factors. In this regard, this document provides guidance to participating experts regarding their role and expectations during the meeting and the forthcoming stages.

Context and progress

The first WG meeting took place in Brussels in September 2024, bringing together over 20 experts and institutional representatives. It laid the groundwork for the Toolkit, emphasizing the need to harmonize definitions and conceptual frameworks, and the importance of a flexible, operational model based on source-specific leakage factors. Key source categories were identified, including plastic production, manufacturing, household use, specific sectors (e.g. agriculture and fisheries), recycling, wastewater and solid waste management. Compatibility with international frameworks (MFA, SDGs) and integration of social and environmental aspects were also highlighted.

Following the meeting, work progressed through expert consultation, leading to the preparation of foundational documents: first a Broad Scoping Paper, then the Guiding Document V1, and most recently the Guiding Document V2. The latter sets the methodological and operational basis for estimating plastic leakages using a leakage factor-based approach, with proposals of equations, variables, reference values, and guidance on data quality and uncertainty. It includes technical annexes to support its practical use across different contexts.

2. Dynamics for the Working Group meeting

The two-day meeting is designed to present and refine the structure and content for developing plastic leakage factors across source categories. On Day 1, technical working sessions will run in parallel, grouped by plastic source categories or value chain stages, according to each expert's area of expertise. On Day 2, discussions will converge in a plenary session to synthesize key insights and consolidate preliminary outcomes.

The session will include:

- A general presentation on the status of the project and progress since the last meeting.
- Technical group discussions, with structured inputs.
- Final plenary exchange to share findings and draft conclusions.

Participants are expected to review and validate critical components such as source sectors and categories, system boundaries, proposed equations, leakage factors, and reference values. The *Guiding Document V2* provides the methodological foundation and outlines the sectoral categories addressed so far. It also presents proposed equations and draft leakage factors aligned with the plastic value chain—from production to end-of-life.

Experts are strongly encouraged to read the *Guiding Document V2* in advance, as it will inform each technical session. A key objective of this effort is to define, where possible, value ranges that reflect variability across countries or systems.

In summary, experts are expected to:

- Evaluate and validate the proposed categories of plastic sources.
- Review the equations and variables used to estimate leakages.
- Analyze proposed emission factors and reference values.
- Provide additional empirical evidence or context-specific data, including national datasets, or pilot studies.
- Recommend methodological or conceptual improvements based on their expertise.
- Critically assess and justify any suggested adjustments to leakage factors.
- Suggest refinements to the structure of equations, terminology, or definition of system boundaries.
- Comment on the model's feasibility and usability, particularly in contexts with limited data availability.

3.Structure and Foundation of the Toolkit

Ideally, the Toolkit is based on a simple yet robust quantitative approach. First, the sources of plastic are grouped into broad thematic categories such as:

- Primary plastic production and handling
- Selected sectors: agriculture, fisheries, etc.
- Diffuse emissions such as tire abrasion or textile wear
- Solid waste and wastewater systems

For each source category, a series of equations is proposed that include components such as activity data and adjustment values aimed at identifying leakage factors.

3.1 Examples[1] (Source categories, proposed equations and components)

a) Plastic Production and production of plastic products (Plastic manufacturing)

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[1] The presented examples can be found in detail in the Guiding Document V.2, which can be found here: https://www.unep.org/ietc/events/working-group-meeting/2nd-working-group-meeting-unepec-project-identifying-and-quantifying.

Proposed equation[2]

$$PL\text{pm} = PP\ (L\text{p} + L\text{s} + L\text{pr})$$

Where:

PLpm: Annual plastic leakage from plastic production and manufacturing (kg)
PP: Annual mass of plastic pellets produced, processed or handled (kg or tons)
LFp: Leakage factor during production (Reference values: 0,01% to 0,04 %)
LFh: Leakage factor during handling (Reference values: 0,01% to 0,04 %)
$LFpr$: Leakage factor during processing (Reference values: 0,01% to 0,04 %)

Examples of triggering questions

- How reliable and disaggregated are these data? Can they be separated by facility, region, or type of polymer?
- Based on available evidence or expert judgment, what leakage factor would you assign for each stage? Do the proposed reference ranges (0.01–0.04%) seem realistic for your context?
- Should the leakage factors vary by type of facility (e.g., large-scale vs. small-scale processors) or geographic region?
- Are there particular components of the equation where uncertainty is especially high or where further data collection is urgently needed?
- Is this formula structure appropriate for estimating leakages from production and manufacturing at national or sub-national contexts?
- What improvements would you suggest to the current equation to enhance its accuracy or usability?

b) Agricultural Sector (Plastic mulching)

Proposed equation

$$PLmulching = A \times U \times (1 - R)$$

Where:

PLmulching: Annual plastic leakage from mulching activities (kg)
A: Total area (m2 or ha) where plastic mulch is applied.
U: Usage/Application rate. Plastic used in mulching activities, typically measured in kilograms per hectare per year (kg/ha) or in total kilograms applied across a region.
R: Retrieval. Fraction of the used plastic that is collected, recovered, or properly managed (recycled or disposed of) after use.

Examples of Triggering questions

• Are there official databases or reliable estimates on the use of plastic films in agriculture for all countries?

• Does this value vary significantly depending on the type of crop or the technology used (e.g., mulching, greenhouses)?

• What percentage of the plastic used ends up not being properly collected or degrades into the soil?

• What level of confidence would you assign to your estimate of the leakage factor? (high, medium, low)

• Do you think the leakage factor should be differentiated by the type of agricultural system (industrial, smallholder, informal)?

• Is this formula structure useful for estimating leakages in national and sub-national contexts?

• What other factors or variables should be incorporated to improve this estimation?

4. Confidence

If deemed appropriate, it is recommended that experts assign a confidence level to the reviewed leakage factors and reference values. This level should be based on two dimensions: the quality of the evidence (e.g., empirical data, peer-reviewed studies) and the degree of expert agreement or methodological consistency. Adopting the approach used in the GEO-7[3] framework, confidence may be classified as:

- High confidence = robust evidence + broad consensus
- Medium confidence = moderate evidence + partial consensus
- Low confidence = limited evidence and significant disagreement or uncertainty

This classification helps prioritize areas requiring refinement or new data and enhances the transparency of the model. It is worth noting that one of the main constraints for applying pollution estimation methodologies is the availability of baseline or source data. This is one of the key challenges that this tool aims to address.

5. Treatment of uncertainty and biases

When possible, every estimate included in the toolkit must explicitly state its level of uncertainty. Uncertainty may arise from factors such as:

- Inherent variability of systems (climatic, geographic, technological)
- Lack of representative data
- Simplifying methodological assumptions

[3] Geo 7- Intergovenmental and Expert-led Scientific Intergovernmental and Expert-led Scientific Assessment Procedures

- Other reasons

Whenever possible, it is recommended to quantify uncertainty (e.g., through ranges or standard deviations) or at least to classify it qualitatively (high, medium, low). This allows users of the model to correctly interpret its results and limits the risk of misuse in policy-making contexts.

6. Controlling bias and use of ranges

When discussing complex issues like plastic pollution, it's important to recognize that everyone—regardless of expertise—is subject to bias. Our perceptions are shaped by personal experiences and the influence of others, whether through direct interaction or media exposure. Even in our areas of specialization, we can make errors in judgment.

As such, we ask all participants to approach this workshop with an awareness of their own potential biases and limitations as observers. To help control these challenges, we intend to present scenarios with clearly defined boundaries and where limitations are explicit, cognizant that this is still subject to continuous improvement.

Extreme events and values tend to capture our attention more easily due to their uniqueness and the unpredictability of their consequences. To prevent overemphasizing such cases, we took inspiration from Cottom et al. (2024)[4] and propose using upper and lower plausible limits, which are expected to cover around 95% of occurrences (Figure 1), while excluding extreme outcomes that do not meaningfully represent the underlying phenomena.

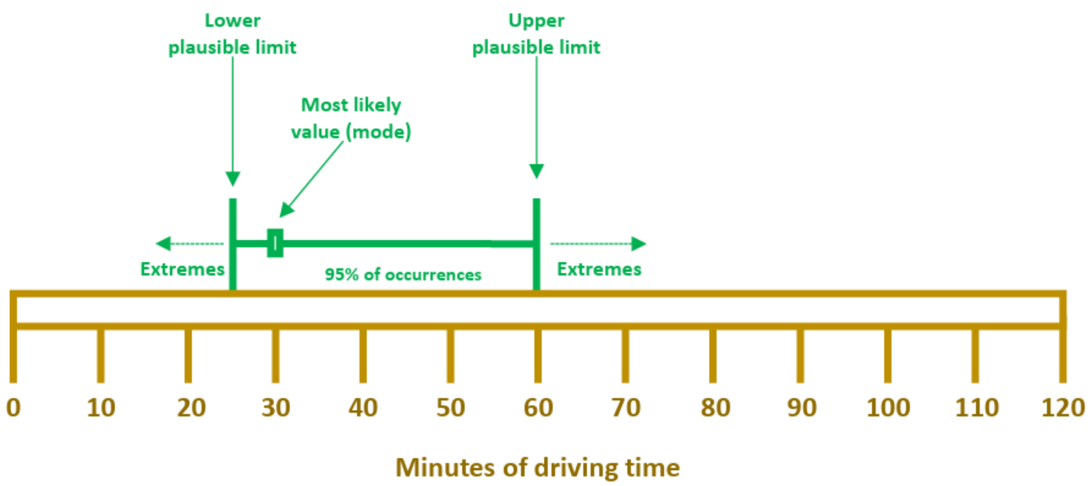

Figure 1. Example upper and lower plausible limits; extremes; and most likely values (mode) based on taxi journey time to the airport.

Source: Cottom et al, 2024. Plastic pollution emission factors: How much escapes, how far it goes, and how to intervene in the solid waste management system. https://doi.org/10.21203/rs.3.rs-4850420/v1.

The use of ranges allows also for better representation of the diversity in technical, economic, and social conditions, and a useful approach is to stratify these ranges based

[4] https://www.researchsquare.com/article/rs-4850420/v1.

on indicators such as the country's income level (low, middle, high), the degree of formalization of the waste management system, or the urban/rural context.

This approach not only improves the representativeness of the estimates but also enhances the adaptability of the toolkit to different implementation scales (National, subnational, city, etc.) and contexts. In scenarios of data scarcity, ranges may serve as reasonable interpretation margins as well, underpinned by expert judgment.

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