Pioneer Project Barrier: Final approved version, November 2020
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	Rationale/explanation	Specific testing, development or fundamental reseach/innovation needed
Overall characteristics						
General design characteristics	Dimensions	> 20x20 mm	> 20x20 mm	≤ 20x20 mm	Enable separation from dirt and other small pieces (currently done by drum screens where items equal or smaller than 20x20 mm are removed from the recycling stream).	Elements of the packaging that are meant to separate from the packaging, e.g. tear-offs, need fundamental re-innovation. Due to their small size, they are known to easily escape the collection infrastucture and if they get collected, they end up in the waste fraction.
	Shape	Container-like flexible packaging is not permitted	Container-like flexible packaging is not permitted	Container-like flexible packaging	Enable mechanical separation of two-dimensional (flexible packaging) from three-dimensional structures (bottles, trays, tubs, etc.); hence flexible packaging structures that behave like a container (e.g. rolls like a bottle) should be avoided.	Case specific testing: For pouches with fitments/spouts to qualify for recyclability requires specific testing to determine if they can be positively sorted into the two-dimensional flexible packaging stream.
	Outer layer	PE or PP	PE or PP	Non-PE or non-PP	Enable positive identification as a polyolefin (currently by using NIR technology).	
	Residues from packaged goods (avg. residue in pack after use)	Package should be designed in a way that minimizes residues	Package should be designed in a way that minimizes residues	High likelyhood of high amounts of residues that are not easily removed by washing	Residues from contents that remain in the packaging might be difficult to remove in a washing step and can contaminate the final recyclates.	
	Density	< 1 g/cm3	< 1 g/cm3	≥ 1 g/cm3	Enable separation from non-polyolefins (for example in a sink-float separation process). Be aware that the concentration of fillers can alter the density to become >1 g/cm3 and thus hinder the sorting into the polyolefin stream.	
Primary Structure (for structure and barrier properties)						
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	PE or PP should make up the majority of the structure to reduce non-polyolefin components and preserve material value and quality.	Case specific testing: Any other material combination not meeting these criteria, with or without compatibilisers, needs further testing to qualify for recycling with the polyolefin stream.
	PET** or PVC** or PVDC** or biodegradable polymer layers	Not permitted	Not permitted	Containing PET or PVC or PVDC or biodegradable polymer layers	Even small amounts of PVC, PVDC, PET or biodegradable polymers lead to the contamination of polyolefin recycling streams, drastically reducing the quality of polyolefin recyclates or disturbing the recycling process.	
Barrier coatings/substances	Acrylic**, PA**, PVOH**, EVOH, SiOx, AlOx, 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	Eliminate/reduce the loss of material quantities as well as properties upon recycling; reduce materials that can cause difficulties in the recycling process.	
	PVDC** coating	Not permitted	Not permitted	Containing PVDC	Reduce disruption of recycling process and eliminate potential for corrosion of reprocessing equipment.	
	Other barrier coatings	Not permitted	Maximum 10% each by weight of the total structure	More than 10% each by weight of the total structure	Eliminate/reduce the loss of material quantities as well as properties upon recycling; reduce materials that can cause difficulties in the recycling process.	
Other materials	Aluminium foil or paper layers	Not permitted	Not permitted	Containing aluminium foil or paper layers	Paper or aluminium containing materials are not suitable for recycling within the polyolefin stream and cause problems for the recycling process (though can be recycled with aluminium or paper streams, respectively, if there is a minimum weight of these materials within the structure). Aluminium foil containing materials are easy to sort out from the polyolefin stream via eddy current separators, thus pose a low risk of contamination.	
Pigments	Carbon black	Not permitted	Not permitted	Containing carbon black pigments	Enable sorting by colour (currently done by NIR).	
Additives	Fillers and workhorse additives (substances not covered elsewhere in this guide)	Permitted, but to be minimized	Permitted, but to be minimized	-	Fillers and workhorse additives such as thermal stabilizers, UV stabilizers, nucleating agents, antistatic agents, lubricants, slip agents, impact modifiers, chemical blowing agents, tackifiers, are allowed but should be kept to a minimum in order to maximize yield and value of recyclate.	
	Substances of very high concern (SVHC)	Not permitted	Not permitted	Containing substances of very high concern	Avoid potentially harmful additives to maximise versatility of applications for recyclates. For definitions of SVHC see: https://echa.europa.eu/candidate-list-table.	
	Oxo-degradable or similar (e.g. enzyme-based) additives	Not permitted	Not permitted	Containing oxo-degradable or similar additives	Eliminate/reduce loss of mechanical properties upon recycling.	
Adhesives and Tie-layers (preliminary, further research needed)	Polyurethane, acrylic-based and other workehorse laminating adhesives, excluding non-permitted ingredients listed in this table	Permitted, but to be minimized	Permitted, but to be minimized	-	Optimise quality of polyolefin recyclates and avoid disruption of recycling process.	There is currently no protocol or solid evidence available for evaluating the impact of adhesives or tie layers on the recycling process and the recycled material. Test results or equivalent evidence need to be developed, based on which these guidelines will need to be confirmed or updated.
Finish						
Print (preliminary, futher reserach needed)	Print coverage	Minimal - the less the better	Any level	-	Reduce non-polymer/polyolefin components upon recycling to optimise quality and value of the recyclate and allow or greater freedom in terms of colour of recyclate.	There is currently no protocol or solid evidence available for evaluating the impact of inks on the recycling process and the recycled material. Test results or equivalent evidence need to be developed, based on which these guidelines will need to be confirmed or updated. Also washable inks and deinking processes should be developed to improve quality of recyclates and reduce problems in recycling processes.
	Colours	Lighter colours to be preferred	All colours	-	Maximise range of applications for recyclate	Case specific testing: Packaging with very dark or very glossy designs needs testing to ensure possitive identification by NIR
Laquers and Inks (preliminary, further research needed)	Lacquers and inks without PVC**-binders	Maximum 5% by weight of the total structure	Maximum 10% by weight of the total structure	More than 10% by weight of the total structure	Reduce non-polymer/polyolefin components upon recycling to optimise quality and value of the recyclate and avoid disruption of recycling process (e.g degassing). High levels of inks might cause gels in the final product.	There is currently no protocol or solid evidence available for evaluating the impact of lacquers and inks on the recycled material. Test results or equivalent evidence need to be developed, based on which these guidelines will need to be confirmed or updated.
	lacquers and inks with PVC**-binders	Not permitted	Not permitted	Containing PVC-binders	PVC disrupts the recycling process.	
Additional Features						
Labels, Zippers, Spouts etc.	Overall	Same criteria as for primary structure	Same criteria as for primary structure	-		
	Same material as primary structure	Preferred	Preferred	-	Increase the amount of polyolefin the final recyclate	
	Other material than primary structure	Easily removable	Easily removable	-	Optimise quality of polyolefin recyclates and avoid disruption of recycling process. A label is e.g. easily removable if the label can be removed by washing with water.	
	Label size(if not composed of PE* or PP*)	Maximum 30% of the packaging surface area	Maximum 50% of the packaging surface area	More than 50% of the packaging surface area	Enable positive identification of the primary structure, i.e. polymer, via NIR.	
Non polyolefin foamed polymer as one element of the total structure	Density < 1g/cm3	Not permitted	Not permitted	Containing foamed non PO with a density < 1g/cm3	Due to the low density, these are likely to end up in the polyolefin stream and contaminate the final recyclate.	

* This denotes the target material of the recycling process and can include PE or PP co-polymers, as long as they are compatible with the respective recycling stream and are neutral or contributing positively to the quality of the recyclate.

** This denotes materials or substances to be avoided or to be minimized and include the respective co-polymers.