RECYCLABILITY OF PLASTIC HOUSEHOLD PACKAGING

IMPROVING RECYCLING THROUGH ECO-DESIGN

GUIDE 2026 EDITION

COTREP

Technical Committee for the Recycling of Plastic Packaging

Message from the Chairman

ALBAN COTARD
Quality & Development
Business Director at Valorplast
and Chair of COTREP
for the 2025-2026 period

At a time when Europe is harmonising regulatory requirements on the recyclability of plastic packaging, the French Technical Committee for the Recycling of Plastic Packaging, COTREP, remains firmly committed to stakeholders within the value chain and continues to be recognised for its technical expertise, as well as its scientific rigour and neutrality.

COTREP guidelines will therefore keep on guiding those placing packaging on the market in France as harmonisation gradually takes place at European level. This constantly evolving regulatory context, affecting all the business sectors concerned, marks a key turning point for the industry: it places eco-design at the heart of the strategy for developing this economic sector as a whole.

Eco-design is no longer an option – it's a must. For COTREP stakeholders, it has become an essential tool for reducing environmental impacts and meeting ever-demanding European and national regulations.

As a technical committee, COTREP has taken a leading role in the transition process by supplying reliable, documented and open-source data, with over 80 general notices published on the recyclability of plastic household packaging and based on field expertise and operational tests. Its role is central as it provides the entire value chain with transparent access to robust data, thereby ensuring that strategic decisions are based on reliable information that has been verified and reflects the reality of industrial operations.

The goal of this COTREP guide is to provide everyone with clear and detailed information on the different end-of-life stages that plastic household packaging goes through in France. It highlights how packaging design choices impact the later stages of packaging life cycles, from collection and sorting to regeneration and outlets for recycled materials. By understanding eco-design more thoroughly and making the right design choices, companies from the sector can commit to a sustainable approach while also ensuring they meet regulatory requirements.

COTREP's collective ethos also expresses itself through the committee's ability to predict which issues may be strategically important for the future. So, given the importance of eco-design for plastic household packaging today, could we not envisage applying it to other sources of plastic tonnage as well, such as professional plastic packaging?

Expanding the reach of eco-design would open up new perspectives on managing plastic waste, while also encouraging industrial stakeholders to commit more fully to the ecological transition.

The path is set. All we need to do is follow it together in the firm belief that, now more than ever, combining innovation, technical rigour and environmental commitment will help us successfully overcome this key challenge.

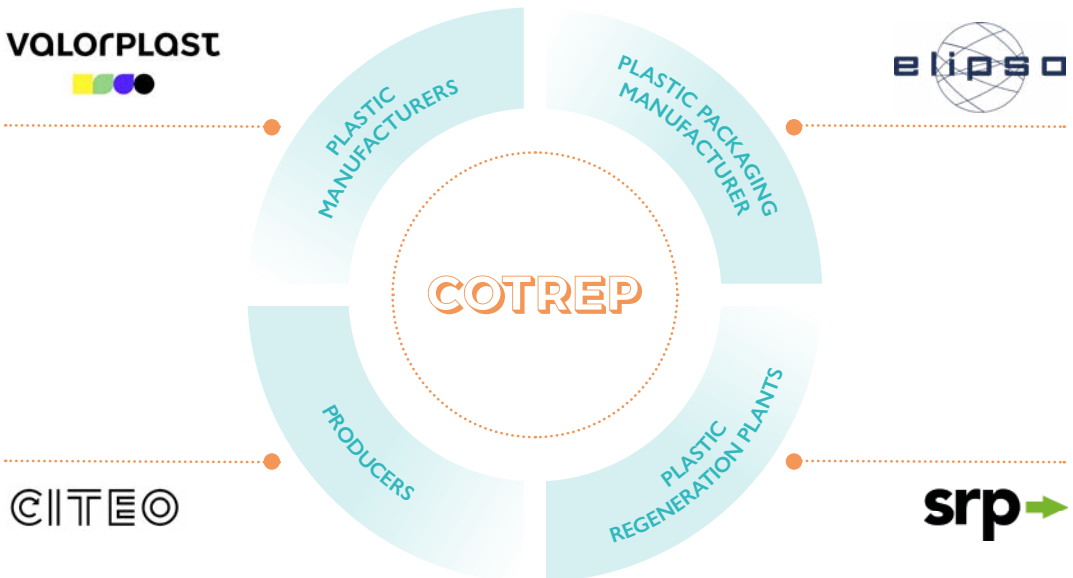
Eco-design – beyond challenges and perspectives lies the need to work together

About us

COTREP is an Economic Interest Group (EIG) whose goal is to guide plastic household packaging designers and users in their choices as they develop innovative and recyclable solutions.

Our guidelines are based on our in-depth knowledge of plastic packaging recycling processes gathered from professional experts from the sector and through testing conducted in laboratories, on a pilot scale or in industrial conditions at regeneration plants.

COTREP embodies a commitment among all stakeholders in the plastic household packaging value chain to improve recyclability. It includes resin manufacturers, plastic packaging manufacturers, marketers and regenerators, represented by Valorplast, Elipso, Citeo and the SRP.



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Members

VALORPLAST

Since 1993, **Valorplast** has advocated three key strategic priorities aimed at developing the circular economy for plastic packaging:

- Increasing the recycling rate of plastic household packaging through eco-design
- Ensuring that recycled plastic meets high quality standards so that guaranteed outlets with high added value are available for this material
- Devising innovations to help develop future recycling streams

In 2025, Valorplast managed the recycling of 154,425 tonnes of plastic waste, 125,500 tonnes of which were plastic household packaging items. 100% of the latter was recycled either in France (75%), or in neighbouring European countries. Valorplast embodies the buy-up guarantee at national level and is developing the regeneration of plastic waste from waste tips, making it a key circular economy partner for local authorities in France.

CITEO

Citeo is a mission-led business set up by companies in the fast-moving consumer goods and retail sectors to reduce the environmental impact of their packaging and paper waste by proposing solutions for waste reduction, reuse, sorting and recycling.

Since Citeo was founded, companies in the fast-moving consumer goods and retail sectors have invested more than €13 billion to develop eco-design, introduce and fund separate collection and create recycling streams, together with their partners – local authorities, industry sectors and operators. In 2025, 69% of household packaging and graphic paper was recycled thanks to the efforts of French people to sort their waste, now the most popular environmental "good deed".

elipso

Elipso is a trade association that seeks to promote the plastic packaging industry. Every day, Elipso:

- Monitors and analyses information to constantly update its network of members on developments in their sector, preparatory work and the implementation of legislative and regulatory changes
- Supports its members through key fundamental shifts, including the ecological transition towards a circular economy
- Contributes to, represents, speaks for and transmits the goals of a unified plastic packaging sector, with all stakeholders in mind: companies, institutions, associations, the media, and other representational organisations.

srp

The **SRP** is the French organisation representing companies that run plastics regeneration units in France. Such facilities are industrial sites used for mechanical recycling, and perform at least two of the following processes: washing, shredding, densification, micronisation, granulation, compounding. Thirty regenerators are currently members, representing fifty post-consumer recycled (PCR[1]) plastic production sites in France, which is approximately 80% of the country's capacity.

SRP members are vital links in the chain for developing an effective and low-carbon national circular economy. Within COTREP, they provide operational expertise on the impact of packaging on regeneration lines and its effect on PCR material quality as defined by converters' specifications.

[1] PCR plastics are materials/compounds that are ready for use by plastics processors as a full or partial substitute for virgin resins. They are produced by regenerators using waste from a variety of sources, including households and economic activities (farming, construction, service sector and industry). They must meet precise specifications.

Contents

ECO-DESIGN: A TOOL
FOR IMPROVING RECYCLABILITY

What progress has been made on eco-designing household packaging?

In 2026, most of the plastic household packaging tonnage in France is already recyclable.

- 75% of plastic packaging placed on the market is recyclable in existing streams This packaging includes PET, PP and PE bottles and dispenser bottles; rigid clear PET, PE and PP packaging; and flexible PE packaging. It also includes packaging whose streams have recently become operational, such as rigid PS and flexible PP packaging.
- 10% of plastic packaging is concerned by emerging streams, especially multilayer trays made of clear PET.
- 15% of plastic packaging has not yet been allocated a recycling stream and requires development to enable recycling. For example: PVC or PLA packaging, PET films, some composite packaging, etc.

COTREP,
ACTIVE AT EUROPEAN LEVEL

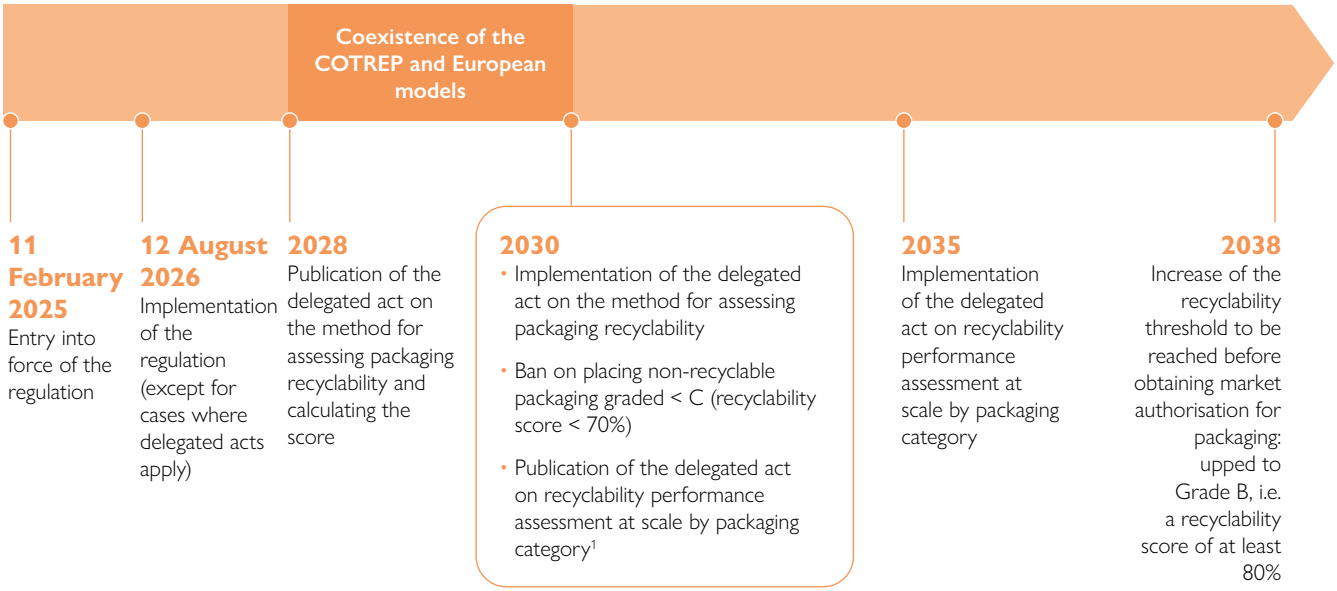
The PPWR: a European regulatory framework for reducing the environmental impact of packaging

In 2023, at time when environmental concerns and the associated challenges were fast multiplying, the European Union decided to publish the Green Deal and the Packaging and Packaging Waste Regulation, or PPWR.

The regulation was adopted by several key stakeholders, such as European institutions, national governments, environmental NGOs and representatives from the industrial sector. It bolstered, modified or replaced the existing directives in force, which were deemed insufficient in terms of waste management and plastic pollution in Europe.

The goal of the PPWR is to reduce the impact of packaging throughout its life cycle, by harmonising rules across Member States and guaranteeing the efficiency of the Single Market. It sets **reduction**, **reuse**, **recyclability** and **incorporation of recycled plastics** targets for all Member States. For example, it has introduced recyclability performance targets for packaging, which need to be met before the packaging is authorised on the market, and it has also set per-inhabitant packaging waste reduction targets. And some sectors, such as the beverage sector, are subject to reusable packaging targets.

Here are the key PPWR publication and implementation dates:



Work on standards underway to clarify regulation implementation conditions

To clarify the regulation's implementation conditions, the European Commission has tasked the European standardization body, *Comité Européen de Normalisation* (CEN), with developing standards. Regulations will draw on these standards to set out criteria for assessing whether the targets set have been reached. This includes criteria on the recyclability of household and professional packaging. As a quick reminder, the recyclability performance grade for these types of packaging must be higher than or equal to C (corresponding to a recyclability score of 70% or more) to be authorised on the market. The method for calculating such grades will be published by the European Commission on 1 January 2028 at the latest. The obligation will come into effect from 2030. Between 2028 and 2030, the European and COTREP models will therefore exist side-by-side.

The goal of European packaging recyclability standards will be to harmonise the various existing guidelines (COTREP, RecyClass, CEFLEX, Cyclos, EPBP, TCEP, etc.) to move towards common obligatory recyclability criteria. In June 2026, 14 plastic packaging standards were published by the French standardization association AFNOR. They cover recyclability performance assessment methods, design guidelines for the recycling of plastic packaging, and recyclability test protocols. Several members of COTREP contributed to this standardisation work by promoting COTREP's methods and guidelines, which reflect the industrial reality of waste recycling streams in France.

COTREP has welcomed this work on harmonising standards, which will help make it easier to assess packaging recyclability across Europe. As a committee, it reasserts its position as an important source of detailed and well-founded technical information for the entire value chain, and will continue to publish clear guidelines on plastic packaging eco-design to achieve the highest possible recyclability rates. COTREP's research work will continue and still be used to develop standards, even after publication, during given revision periods.

[1] Packaging categories are described in detail in Annex II of the PPWR (page 94)

PART 1: Plastic packaging sorting in France

CHANGES TO SORTING INSTRUCTIONS IN FRANCE

From 1992

The yellow bin was introduced so that people could start sorting certain types of packaging waste – paper/cardboard packaging, metal packaging and plastic bottles and dispenser bottles.

Now: sorting instructions extended to all plastic packaging

The goal of the plan to extend sorting instructions launched by CITEO and its partners in 2011 was to make sorting simpler for consumers by allowing them to dispose of **all packaging waste in the sorting bin**.

Today, thanks to the **extension of sorting instructions**, 99% of the French population can sort all their plastic packaging waste, including pots, trays and films.

Steps to speed up plastic recycling

Getting people to sort all types of household packaging waste has had a positive effect on the amount of packaging collected for recycling – this also applies to the first types of packaging included in sorting instructions in 1992.

An extra 7 to 8 kg of household packaging is sorted per person annually. Evidence confirming the anticipated ripple effect can be seen in the fact that part of this additional sorted packaging is glass, metal, paper/cardboard or plastic bottles/dispenser bottles. The extension of sorting instructions therefore prompted a 2.5-point rise in the recycling rate between the start of the project and its deployment at scale across France, with an additional 1.2-point rise expected in 2026, with the end of the roll-out period.

The ensuing challenge will be to design packaging that is recyclable, meaning that it shouldn't disrupt industrial sorting and regeneration processes or affect the quality of the recycled material.

1992
Sorting instructions only apply to some types of household packaging (plastic bottles and dispenser bottles, metal cans and tins, cardboard)

2011
Sorting instructions gradually extended to all household packaging (all packaging waste placed in the sorting bin)

2023
Extension of sorting instructions prompt a 2.5-point rise in recycling rate

2026
Roll-out of extended sorting instructions across France complete

PROCESSES AT SORTING CENTRES

Separating and preparing different packaging items for recycling

Packaging is placed in sorting bins by residents and is then collected and taken to sorting centres. These sorting centres separate the various packaging types into streams which are forwarded to regenerators.

It has been necessary to modernise and reorganise French sorting centres to meet the needs of the sorting instructions extension project. France has now gone from having 260 partly outdated centres to 115 modern centres fitted out with a variety of technologies to separate the different types of packaging.

The table below shows the main processes used to sort plastic household packaging waste at sorting centres before it is forwarded to regenerators. As for packaging (or packaging components) not covered by an emerging or mature recycling stream, it is channelled towards reject bins for energy recovery purposes (80%) or to be sent to landfill (20%).[1]

STEPS	DESCRIPTION	EXAMPLES OF WHAT TO AVOID
FEED	Packaging collected under the selective collection system is unloaded. Any collection bags are opened to fully separate all packaging for sorting processes.	
BALLISTIC SEPARATION	Packaging is sorted by size and shape. Depending on how they behave, packaging items are divided into flat materials (bags, films, etc.) and hollow containers (bottles, pots, trays, etc.).	**Avoid:** • Packaging that combines features of hollow containers and flat materials
METAL SORTING	Packaging items partly or fully composed of metals are divided into ferrous metals and non-ferrous metals.	**Avoid:** • Mixed plastic/metal packaging • Packaging components such as hinges, springs, etc. enclosed in plastic components
OPTICAL SORTING	Using optical sorting technology, it is possible to sort by material, as well as colour where necessary. Material sorting is performed by near-infrared (NIR) spectroscopy, enabling different plastic resins to be detected and separated. Colour sorting is performed by camera in the visible light range of the spectrum (VIS) and generally applied to the PET stream to divide it into a clear (transparent and blue-tinged) and a coloured stream.	**Avoid:** • Packaging covered in a full sleeve not of the same material as the packaging • Dark packaging incorporating carbon black • Packaging whose body is made of a combination of different resins or materials
MANUAL FILTERING	After automatic sorting, the quality of plastic streams can be further enhanced manually by operators removing easy-to-spot unwanted residual items.	**Avoid:** • Non-PET, PE, PP and PS resins For example: PVC, PLA, PC, etc. • Copolyesters (PETG, etc.)
BALING	The various sorted plastic streams are compressed into bales to facilitate and optimise transport to: • Regeneration plants • Secondary sorting centres: rigid packaging, which is part of an emerging stream, is sent to a secondary sorting centre to prepare the new streams to be sent to various regenerators.	

A technical committee for studying the behaviour of packaging in sorting centres

Following the extension of sorting instructions in France, new types of packaging started arriving at sorting centres, setting new challenges to be explored and understood. COCET was therefore created in 2021 to study the behaviour of household packaging at sorting centres, regardless of the materials used to make the packaging. Given that compatibility with sorting processes is a key packaging recyclability criterion, COCET and COTREP have always worked hand in hand: COCET issues notices on the compatibility of packaging with sorting processes, which are taken into account by COTREP when it issues its guidelines.

1 - Source: 2023 collection survey conducted by ADEME, data from 2021

NEW FLOWS TO PROVIDE MATERIAL FOR RECYCLING STREAMS UNDER DEVELOPMENT: "DEVELOPMENT STREAMS"

Waste streams that help create new recycling streams

With the extension of sorting instructions in France, new types of packaging have been arriving at sorting centres, setting the additional packaging waste separation challenge of protecting existing mature recycling streams.

It has led to the creation of two so-called "development streams" for rigid and flexible packaging, the goal being to have sufficient material to develop emerging recycling streams while also ensuring the viability of long-standing streams.

Flexible packaging development stream:

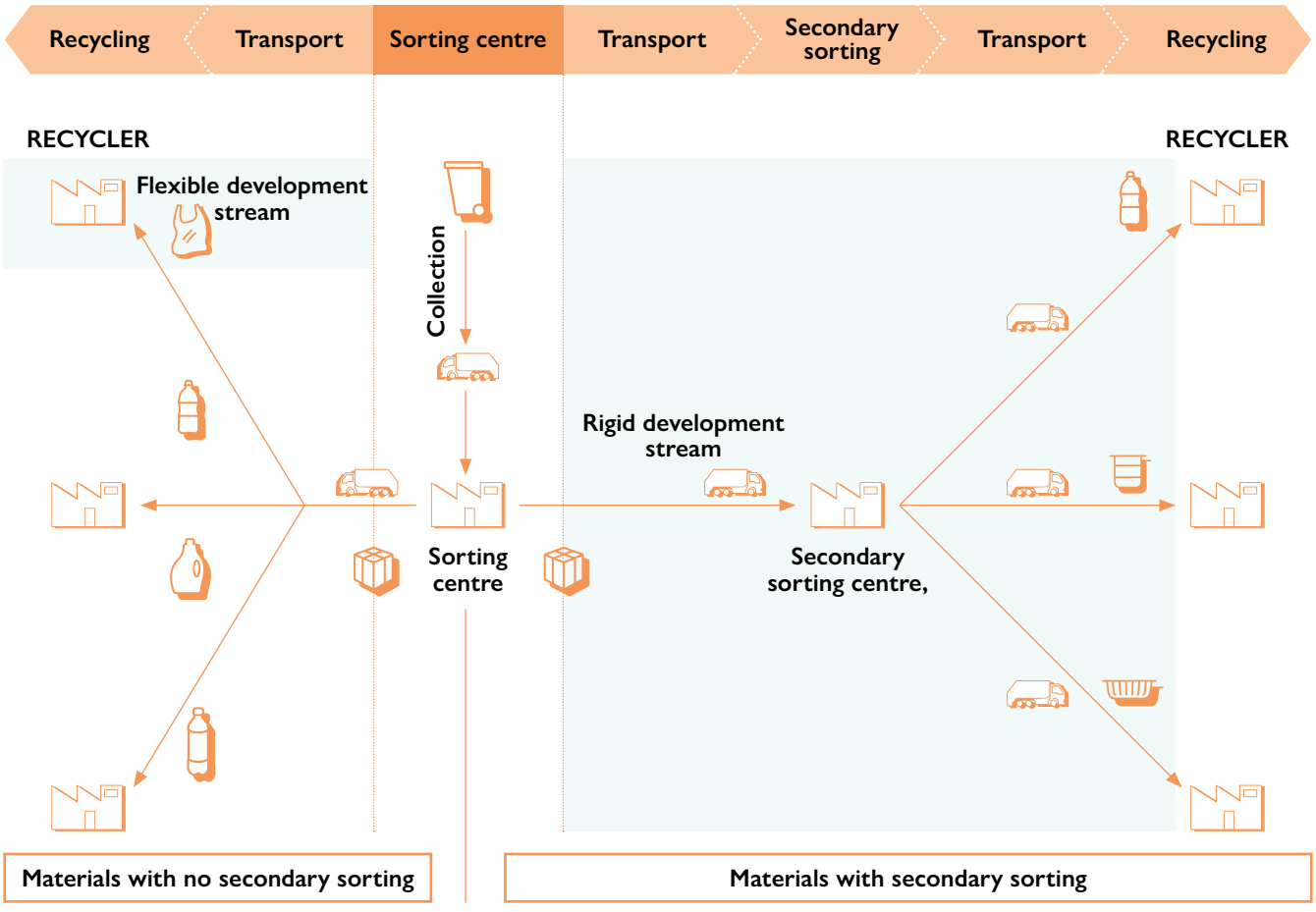
The stream is made up of flexible PE or PP packaging, and composite PE- or PP-based flexible packaging.

This new mixed stream replaces the former flexible PE stream. The packaging from this stream skips secondary sorting and is sent directly to regeneration plants that already exist or are under development. Depending on the material preparation processes and recycling technologies at each regeneration plant, additional separation may take place on their premises.

Rigid packaging development stream:

The stream is made up of clear, single- or multilayer PET trays, coloured and opaque PET packaging and PS packaging.

This new mixed stream is baled at sorting centres and forwarded to secondary centres so that the various packaging categories can be further separated before being sent to specific regeneration plants that already exist or are under development. Today, there are three secondary sorting centres in operation and a fourth under construction in France, all dedicated to the secondary sorting for the rigid development stream.



TWO CASE STUDIES OF PACKAGING WITH SORTING CHALLENGES

Small packaging items are not always captured at sorting centres

Although there is no current official definition for small packaging items, this type of packaging often ends up in the rejects bin at the ballistic separation stage. The fine fraction, in which small packaging items are included at sorting centres, is highly disparate and includes numerous impurities (sharp objects, residues, food remains, etc.). This fraction is generally rejected at the early stages of sorting by ballistic separation.

However, this on-site observation does not exempt small packaging from the statutory designed-for-recycling-by-2030 obligation, in keeping with the PPWR. In any case, given that the size of screens differs from one sorting centre to another, it's virtually impossible to determine a specific small packaging format or capacity starting from which packaging is systematically rejected at the sorting stage. Eco-design is therefore still essential alongside ongoing efforts to improve sorting technology to better capture these small formats.

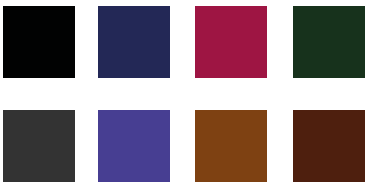
Not all dark packaging is detectable

The use of certain colorant solutions in dark plastic packaging, e.g. certain solutions containing carbon black, can render dark packaging items undetectable by optical sorting equipment. These pigments absorb infrared radiation, which means that the packaging returns no signal to the optical sorting equipment and therefore cannot be identified at sorting centres and directed towards a recycling stream.

Innovative detectable dark colorant solutions are however available. COTREP has developed a test protocol for validating the detectability of dark colorants for rigid packaging. It is available on COTREP's website. A list of detectable dark colorants tested has also been made available. This work on eco-design, which has also impacted eco-modulation, led to a 40% reduction in dark packaging containing carbon black placed on the market between 2021 and 2024.

From 2025, COCET (Committee for Studying the Behaviour of Packaging in Sorting Centres) also started to focus on the sorting of dark packaging, especially to include other types of packaging in its research.

Colours considered to be dark. A specific detectable colorant must be used.



Colours considered detectable by near-infrared optical sorting equipment.

Part 2: recycling of plastic packaging in France

REGENERATION STREAMS
DIFFERENT LEVELS OF MATURITY

Packaging collected and sorted at sorting and secondary sorting centres are sent to existing regeneration streams. Plastic regeneration plants are industrial sites performing at least two of the following processes: washing, shredding, densification, micronisation, granulation, compounding.

The development of new regeneration streams is currently underway. Some packaging items have no allocated regeneration stream.

Available streams

CLEAR PET bottles & dispenser bottles
Transparent or blue transparent bottles and dispenser bottles

COLOURED PET bottles & dispenser bottles (OPAQUE AND TRANSPARENT)
Coloured transparent and opaque bottles and dispenser bottles

RIGID PS PACKAGING
Pots and trays and other rigid packaging

Rigid PP packaging
Bottles and dispenser bottles, pots and trays, and other rigid packaging (including tubes)

Rigid HDPE packaging
Bottles and dispenser bottles, pots and trays, and other rigid packaging (including tubes)

PE films and flexible items
Flexible packaging, films, nets and bags

PP films and flexible items
Flexible packaging, films, packets, nets and bags

Other SINGLE-LAYER CLEAR rigid PET packaging
Pots, trays and other single-layer rigid PET packaging

Streams under development

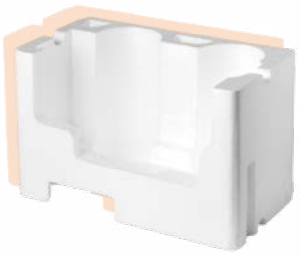
Work is in progress to set up regeneration streams for certain packaging items sorted in sorting and secondary sorting centres.

Other multilayer CLEAR rigid PET packaging

Mechanical regeneration is now becoming an option, thanks to the development of new processes. Chemical regeneration is also under study.

Other SINGLE- AND MULTILAYER rigid COLOURED PET packaging

Trials are underway to test mechanical and chemical regeneration on this type of packaging.



Special rules for EPS packaging: collected separately, not in the yellow bin

Rigid protective household packaging made of EPS is also part of a stream that's under development. Projects for separate collection at tips or buy-up at delivery to distributors will open up the possibility of launching an operational stream in the medium term.

EPS packaging is sorted, sometimes shredded, and consolidated by operators before being forwarded to mechanical regenerators specialised in EPS.

No streams available

Some plastic resins are not allocated permanent recycling streams, as the marketed tonnages are insufficient to justify organising an industrial sorting and regeneration stream.

PVC packaging

PVC waste from the construction sector has been regenerated at industrial scale for several years now.

But due to its low tonnage in terms of packaging, there are no plans to develop a dedicated sorting and regeneration stream for PVC packaging.

Moreover, this resin is not eligible for additional recovery processes (e.g. solid recovered fuel or pyrolysis), which means sorted waste containing PVC packaging cannot be recovered. PVC is therefore not appropriate for use in packaging and COTREP discourages its use.

COMPOSTABLE packaging

Compostable packaging is rejected at sorting centres, as there is no dedicated regeneration stream for this type of packaging.

Key compostable materials: PLA and PHA

Currently marketed tonnages are too low to develop a dedicated sorting and regeneration stream.

Packaging other than PE, PP, rigid PET, rigid PS packaging

Currently marketed tonnages are too low to develop dedicated sorting and regeneration streams.

MECHANICAL REGENERATION PROCESSES

Mechanical regeneration is the process by which packaging from sorting and secondary sorting centres is used to produce recycled materials ready to be reincorporated into new products.

The table below shows the main mechanical processes used to regenerate plastic household packaging waste.

STEPS	DESCRIPTION	EXAMPLES OF WHAT TO AVOID
BALE OPENING 	A quality inspection of bales is conducted on receipt: checks are performed on specifications (dimensions, weight, etc.) and compliance with quality standards (characterisation of composition).	
SCREENING  **OPTICAL SORTING**  **METAL SORTING** 	The quality of bales leaving sorting centres is not sufficiently high for them to enter the regeneration process directly. Screening and material sorting of objects are performed to remove fines, contaminants and other impurities: other polymers, non-polymer compounds (e.g. wood, metal, paper, etc.). The PET stream is also colour sorted to extract coloured or opaque PET.	**Avoid:** • Packaging combining several resins and plastic/ metal • Hinges or metal springs enclosed in plastic items • Carbon black as an outer layer or combined with materials preventing recognition by optical sorting equipment (NIR)
SHREDDING 	Packaging is shredded into flakes.	**Avoid:** • Incompatible, inseparable multilayered packaging • Glass, metal items, etc. that may damage the shredder
WASHING 	The flakes are washed to remove particles and residues (labels, adhesives, inks, remains, etc.). Conditions for washing in water: • PET: 60-90°C in alkaline conditions • PE/PP/PS: water at room temperature	**Avoid:** • Metallic ink pigments which are difficult to eliminate • Labels that are non-removable in water
FLOTATION 	The flakes are placed in a flotation tank to separate the required polymer from other polymers by density. For PE or PP, contaminants such as stones or metal can also be eliminated at this stage.  EPS: 0.04 PP: 0.9 LDPE: 0.92 HDPE: 0.94 **1: buoyancy limit in water** PS: 1.05 PLA: 1.24 PET: 1.34 PVC: 1.34-1.40	**Avoid:** • Combinations of separable items of similar densities (e.g.: PVC with PET) • Items of a very similar density to water (d=1) • Additives that alter flake behaviour during flotation (e.g.: fillers)

STEPS	DESCRIPTION	EXAMPLES OF WHAT TO AVOID
OPTICAL SORTING OF FLAKES (*)	Final filtering of flakes by optical sorting to eliminate trace impurities (other polymers, other materials, same polymer in a different colour).	**Avoid:** • Materials/resins other than the majority resin (loss of material: approximately 20 flakes removed per 1 unwanted flake in the stream) • Plastic combined with metal (aluminium or steel)
EXTRUSION/ GRANULATION	Conversion into granulate with a filtration stage to eliminate any final impurities.	**Avoid:** • Thermosetting materials • Combining with polymers that have different softening/melting points to the main polymer • Materials that are not separable by filtration • Metal items
VACUUM DECONTAMINATION (**)	The PET is heated under vacuum to extract any remaining contaminants, make it suitable for contact with food, and increase the viscosity to achieve characteristics required for manufacturing bottles or trays.	**Avoid:** • Direct printing except for expiry dates on clear PET
QUALITY CONTROL	Quality check (of physical, mechanical and chemical parameters) prior to shipment to plastics converters for manufacture of new items.	

(*) optional step performed on certain regeneration lines (**) for food-grade PET only.

Packaging items (or components of packaging items) with elements that cause issues for regeneration are rejected (the procedure varies depending on the stage in the process at which they are discarded).

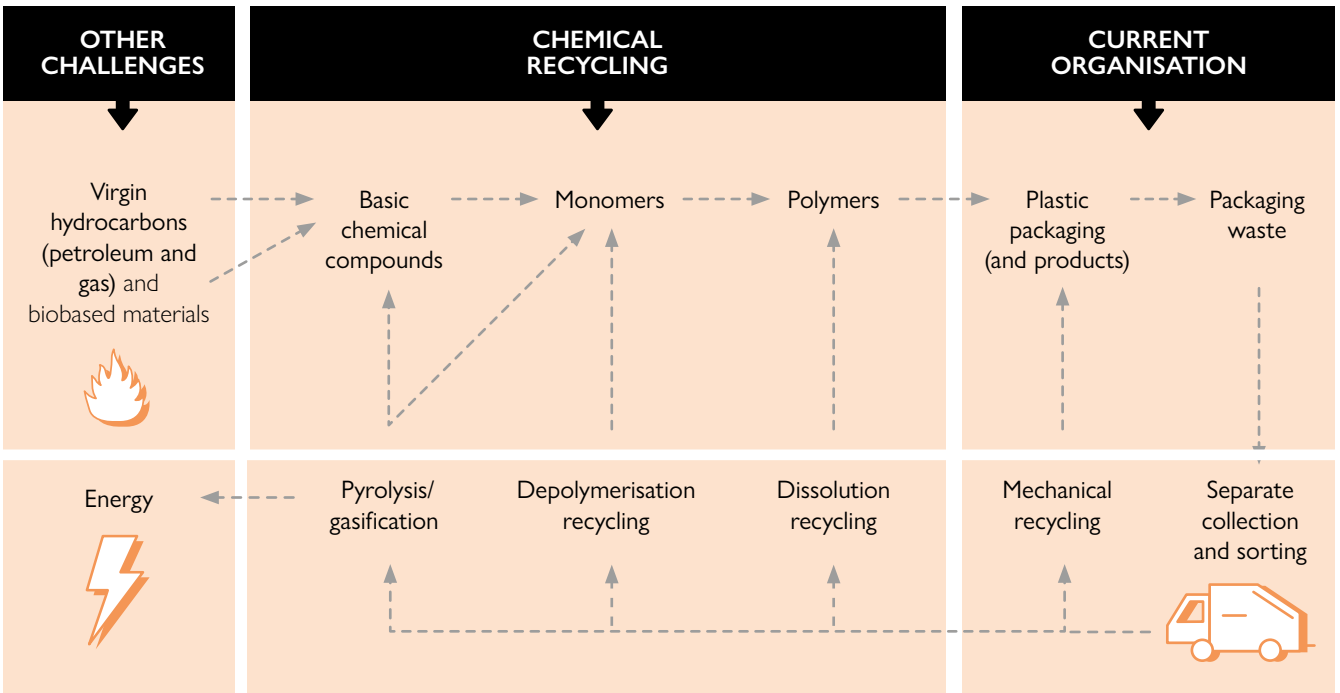
CHEMICAL RECYCLING:
AN OVERVIEW

Chemical recycling – a solution to supplement mechanical recycling

Chemical recycling is a solution that's currently at a laboratory, pilot and/or at-scale development stage, depending on the process. The goal is to process certain types of composite packaging, or packaging that is hard to recycle using mechanical solutions.

The term chemical recycling may cover several types of processes:

- **Physical or dissolution recycling:** the plastic is mixed into a solvent to remove additives and colorants, leaving only "pure" plastic. The polymers remain intact.
- **Depolymerisation recycling:** a chemical, biological and/or thermal process breaking plastic's molecular bonds to turn them back into monomers.
- **Pyrolysis and gasification:** these heating processes are used to break plastic's molecular bonds to form liquid (pyrolysis oils) or gaseous (syngas) hydrocarbons similar to petroleum refining by-products used for making plastic.



Plastic pyrolysis plants have recently been commissioned in Europe and are ramping up operations. The plants process some plastic from the PS stream and some from the emerging flexible packaging stream, which includes packaging from the French separate waste collection system, ensuring these streams remain operational.

PYROLYSIS:
FOCUS ON A CHEMICAL RECYCLING PROCESS

Pyrolysis – a process rolled out to develop polystyrene and flexible packaging recycling

With the extension of sorting instructions in France and the development of sorting and secondary sorting facilities, a significant additional supply of packaging waste has become available for recycling streams.

This is the especially case for some flexible packaging and some PS packaging, which now have a recycling stream based on the plastic pyrolysis process, in addition to existing mechanical recycling streams.

Stages of the plastic pyrolysis process

1 Preparation of the material:

Before entering the pyrolysis reactor, packaging is pre-treated to remove as many impurities as possible and prepare it appropriately. The packaging is shredded and metal elements and fines are then removed. It then undergoes optical sorting to remove elements that may disrupt the recycling process. Once sorted, the packaging is finely shredded and sometimes densified. It is then fed in shredded or densified format into the reactor where pyrolysis takes place.

2 Pyrolysis:

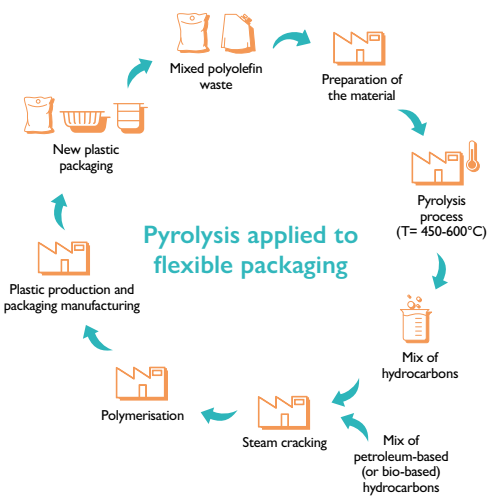
The processed raw material fed into the reactor is heated to a very high temperature (400 to 600°C) in an oxygen-free environment, so that it doesn't oxidise and catch fire. During the ensuing partial chemical breakdown, some molecules turn into vapour. This vapour then cools and condenses directly into **monomers, where polystyrene is concerned,** or **a pyrolysis oil requiring further processing, where polyolefins are concerned**.

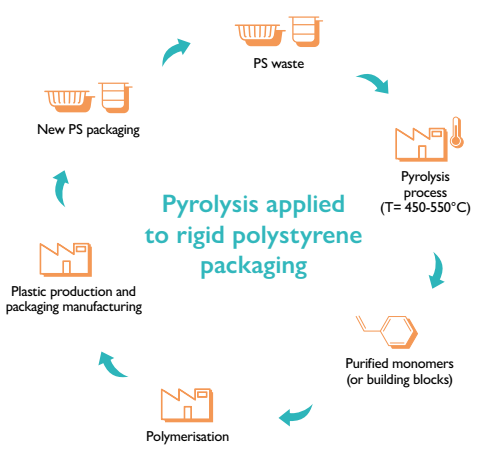
3 Flexible polyolefin packaging and transforming pyrolysis oil into monomers:

Pyrolysis oil mixed with virgin naphta (mainly fossil or bio-based) is then subjected to **steam cracking**. This reaction transforms the hydrocarbons into monomers.

4 Polymerisation:

The monomers obtained are polymerised to produce a plastic material with a quality equivalent to raw plastic.
The plastic obtained can be used to make food-grade packaging.





RECYCLING – A SECOND LIFE!

Today

Mechanical recycling is the most common process in Europe Applications for recycled polymers vary depending on the material's mechanical properties, colour, available quantities, and suitability for use in food-grade products.

Outlets for clear PET bottles:

In France, the recycled clear PET stream consists of transparent blue or colourless plastic bottles and dispenser bottles. Most French clear PET regenerators currently apply EFSA[1]-approved processes enabling them to produce food-grade clear rPET. Currently, the main outlets for clear rPET are packaging items, i.e. bottles, pots and trays.

Outlets for clear single-layer PET trays:

Clear single-layer PET trays are mechanically regenerated.

The material produced through the mechanical recycling process is used to make rigid packaging, such as trays, with a decontamination stage sometimes included to obtain food-contact grade packaging.

Outlets for coloured PET bottles:

Coloured PET bottles have always been recycled into fibres.

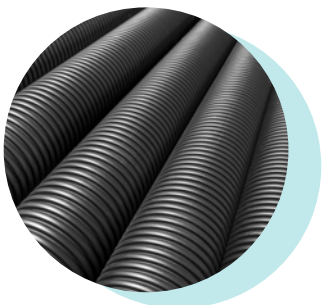
This outlet is changing, with some of the packaging stream being used to produce food-grade bottles where certain bottle colours are concerned (green and opaque white).

Outlets for rigid PE packaging:

In France, rigid PE packaging is generally regenerated without being sorted by colour or packaging type. The regenerated material has therefore always been grey. The main applications for grey rPE from rigid packaging are tubes for the construction sector, watering cans, car seats and bins.

The sorting of flakes at regenerator facilities has enabled different ranges of coloured or colourless regenerated materials to be developed. The new ranges have led to the development of non-food packaging applications.

As part of the effort to meet PPWR requirements on reincorporating recycled materials, French rigid PE regenerators are carrying out R&D projects to study the feasibility of producing recycled PE that can be reincorporated into food packaging. It's therefore possible that eco-design guidelines for rigid PE packaging will change to make space for these new outlets.



[1]EFSA: European Food Safety Authority

Outlets for rigid PP packaging:

In France, rigid PP packaging is regenerated without being sorted by colour or packaging type. The regenerated material is therefore grey. rPP is generally used to make injection-moulded parts for manufacturing automotive components, flower pots, or storage crates. Non-food packaging applications are also beginning to be developed.

As part of the effort to meet PPWR requirements on reincorporating recycled materials, French rigid PP regenerators are carrying out R&D projects to study the feasibility of producing recycled PP that can be reincorporated into food packaging. Consequently, the eco-design guidelines for rigid PP packaging may change to make space for these new outlets.

Rigid PS outlets:

Rigid PS packaging is regenerated without being sorted by colour or packaging type. It can be regenerated mechanically or chemically.

The chemically regenerated material can be reincorporated into the production of new packaging, especially food-grade packaging.

The mechanically regenerated material is grey in colour. rPS from rigid packaging is generally used to make hangers, furniture legs, thermoforming sheets (used for horticultural trays, for example). Recycled-to-food-grade projects for mechanically recycled plastic are in progress.

Outlets for flexible PE packaging:

Flexible PE packaging is regenerated without being sorted by colour or packaging type. It can be regenerated mechanically or chemically.

The mechanically regenerated material is therefore grey. rPE from flexible packaging is generally used to manufacture bin bags and irrigation pipes.

Some of the packaging from the flexible PE stream is chemically regenerated. In that case, the regenerated material can be reincorporated into the production of new packaging, especially food-grade packaging.

Outlets for flexible PP packaging:

Flexible PP packaging is chemically regenerated without being sorted by colour or packaging type. The chemically regenerated material can be reincorporated into the production of new packaging, especially food-grade packaging.

Tomorrow

Mechanical and chemical recycling solutions are currently being studied for streams under development. The recycled material produced will generally be reincorporated into new packaging.

Planned outlets for multilayer clear PET trays:

Mechanical and chemical recycling processes for multilayer clear PET trays are currently being explored.

The plastic produced using these processes is designed to be used to manufacture rigid packaging, especially trays.

Planned outlets for single-layer and multilayer coloured PET trays:

Regeneration processes for coloured PET trays are currently being explored.

The regenerated material is designed to be reincorporated into the production of new packaging, especially food-grade packaging.

Planned outlets for EPS packaging collected elsewhere than via the yellow bin

EPS packaging is chemically regenerated into EPS beads or extruded/granulated to obtain PS granules.

rPSE is generally used to manufacture packaging that is not contact-sensitive, stuffing for seating, or panels for the construction sector.

Encouraging the development of new outlets: the challenges of clear plastics

The outlets for recycled plastics depends significantly on the final properties of the regenerated plastics, especially the colour.

When coloured (especially dark) packaging is recycled, it often leads to darker coloured recycled plastics with limited outlets. Furthermore, de-inking processes are not in widespread use today, given how ineffective they are for packaging that is mass-dyed or has printed matter on it.

However, using clear or colourless plastic and reducing the amount of ink used to a minimum are an excellent way to meet the expectations of manufacturers and develop new outlets for recycled plastics. For example, higher added value applications, such as manufacturing new packaging, in anticipation of the PPWR.

That's why regenerators advocate using clear or neutral colours, as well as elements that don't have a lasting impact on the colour of the recycled plastic (such as metallised surface decoration, metallised inks, dark colorants, etc.). This design choice contributes directly to opening up recycling possibilities and strengthening the circularity of plastic packaging.

INCORPORATION OF RECYCLED PLASTICS: THE CHALLENGE OF RECYCLED CONTACT-SENSITIVE PACKAGING

Ever demanding targets for incorporating recycled plastics:

As we transition to a circular economy, the incorporation of recycled material will become obligatory for plastic packaging items in Europe under the PPWR. Article 7 sets out the following targets for incorporating post-consumer recycled plastics (PCR[1] - PCW[2]):

PACKAGING TYPE	PERCENTAGE OF POST-CONSUMER RECYCLED MATERIALS[3] TO BE INCORPORATED PER YEAR		
	2025	**2030**	**2040**
Contact-sensitive plastic packaging made of PET (majority material)	25% (Single Use Plastic Directive)	30%	50%
Contact-sensitive plastic packaging other than that made of PET		10%	25%
Single-use plastic beverage bottles		30%	65%
Plastic packaging other than that already mentioned above		35%	

Regulatory requirements for decontamination technologies

Plastics can be exposed to contaminants throughout their life cycle. However, it is difficult to anticipate when contamination may occur: it varies depending on the type of resin and whether it attracts or repels certain substances. As a result, it's impossible to establish a set of criteria applicable to all recycled plastics.

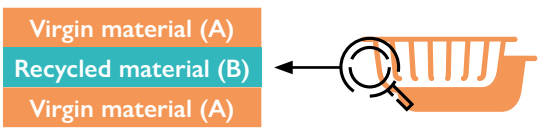
The safety of a recycled plastic therefore depends on the quality of sorting operations and making sure the right decontamination technology is used. The entire value chain is collectively responsible for these aspects, which are essential if we want to guarantee the safety of consumers.

Two technologies have been designated as suitable in keeping with the regulation on recycled plastics intended for food-grade packaging[4], and can continue to be used under the conditions provided for in the opinions published by the European Food Safety Authority (EFSA):

- Recycling of certain packaging within a closed loop
- Mechanical PET recycling **provided that the incoming stream contains no more than 5% of packaging from non-food consumer applications**

Any other recycling technology that has not yet been approved by the EFSA is considered new and must go through an assessment process.

Please note that functional barriers (also called ABA structures) are regarded as new technologies – a functional barrier is a packaging layer separating the product from the recycled material to avoid direct contact between the two.



[1] PCR plastics are materials/compounds that are ready for use by plastics processors as a full or partial substitute for virgin resins. They are produced by regenerators using waste from a variety of sources, including households and economic activities (farming, construction, service sector and industry). They must meet precise specifications.

[2] Plastic post-consumer waste (PCW) is plastic waste generated by products made of plastic, placed on the market or supplied for the purpose of being distributed, consumed or used.

[3] The assessment is carried out by packaging format and an average score will be calculated per manufacturing site and per year.

[4] Regulation (EU) No. 2022/1616.

Recycling polyolefins to food grade is a real technical challenge

For the moment, the EFSA has not approved any mechanical recycling process for the recycling of resins to food grade other than for PET[1].

This can be explained by two factors:

- **Absorption properties that vary between different resins:** because of their structure, polyolefin resins can absorb a wide variety of contaminants with varying migration rates. They are somewhat like "sponges", and sometimes release contaminants into the final product. PET, however, is not very absorbent in terms of quantity and range of contaminants. It is therefore easier to decontaminate PET than polyolefin packaging.
- **Different levels of maturity in terms of decontamination performance testing:** A standardised method for testing the performance of decontamination processes for PET is currently available, making it easier to evaluate the safety of recycled PET. No such method exists for polyolefins.

However, to meet PPWR reincorporation targets, regenerators are now studying how to produce recycled PE and PP that can be used for food packaging in compliance with regulations. The studies are being conducted jointly with technology providers and research laboratories.

Otherwise, chemical recycling also offers further opportunities, alongside mechanical recycling, for polyolefin resins as well as other categories of resin (e.g. styrenics). Breaking resins back down into monomers and other starting substances means you can produce new food-grade resins from packaging waste.

How can eco-design help incorporate recycled plastics back into packaging?

Eco-design supplements the efforts made in terms of sorting and decontamination technologies by discouraging the use of combinations of resins likely to lead to contaminations as much as possible . It contributes to improving the purity of the packaging waste entering mechanical regeneration plants, and to developing new outlets.

Through its members, COTREP monitors various projects receiving packaging waste from the separate collection system in France, and exchanges with stakeholders to ensure that the guidelines it publishes are adapted to the various recycling processes. When several processes are available, COTREP makes sure its guidelines are relevant to both mechanical and chemical recycling.

Resources to provide you with more information:

Below is a list of the regulations on the safety of plastic materials intended for contact-sensitive packaging or objects:

- Regulation (EU) No. 10/2011 on plastic materials and articles intended to come into contact with food. It applies to virgin plastics and recycled plastics produced using authorised monomers and starting substances.
- Regulation (EU) No. 2022/1616 that governs recycled plastics intended to come into contact with foods, especially those produced via mechanical or physical[2] recycling processes.

Below is the REACH regulation on the marketing of all products:

- Regulation (EC) No. 1907/2006 (REACH), which registers, evaluates and controls chemicals substances used in Europe, some of which are present in plastics.

[1] Aside from a few processes that operate in a closed loop system.

[2] Physical recycling is a process whereby a plastic undergoes several purification stages to separate the reusable polymer(s) from other polymers, additives and other added substances, resulting in virgin-like polymers that are chemically intact for the most part and can be reused to manufacture new plastic products.

END OF LIFE AND RECYCLABILITY OF REUSABLE PACKAGING

Since the publication of the AGEC Law and the PPWR, requirements regarding the placing of reusable packaging on the market have emerged. The PPWR sets out that 10% of packaging used in the beverage sector must be reusable from 2030.[1]

Packaging is considered reusable if it has been designed, manufactured and marketed to be used for multiple trips or rotations during its life cycle, by being refilled or reused several times for a purpose identical to that for which it was designed. Such reuse is organised by or on behalf of the producer.

It is important to remember that reusable packaging needs to meet the same recyclability requirements as single-use packaging by 2030. **These new reusable packaging items must not be discarded in the household sorting bin**, but returned to points of sale instead.

This is because reused household packaging items[2] are not collected and sorted for recycling in the same way as single-use household packaging: they are not supposed to be sent to packaging waste sorting centres. Instead, they are set aside by washing operators at the sorting-washing-inspection stage, before being sorted, grouped together and then sent to specific recyclers.

The recyclability of reusable packaging therefore needs to be carefully evaluated using a method approved by the entire value chain and standardised across all types of packaging, without forgetting to take account of the specificities of the various reuse systems. The TREE tool will still be the go-to tool for assessing the recyclability of reusable packaging.

Nevertheless, we cannot exclude the possibility that some consumers may discard such packaging in the sorting bin, and that it then arrives at sorting centres along with single-use household packaging. Consequently, the detection of these types of packaging item by optical sorting equipment needs to be investigated to make sure that, if disruptive, they are rejected at the sorting centre so as not to pollute single-use packaging recycling streams.

COTREP has been asked to draw up guidelines and determine, where applicable, the disruptions reusable packaging may cause if it ends up in existing single-use household packaging recycling streams.

[1] For more information on reuse obligations, consult Article 29 of the PPWR (page 58): Regulation (EU) 2025/40 of the European Parliament and of the Council of 19 December 2024 on packaging and packaging waste

[2] Reused packaging is reusable packaging that has completed at least one rotation before being placed back on the market.

Part 3: COTREP guidelines

DESIGN PRINCIPLES FOR RECYCLABLE PACKAGING IN FRANCE

COTREP publishes guidelines helping designers and users of plastic packaging to market solutions that can be collected, sorted and regenerated in French packaging recycling streams. Each stream operates in its own specific way and has its own prerequisites and outlets for regenerated materials.

Rather than performing individual recyclability assessments, COTREP provides a knowledge base comprising a set of general notices and guidelines helping individuals assess the recyclability of their packaging.

The following 3 principles should be applied to ensure that packaging is recyclable throughout France:

1 The priority is to recycle the main packaging element, i.e. the packaging body For example: the bottle, tray or pot body, the film, etc.

Ideally, the main element should therefore be mono-material and composed of a resin that is sorted and directed to an existing recycling stream.

PACKAGING TYPE	BOTTLES & DISPENSER BOTTLES	POTS, TRAYS & OTHER RIGID PACKAGING	FILM & FLEXIBLE PACKAGING
Existing streams	Clear PET, coloured transparent and opaque PET, PP, HDPE	Clear single-layer PET, PP, HDPE, PS	PE, PP
Streams under development		Clear multilayer PET Coloured single-layer and multilayer PET	

2 Barriers, additives and fillers should not compromise sorting and recycling.

The main resin is often combined with other materials used to improve packaging features (barrier properties, sealability, visual aspects, machinability, etc.). For example, packaging should not contain carbon black as an outer layer, or fillers or additives that alter its density. Compatible functional barriers should be used instead.

3 None of the associated components should disrupt recycling of the packaging body.

Design choices for associated components (closure systems: covers, lids, etc. and design elements: labels, inks, adhesives, etc.) should be based on the resin used in the body.

GUIDELINES ON ECO-DESIGN IN FRANCE

Recycling compatibility is rated using 4 categories

COTREP guidelines are regularly updated to improve their accuracy and better reflect the impacts of packaging components on recycling.

The guidelines are based on advice from experts and the results of tests carried out using protocols drawn up by COTREP, to closely reflect the current industrial context for recyclers processing French packaging waste. It reflects current knowledge of the various streams and may be updated to reflect changes in industrial practices and packaging tonnage.

For each sorted stream, COTREP issues guidance on recycling plastic packaging in optimal conditions without disrupting the stream (in terms of yield, damage to equipment, decline in the quality of recycled materials, etc.).

The guidelines are split into 4 categories. Each packaging component is assessed in light of sorting and regeneration constraints for the various streams.

FULL COMPATIBILITY – IDEAL

This category includes elements that are most compatible with recycling in the identified stream.

Congratulations! No need for further action. Your packaging element or resin is eco-designed to be recycled in line with the French system.

Example:
- PE cap on a PET bottle

PARTIAL COMPATIBILITY – TOLERATED

The elements or resins that are compatible with recycling in the identified stream.

COTREP considers them to be sufficiently compatible with the recycling stream.

Example:
- EVOH in rigid PP and HDPE packaging

LIMITED COMPATIBILITY – CONDITIONAL

This category includes components or resins that have limited compatibility with recycling in the identified stream and should be substituted where possible.

Although inclusion of such items in the recycled stream causes issues, the sector has adapted to limit impacts to an acceptable level under current marketing conditions.

Action should be taken to substitute these components where possible.

Example:
- Aluminium lid on an HDPE bottle

NON-COMPATIBLE AND/OR DISRUPTIVE

This category includes components or resins that should be avoided as they will significantly diminish the quality of recycled material and/or disrupt sorting and regeneration processes.

Priority action should be taken to attempt to eliminate such components.

Examples:
- Aluminium on PET
- PVC on PET
- Wood combined with rigid HDPE or PP

Moving towards harmonised European guidelines

Harmonised European guidelines will be effective as soon as the corresponding delegated act is published in 2028. COTREP and European guidelines will exist side-by-side from 2028 to 2030, with either being applicable to comply with the QCE decree[1]. From 2030, the harmonised European guidelines provided for by the PPWR's delegated act will take precedence for all European Union Member States.

[1] Decree No. 2022-748 of 29 April 2022 concerning consumer information on the environmental qualities and characteristics of products generating waste: https://www.legifrance.gouv.fr/jorf/id/JORFTEXT000045726094

HOW TO USE THE COTREP GUIDELINES?

Assessments should be performed in 3 steps:

1 Select the packaging type you wish to assess (bottle, dispenser bottle, tray, pot, flexible packaging, tube, etc.)

2 Select the majority plastic resin used in the packaging body

3 Consult the detailed guidelines for the body, closure system, design elements, and any other associated components

i. **Packaging body:** This is the majority component that should be given priority for recycling. Which colours, barriers and additives are compatible with the main resin?

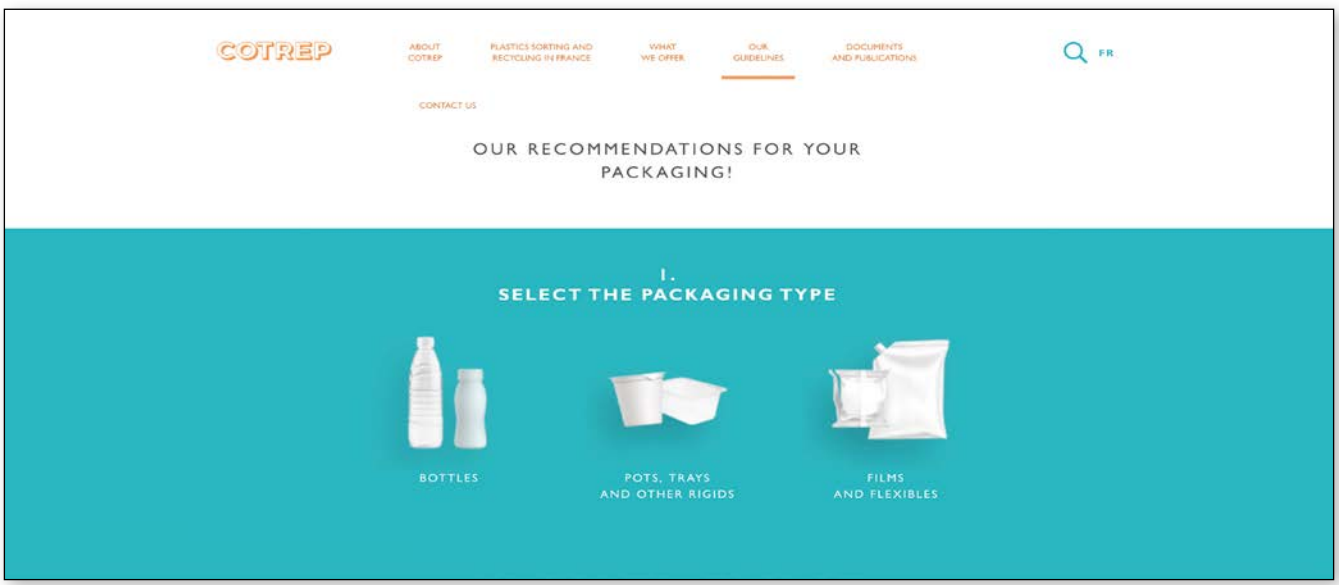
ii. **Closure system:** These associated components should not disrupt recycling of the packaging body. Please note that if your packaging includes a lid or cover, the adhesive used to bond the closure system should also be included in the assessment.

iii. **Design elements**: These should be designed to enable the packaging item to be sorted in the appropriate recycling stream and to be easily separable from the packaging body during regeneration. What labels, sleeves or printing is appropriate for your packaging item?

How should the COTREP guidelines be interpreted?

If a component falls in the orange column (limited compatibility – conditional), this does not mean that your packaging item is not recyclable in its stream and you should not be discouraged. Where possible, we recommend carrying out eco-design or R&D work to try and substitute it and improve your packaging's recyclability grade.

If a component falls in the red column (not compatible and/or disruptive), this means that your packaging item is not recyclable in the French stream as this component limits recyclability of the full packaging item. These disruptive elements may damage regenerators' industrial facilities and/or diminish the quality of recycled material.



Finding information

Technical Committee for the Recycling of Plastic Packaging www.cotrep.fr

- Guidelines issued on the compatibility of packaging with recycling streams
- Provision of general notices on the impact of packaging on the recycling stream

Committee for Studying the Behaviour of Packaging in Sorting Centres www.cocet.fr/

- Field of action: Household packaging, all materials
- Publication of protocols to show you the framework of the various tests and their methodology
- Publication of general notices outlining the lessons learned from the tests

Assessing recyclability

Packaging recyclability test
https://tree.citeo.com/

- Packaging recyclability performance assessment based on guidelines issued by COTREP and other specialist material networks
- Identification of disruptive components

FURTHER INFORMATION

Securing backing for your environmental process

French Environment and Energy Management Agency www.ademe.fr

- General database on eco-design and sustainable development
- Funding of projects relating to eco-design and packaging waste management

Glossary

d	Density
EFSA	European Food Safety Authority
EVOH	Ethylene vinyl alcohol
HDPE	High Density Polyethylene
LDPE	Low Density Polyethylene
NGO	Non-Governmental Organisation
NIR	Near-Infrared
PA	Polyamide
PC	Polycarbonate
PCR	Post consumer recycled materials
PE	Polyethylene
PET	Polyethylene terephthalate
PETg	Polyethylene terephthalate glycol
PHA	Polyhydroxyalcanoates
PLA	Polylactic acid
PP	Polypropylene
PPWR	Packaging and Packaging Waste Regulation
PS	Polystyrene
PVC	Polyvinyl chloride
R&D	Research and Development
rPE	Recycled polyethylene
rPET	Recycled polyethylene terephthalate
rPP	Recycled polypropylene
SRF	Solid Recovered Fuel

COTREP

www.cotrep.fr

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including this document.

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