

# Pioneer Project Barrier

## Explanatory Notes

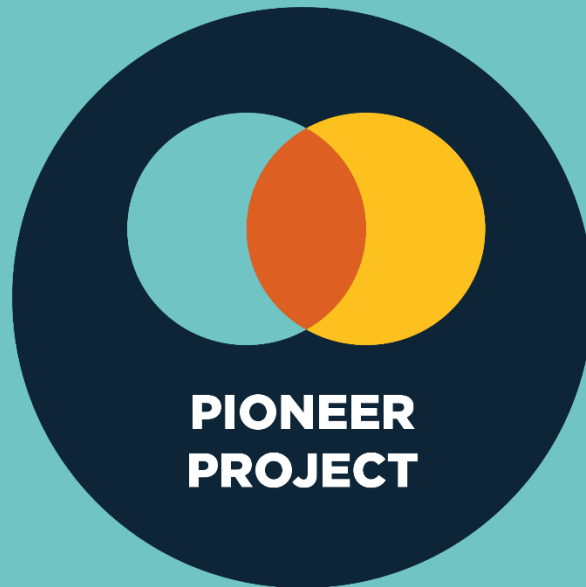
### EMF NPEC project value chain partners

Amcor (lead), APK AG, Borealis with their recycler  
mtm Plastics, Constantia Flexibles, Dow, Futamura, Mars, Mondi,  
Natureworks, Nestlé, PepsiCo, Recycle BC, Target, Unilever, Veolia

### Supporting organizations

CEFLEX (160+ value chain partners), cyclos-HTP, Henkel, Siegwerk

Facilitated by The Ellen MacArthur Foundation

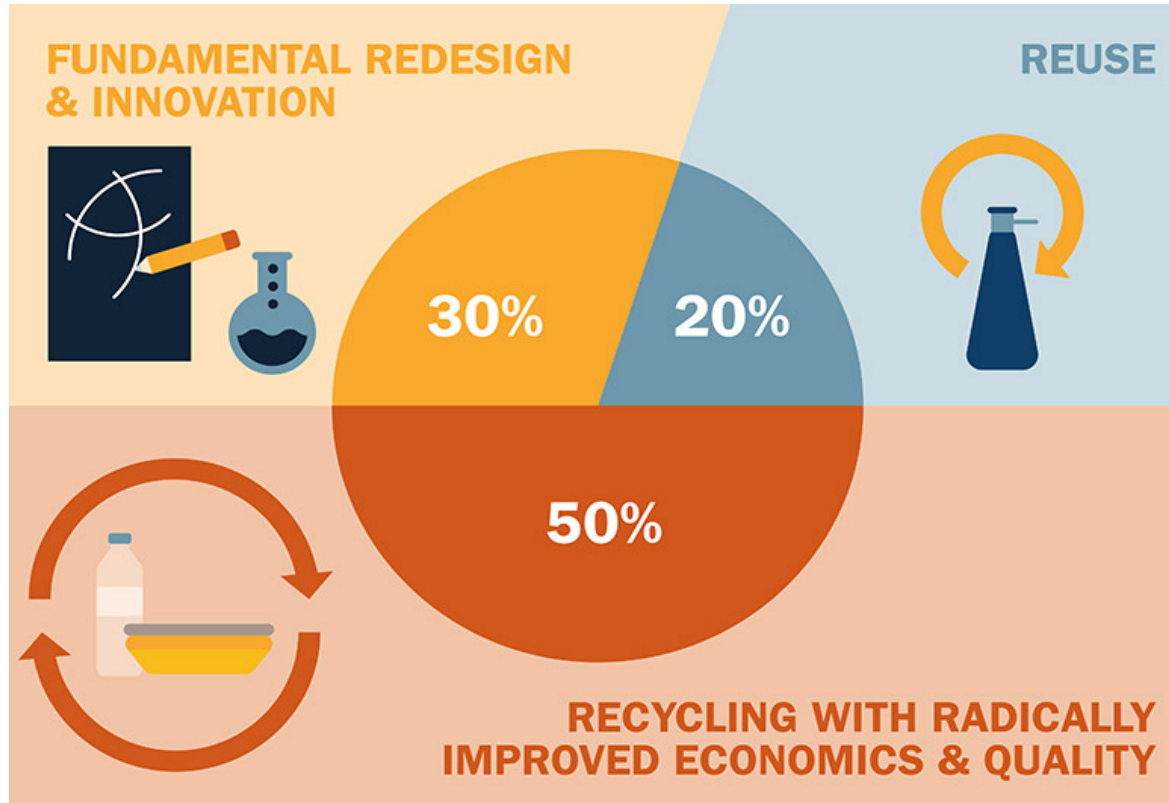




# Background

- According to the Global Commitment, a packaging or packaging component can be considered “recyclable” if its successful post-consumer collection sorting, and recycling is proven to work in practice and at scale, which requires the packaging to fulfil the following two criteria:
  - a. Recycling Infrastructure - the existence of a recycling stream for the packaging in question including collection, sorting and recycling infrastructure.
  - b. Packaging Design - the packaging itself has to be designed for recycling, i.e. in accordance with design for recycling guidelines for the intended recycling stream.
- The Project Barrier guidelines address Packaging Design (point b. above) for plastic-based flexible barrier packaging.

# Project Barrier Guidelines: Driving Redesign & Innovation for Radically Improved Recycling of Plastic-Based Flexible Barrier Packaging



Project Barrier addresses one fundamental issue of plastics recycling: Plastic-based flexible barrier packaging is often made from materials that are not recyclable, or not compatible for recycling. Fundamental redesign, standardization, and innovation is required to radically improve recycling of plastic-based flexible barrier packaging.



## Develop Design for Recyclability guidelines for plastic-based flexible barrier packaging (PBFBP)

- Create clarity and industry agreement on the types and characteristics of PBFBP designs which could increase the quality of recyclates from PBFBPs and thus enable the development of recycling streams for these.
- Help identify quick wins for PBFBP design changes that could be implemented relatively quickly.
- Guide and support longer-term innovation towards making more challenging packaging applications fit for a circular economy.

# Project Barrier Design for Recyclability Guidelines for Plastic-Based Flexible Barrier Packaging



Category		Plastic-based flexible barrier packaging		
		Compatible with PE or PP recycling	Limited compatibility with PE or PP recycling	Not compatible with PE or PP recycling
General design characteristics	Dimensions	> 20x20 mm	> 20x20 mm	≤ 20x20 mm
	Density	< 1 g/cm <sup>3</sup>	< 1 g/cm <sup>3</sup>	≥ 1 g/cm <sup>3</sup>
Polymers	PE* or PP* content	Minimum 90% monomaterial-PE or monomaterial-PP by weight of the total structure	Minimum 80% monomaterial-PE or monomaterial-PP or mix of PE and PP by weight of the total structure	Less than 80% mix of PE and PP by weight of the total structure
	PET** or PVC** or PVDC** or biodegradable polymer layers	Not permitted	Not permitted	Containing PET or PVC or PVDC or biodegradable polymer layers
Barrier coatings/substances	Acrylic**, PA**, PVOH**, EVOH, SiO <sub>x</sub> , AlO <sub>x</sub> , metallisation	Maximum 5% each by weight of the total structure	Maximum 10% each by weight of the total structure	More than 10% each by weight of the total structure
	PVDC** coating	Not permitted	Not permitted	Containing PVDC
	Other barrier coatings	Not permitted	Maximum 10% each by weight of the total structure	More than 10% each by weight of the total structure
Other materials	Aluminium foil or paper layers	Not permitted	Not permitted	Containing aluminium foil or paper layers

**+ 17 detailed additional criteria (see complete spreadsheet)**



## In Scope

- Plastic-based flexible post-consumer packaging with medium- to high-barrier functionality (barrier against oxygen and water vapor transmission, etc.).
- From households, on-the-go packaging and from similar uses (e.g. cafeterias, hospitals).
- Generally smaller than A4 in size, but can also include larger applications.
- Materials targeting the polyolefin recycling stream.

## Out of Scope

- Commercial or commercial-like post consumer flexible packaging (e.g. from back of the store collection systems) with no or low barrier requirements for which recyclability guidelines already exist (e.g. by Plastics Recyclers Europe, PRE, or the Association of Plastic Recyclers, APR).
- Other post consumer flexible packaging with no or low barrier requirements that are easily suitable for recycling together with commercial waste.
- Rigid packaging such as trays, pots, or other containers.
- Aluminum- or paper-based flexible packaging that is suitable for existing aluminum and paper recycling infrastructure, respectively.

# Background and Rationale of the Guidelines 1/2

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- The guidelines are based on real world curbside recycling infrastructure and processes as existing today in those countries that are globally leading in recycling flexible packaging, i.e. Austria, Germany, Netherlands, Norway and regions of Italy and Spain. In these countries household post-consumer flexible packaging is generally recycled into durable injection- or intrusion-molded polyolefin-based goods, e.g. for automotive or building applications where virgin polymers are replaced by the recyclates.
- The Guidelines aim at maximizing and optimizing target materials: The guidelines standardize around PE and PP as target materials (similar to plastic beverage bottle recycling, where the target material is PET) due to the prevalence of PE and PP in flexible packaging and the existence of proven recycling technologies and end-markets for these materials.
- The Guidelines aim at minimizing contamination: Materials that have no or limited compatibility with PE and PP recycling are to be eliminated or minimized in order to increase the recycling yield and enable a higher quality output. Contamination of the pack by product residues should also be minimized, leading to the requirement of a pack to be easily emptied by the consumer.
- Targeted end markets for use of these recycled materials are based on capabilities of currently existing infrastructure at an industrial scale, i.e. mechanical recycling. In most cases this means targeting intrusion or injection molding applications for durable goods such as applications in the automotive sector, but where possible film applications for the recycled materials are also in scope, specifically if all the requirements in the green column of the guidelines (see slide 5) can be met.

## Background and Rationale of the Guidelines 2/2

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- The Guidelines are agnostic to different sorting and recycling technologies, but focus on real world technologies that are proven at an industrial scale. Therefore, the requirements are based on those for mechanical recycling. However, judging from currently available knowledge, the requirements are also valid for feedstock/chemical or other forms of polyolefin recycling.
- Expected impact on recycling systems: If the target materials are maximized and contaminants are minimized, the quality of the available feedstock for recycling will be dramatically improved, thus facilitating the development and operation of functioning, efficient and effective recycling infrastructure. Therefore the guidelines can be seen as an enabling factor for reaching the goals of the Global Commitment.
- The Guidelines provide a sense of direction: The guidelines differentiate between ‘compatible with PE or PP recycling’ (green column) and ‘limited compatibility with PE or PP recycling’ (yellow column). The aim is for value chain actors to work towards the requirements in the green column. The requirements in the yellow column are to be viewed as an interim position to work towards the green column.
- The Guidelines highlight areas for innovation and further research in terms of materials, structures, compatibility and recycling infrastructure. It is recommended to closely follow any developments related to new materials, new sortation technologies such as digital watermarking, advancement in mechanical as well as in feedstock/chemical recycling, etc., all of which will inform future versions of design guidelines.
- The Guidelines acknowledge that there is a fundamental difference between looking at the material composition of a specific packaging structure and looking at the material composition of a recycling stream to be processed. The goal is to influence the design of packaging that is put on the market and thereby influencing the recycling streams in order to make recycling more efficient and enabling higher quality recycling products.



# Target Audiences and How to Apply the Guidelines

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- Target audiences are all stakeholders who design plastic-based flexible barrier packaging or who have an influence on the design and design requirements for plastic-based flexible barrier packaging. This includes, but is not limited to material producers, packaging converters, brand owners, retailers, waste management companies, recyclers, governmental bodies, and packaging recovery organizations.
- Widespread application of the guidelines is encouraged in order to work towards mono-material streams that can be more easily recycled. Therefore a portfolio approach is recommended that moves large quantities of packaging put on the market to align with the requirements of the guidelines.
- Guidelines should be seen as default recommendations. If there are packaging structures that don't meet the requirements of the guidelines, but are compatible with PE or PP recycling, this needs to be demonstrated on a case by case basis, e.g. via suitable testing procedures (e.g. via RECYCLASS or APR protocols or certification by organizations such as cyclos-HTP).



- Compliance with the guidelines alone does not enable the user to make consumer facing recyclability claims. Such claims are region-specific and need to be compliant with the requirements of ISO 14021: 2016 and local regulations.
- Compliance with these guidelines alone is also not sufficient for meeting the requirements of the Global Commitment, since there are additional requirements that need to be met (population access, actual recycling rates). Generally, successful recycling needs design for recyclability, collection and recycling infrastructure and consumer participation. These guidelines cover only the first part as an enabler for the system.
- The guidelines target packaging design and are not be seen as a bale-specification for recycling (input material to a recycling process). However, if implemented broadly in the industry, the guidelines will lead to decontamination of the stream going into recycling processes, since not all packaging will need to go to maximum allowed levels. Hence bale compositions are expected to improve.
- The guidelines are not equivalent to a certification system for recyclability.
- The guidelines do not constitute legally binding requirements, but are the recommendation of a group of value chain partners, who aim at improving recyclability of plastic-based flexible barrier packaging.

# Employed Process and Outlook for the Development of the Guidelines

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- The approach taken by Project Barrier has been to base and build its guidelines on existing work, projects and knowledge, such as from the past projects REFLEX and FIACE and the ongoing CEFLEX initiative and expertise of the project group itself. The expert group established for Project Barrier brought together specialists from across the plastic packaging value chain while, at the same time, drawing inputs from other experts outside the working group. Several meetings were held with the group to discuss and develop the guidelines that form the basis of this document. The project has been led by Amcor and included the following organisations: APK AG, Borealis with their recycler mtm plastics, Constantia Flexibles, Dow, Futamura, Mars, Mondi, Natureworks, Nestlé, PepsiCo, Recycle BC, Target, Unilever and Veolia. To avoid duplication and ensure continuity, representatives from the European-focused CEFLEX Initiative, that has been progressed in parallel with Project Barrier, have also participated in the project and contributed significantly. In addition, several other organisations gave valuable inputs and insights: cyclos-HTP, Henkel, and Siegwark. The Ellen MacArthur Foundation acted as a facilitator.
- The guidelines are the result of an intensive dialogue between different partners from all elements of the value chain of plastic-based flexible barrier packaging and are based on expert judgement and experience of all involved partners. As a result they provide a compromise between enabling the design of medium- and high-barrier packaging that meets all the functional requirements for production and use of the packaging and simplifying packaging to enable more efficient and higher quality recycling.

# Outlook and Further Development of the Guidelines

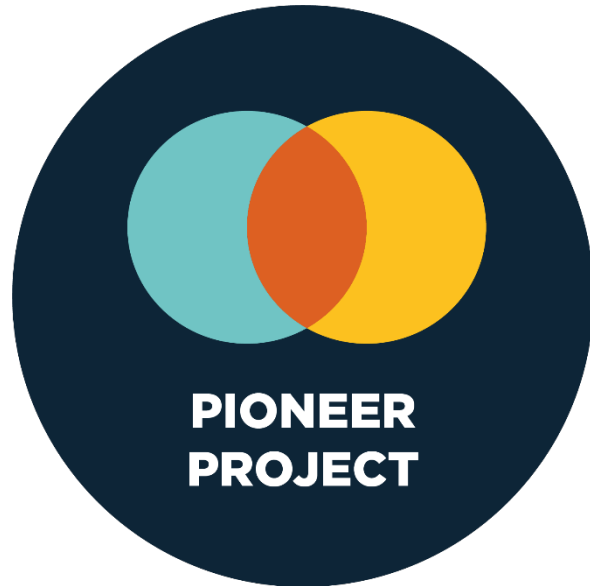
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- Project Barrier brought together stakeholders from the entire plastics value chain to develop broadly aligned design for recyclability guidelines. It is recognised that this document is a first of many steps that will be needed to bring about the significant changes required to make these types of flexible packaging materials circular across the globe. Whilst some of the other steps are being addressed by the New Plastics Economy of the Ellen MacArthur Foundation and other initiatives, the Project Barrier team recognises that initiatives such as CEFLEX, the Polyolefin Circular Economy Platform (PCEP), Materials Recovery for the Future (MRFF) and others will also play an important role in embracing and building on the knowledge generated in Project Barrier. These initiatives have a common theme: stakeholders from across the value chain taking responsibility for the packaging that is produced and put on the market, moving forward and collaborating to identify the issues, develop solutions and implement changes.
- The guidelines should be viewed as a baseline document, to be reviewed and regularly updated based on new knowledge, new and emerging materials and technologies. This will be done by CEFLEX in the process of updating the CEFLEX design guidelines, that have integrated the findings of Project Barrier, in collaboration with other relevant stakeholders.
- New technologies that do not yet exist at large scale, such as chemical recycling, may play a key role in further improving recyclability of plastic-based flexible barrier packaging and enable higher quality film-to-film recycling and the production of food-grade recycled-content materials. While this is acknowledged by the project team, there is also consensus that the requirements for mechanical recycling will also benefit chemical recycling, therefore it is not expected that chemical recycling would dramatically change the direction that Project Barrier is outlining.
- For the guidelines to have the desired effect, it is imperative that as many stakeholders as possible implement the guidelines, aligned with other functional and manufacturing requirements. The project team and many other stakeholders have already committed to their implementation, including many stakeholders of CEFLEX.

# WHAT ARE PIONEER PROJECTS?

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Today's plastics system faces challenges that no organisation can address alone. Pioneer Projects are pre-competitive collaborations that are led and run by participants of the New Plastics Economy initiative. They invite stakeholders from across the plastics value chain to design and test innovations that could change the way we make, use and reuse plastics.

The New Plastics Economy Initiative is led by the Ellen MacArthur Foundation. The Foundation works with business, government and academia to build a framework for an economy that is restorative and regenerative by design.

The Ellen MacArthur Foundation is not to be held responsible for any output from the Pioneer Projects. It focuses only on facilitating the setup and engaging in the process, and on encouraging circular economy thinking and the application of a systems perspective.