

"How to specify and design paper-based packaging in a way to ensure high quality recycling by the paper industry"



EXECUTIVE SUMMARY

How can the value chain, including retailers and brand owners, specify and design paper-based packaging to support the recycling process?

There is a growing expectation from consumers, brands and retailers that the packaging they use is recyclable, as part of a global ecodesign approach to reduce its impact on the environment. Producers and recyclers of paper-based packaging are committed to delivering on this expectation.

A primary function of packaging is to protect the packed goods during the logistics chain until their final consumption in order to avoid product loss and food waste. Another important function is the communication to the consumer. Paper is always recyclable but some functional properties expected from the packaging require it to be in some cases coated, laminated or treated in other ways in order to meet the different barriers or functional requirements (e.g. for food contact) which can be more challenging for the recycling process. The combination of paper and board with other materials must therefore be implemented in a way that does not hamper recycling, while ensuring that the expected role of packaging is fulfilled.

The recommendations here in will allow the value chain, including retailers and brand owners, to improve the recyclability of paper packaging products in the paper recycling process.

These recommendations are generally applicable in Europe, however it is recommended that national Extended Producer Responsibility schemes or relevant bodies are referred to in order to ensure the recyclability of the packaging on the targeted markets and to comply with specific national protocols for assessing recyclability of packaging. National protocols are divergent due to the presence of different collection systems and requirements for collection in the paper and board stream. While national specificities continue to exist, steps towards a harmonisation of recyclability test methods are underway. The recommendations below should be communicated widely to the value chain, including retailers and brand owners, to further improve paper packaging recyclability and help meet national protocols and requirements. The undersigned organisations will continue the open dialogue in the value chain to assess developments in material and recycling technology in order to review these guidelines, as appropriate.





The design phase should consider the intended purpose and end-of-life stage of the packaging in order to optimise the recycling of paper packaging

REGARDING METAL OR PLASTIC LAMINATES

- Use only the required quantity of non-paper constituents to fulfil the expected functions of the packaging.
- If non-paper constituents are needed for the intended use, the separation of the different elements should be as easy as possible.
- Plastic lamination layers should not readily degenerate or break into very small pieces in the pulping stage.
- Optimise the adhesion between the laminate side and the board to facilitate separation.
- If functionality allows, use material that is laminated on one side only.

REGARDING ALTERNATIVE BARRIERS FROM NEW TECHNOLOGIES, FOR EXAMPLE POLYMER DISPERSION COATED BARRIERS AND DIRECT METALLISATION

When designing alternative barriers, refer to recognised recyclability test methods and test at paper recycling mills to verify performance on the following aspects:

- Ensure that paper fraction of the packaging breaks down into single fibres when pulped within a specified time frame.
- Give preference to polymers and other sealing agents that can be removed from the fibre in the conventional screening process.
- Give preference to polymers, sealing agents and application processes that can be dealt with efficiently by the paper mill process and effluent water systems and do not compromise the finished product, the production process or the environment whilst being recycled.
- Direct metallisation: Metallic and other inorganic coatings applied via vacuum deposition shall not hinder the repulping process and shall be capable of being screened out.

REGARDING COATINGS AND VARNISHES

- When using water soluble or non-water soluble coatings, refer to recognised recyclability test methods and test at paper recycling mills for performance in the process and waste water treatment.
- Identify varnishes that break down into large, discrete particles.

REGARDING ALTERNATIVE FIBRES

- Ensure that alternatives to cellulosic wood fibres, such as from agricultural residues have been prepared for use in papermaking and can be recycled.

REGARDING INKS

- Optimise the quantity of used ink.
- Use mineral oil free inks in accordance with the industry commitment¹.
- Minimise metallic components in the ink formulation.
- Where possible, consider deinkable² printing technology when producing packaging from bleached paper and board.
- For producers of food contact packaging, follow the Food Contact Guidelines for the Compliance of Paper and Board Materials and Articles³. Producers of inks should follow EUPIA's guidance for food contact inks⁴.

REGARDING ADHESIVES

- Optimise the quantities of adhesives to fulfil the expected sealing of the packaging while considering the influence on paper recycling.
- Minimise certain "soft" adhesives such as those adhesive tapes and self-adhesive labels with an adhesive film that cannot be separated in the recycling process.
- Give preference to adhesives that can be applied in a way that they can be easily removed from the pulp at typical temperatures in the packaging recycling mill environment⁵.

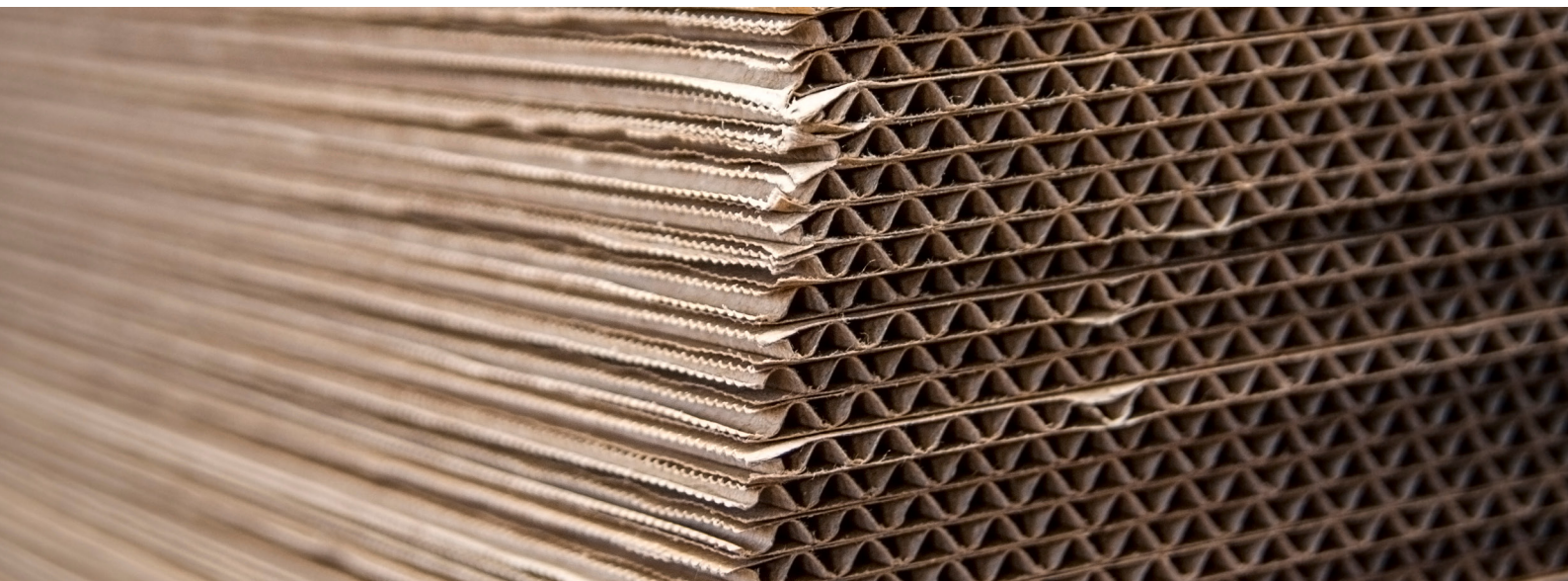
- For producers of food contact packaging, choose adhesives intended for food contact application. Producers of other grades should consider to do so as well in order to reduce critical substances which may tend to accumulate.
- For producers of food contact packaging, follow the Food Contact Guidelines for the Compliance of Paper and Board Materials and Articles⁶. Adhesives producers should follow FEICA's guidance for a food contact status declaration for adhesives⁷.

REGARDING THE USE OF CHEMICALS

- Give preference to chemicals that have no tendency to accumulate in fibres over several recycling cycles.
- Do not use substances of very high concern unless an authorisation is granted for the specific use⁸.

REGARDING SPECIAL PAPERS

- To meet functionalities such as water-resistance or greaseproof, there are special papers such as wet-strength, waxed or wax coated papers, siliconised papers, or papers treated with fluorochemicals. To improve recyclability, pay attention to the amounts of substances used that make these papers greaseproof or water-resistant.



¹ CEPI CITPA press release, 8 December 2011

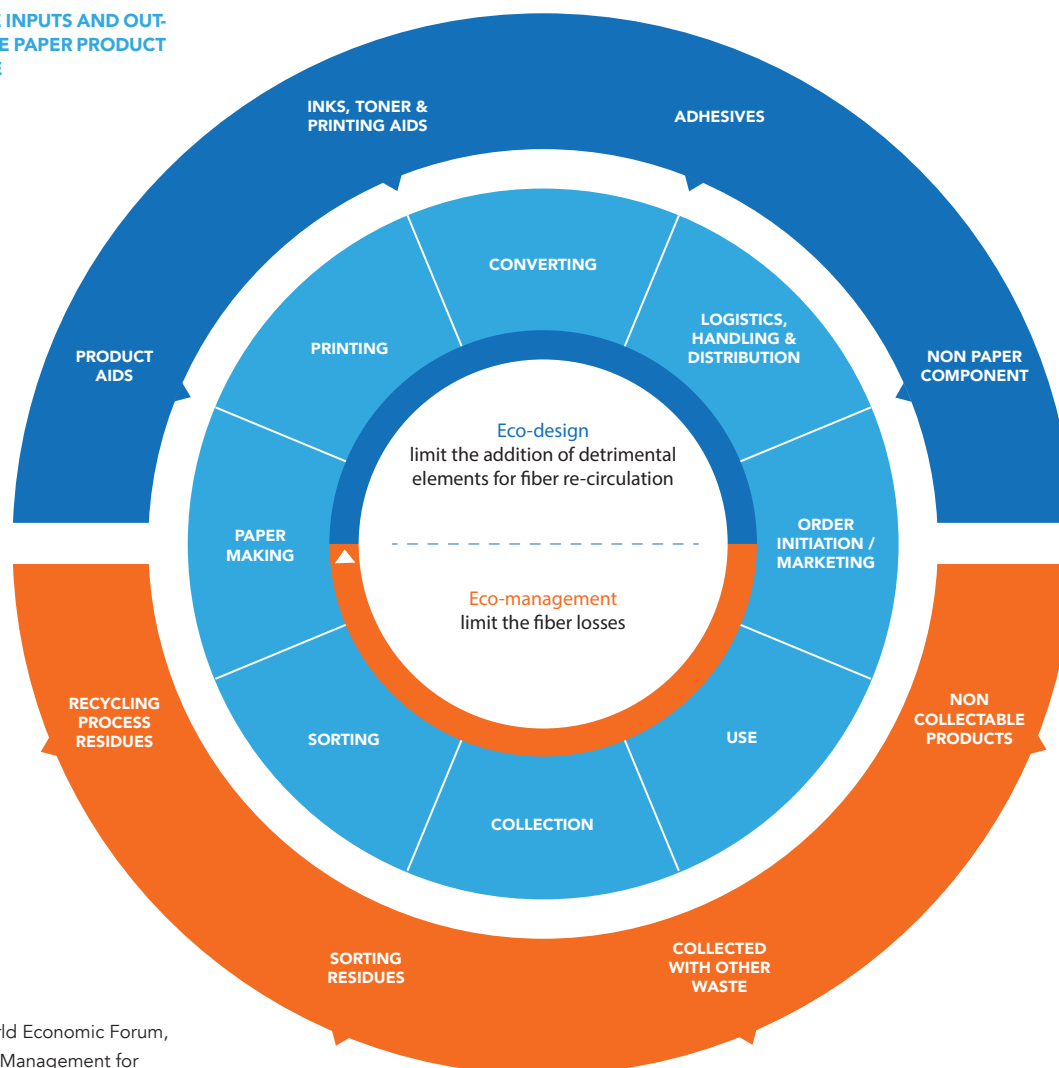
² Deinkability is a function of the ink, substrate and drying/curing technology as well as further surface treatment

³ Food Contact Guidelines for the Compliance of Paper and Board Materials and Articles (http://www.cepi.org/food_contact_guidelines)

⁴ <https://www.eupia.org/key-topics/food-contact-materials>

⁵ For graphic paper products, the EPRC scorecard for the removability of adhesive applications recommends adhesives with a softening point of more than 68° Celsius and a film thickness of more than 120µm. www.paperforrecycling.eu

NON-FIBRE INPUTS AND OUTPUTS IN THE PAPER PRODUCT LIFE CYCLE



Source: World Economic Forum, Design and Management for Circularity - The case of paper

REGARDING FOOD AND OTHER RESIDUES IN PACKAGING

- Design the packaging in a way that it can be optimally emptied.
- Encourage consumers to empty and clean the empty packaging before placing it in the right bin.
- Where applicable, ideally provide tear-off solutions or peelable surfaces to allow consumers to dispose of the surface in contact with food in the appropriate waste bin and the clean paper substrate in the paper recycling bin.

REGARDING CONSUMER INFORMATION

- Consider providing consumers with information to encourage sorting and placing of the packaging in the right bin.

European legislation requires paper to be separately collected, as this is a pre-requisite for recycling. There are different national collection schemes and recyclability protocols in place. Some countries collect all paper-based packaging in one stream. Other countries differentiate a separate paper and board fraction and collect some paper-based packaging with the lightweight packaging stream. Provided that appropriate collection and sorting is organised, literally all paper packaging can be recycled. The paper industry has invested in a wide network of paper mills with innovative processes in order to allow recycling in standard or specialised paper recycling mills.

⁶ Food Contact Guidelines for the Compliance of Paper & Board Materials and Articles (http://www.cepi.org/food_contact_guidelines)

⁷ <http://www.feica.eu/our-priorities/key-projects/food-contact.aspx>

⁸ Substances listed in Annex XIV of Regulation 1907/2006 (REACH), 10 according to article 64(8) of REACH

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GENERAL STATEMENT

In essence, paper and board is always recyclable. Its combination with other materials, which is necessary to provide certain functions of packaging, can raise challenges in the recycling process. Packaging is essential to an efficient supply chain for consumer products. It has three main functions: protecting, presenting and preserving goods to minimise waste at each stage of the production and delivery process. The basic raw material for paper and board is renewable as wood is sourced from sustainably-managed forests, mostly certified by third party verified schemes. On a European average, paper and board packaging has the highest recycling rate. According to EUROSTAT, the 2016 recycling rate for paper-based packaging was 84,8%. In absolute volumes, more paper-based packaging was recycled than all other packaging materials together⁹. The sector aims at further improvement. The biggest potential for improvement of paper recycling is the development of separate collection¹⁰. While separate collection should be further promoted, the provision of growing functional properties of paper-based packaging should always consider the end-of-life fate of the product so as to optimise its recyclability. It is therefore important to raise awareness of the recyclability potential in the design phase of paper-based packaging. Communication between actors in the value chain is key in order to ensure accurate fulfilment of the legal requirements and to further increase the recycling of paper through design, innovation and investment. Clear communication to end users is also needed to support their efforts to appropriately sort paper products for recycling.

PURPOSE OF THE DOCUMENT

Today, every paper-based packaging meets its functional requirements while being, in essence, optimally recyclable. However, producers are increasingly working with and enquiring about new paper-based solutions as an alternative to non-renewable or difficult to recycle materials. In order to offer the different functional properties required, paper-based packaging is, in some cases, coated, laminated or treated in other ways. Via this document, the undersigned associations representing the paper and board recycling, manufacturing and converting industry intend to inform specifiers and designers about the implications of certain converting steps on the recyclability of used paper-based packaging in the collection, sorting and recycling processes. The guidelines aim to inspire innovation and the introduction of new techniques. These guidelines are applicable to paper-based packaging. Extensive guidelines already exist on deinkability and adhesives removability of printing and writing products¹¹. The guidelines cover the paper substrate as well as the materials applied to it.

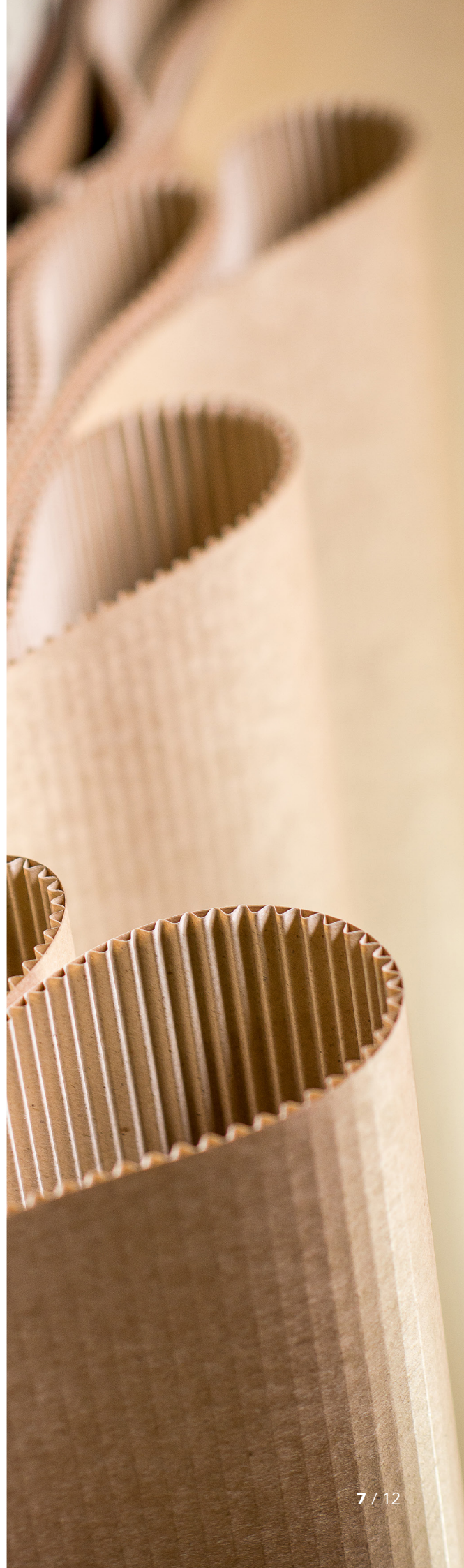
SCOPE

This document covers paper-based products legally defined as packaging as well as paper-based products fulfilling similar functions.

⁹ EUROSTAT: PPWD Monitoring, 2016 data on packaging waste generation and recycling by material. https://appsso.eurostat.ec.europa.eu/nui/show.do?dataset=env_waspac&lang=en

¹⁰ www.impactpaperec.eu

¹¹ www.paperforrecycling.eu



DEFINITIONS AND TERMINOLOGY¹²

Recycling: Reprocessing of used paper in a production process into new paper and board.

Recyclability of paper-based packaging: The individual suitability of a paper-based packaging for its factual reprocessing in the post-use phase into new paper and board; factual means that separate collection (where relevant and followed by sorting) into EN 643 grades and final recycling takes place on an industrial scale.

REGULATORY AND NORMATIVE FRAMEWORK AND INDUSTRY PRACTICE

The revised Directive on packaging and packaging waste sets high targets for the recycling of paper-based packaging: 75% by 2025 and 85% by 2030. It also provides essential requirements to be complied with for the conception of packaging. In this respect, European Standards EN 13427 (Requirements for the use of European Standards in the field of packaging and packaging waste), EN 13428 (Requirements specific to manufacturing and composition - Prevention by source reduction) and EN 13430 (Requirements for packaging recoverable by material recycling) define the requirements for packaging conception as well as EN 13432 on the consideration of biodegradability of packaging.

According to implementing decision 2019/665/EC, Member States will have to report on the recycling targets for packaging waste per material, which in the case of composite materials means that the recycling rates will be reported for each material separately¹³.

The revised waste Directive sets high recycling targets for municipal waste and confirms that separate collection of certain materials, including paper, is mandatory. It also frames the functioning of Extended Producer Responsibility schemes, including the parameters for eco-modulation of fees, such as the recyclability of products and their value after collection.

The EN 643 "European list of standard grades of paper and board for recycling" describes the grades of paper and board which, after their use, disposal, collection and sorting, can be used by paper recycling mills. Since its creation in 2001, EN 643 has become the key reference to describe the quality requirements of paper and board grades for recycling. The described grades range from very specific homogeneous grades, e.g. cuttings from converting plants to mixtures of different grades of paper and board resulting from household collection.

Paper packaging is successful among others because of a currently functioning, self-sustaining, economically viable recycling loop. There is a strong market demand for paper for recycling thanks to a sustained demand for packaging products made of recycled paper, which translates into value creation along the recycling chain including its collection.

¹² Source: EPRC, adapted from Institut cyclos-HTP

¹³ Implementing decision 2019/665/EC, article 6c(2): "For the purposes of calculating and verifying attainment of the recycling targets set in points (f) to (i) of Article 6(1) of Directive 94/62/EC, composite packaging and other packaging composed of more than one material shall be calculated and reported per material contained in the packaging. Member States may derogate from this requirement where a given material constitutes an insignificant part of the packaging unit, and in no case more than 5 % of the total mass of the packaging unit."

The value creation from the raw material constitutes a major contribution to the functioning of waste management systems in Europe. Together with the fees paid by producers (placers on the market) under Extended Producer Responsibility schemes, this finances the collection and sorting of used paper-based products to become a secondary raw material to be used by the industry again.

The value of this material for the industry is determined by the capability of its components to be re-integrated in a new paper product. The quality should be according to EN 643 requirements, meaning it is good enough for the paper industry to recycle it and to produce new fit-for-purpose paper products from it.

This quality requirement should be taken into account at the product design stage so that after collection, separation from other material and sorting (where relevant), the used product can be recycled in standard or specialised paper recycling mills to produce new recycled pulp and paper.

The specialised paper recycling mills have specific processes in place to handle paper packaging products which cannot be handled in standard processes. It is crucial that these paper packaging products are channelled through the right collection and sorting schemes to the paper recycling mills that can actually recycle them.

Each element that is difficult to separate from the fibrous material will decrease the pulp's quality and generate fibre losses in one of the different stages; it can prevent collection, be collected with other materials, generate losses in sorting or finally generate recycling process losses in the paper mill with adverse environmental effects as those losses have to be discarded.

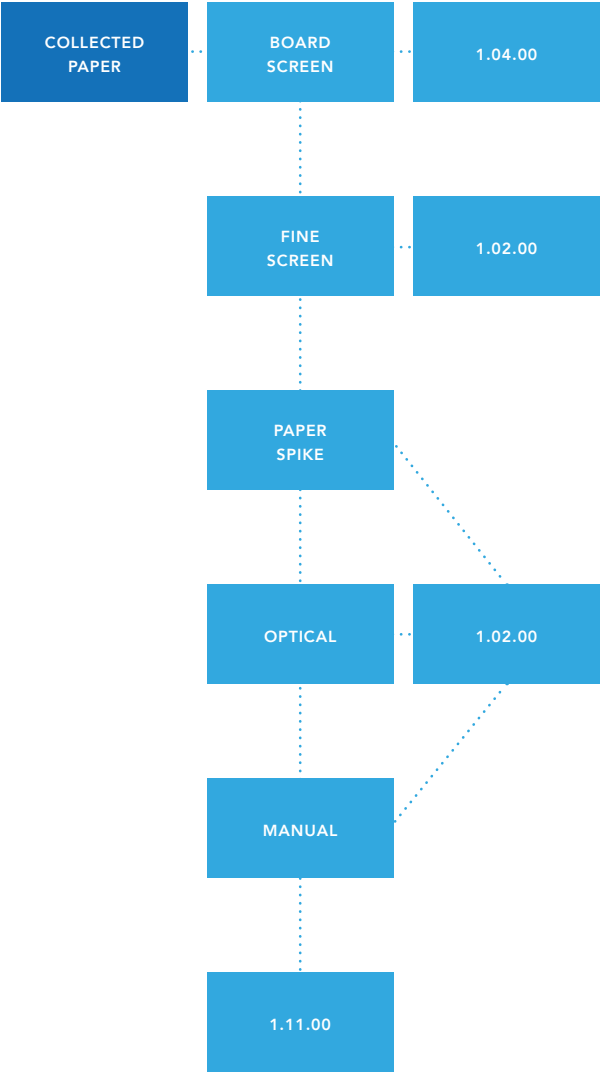
FOOD SAFETY

Specific guidance for producers of material intended to be in contact with food has been produced: Food Contact Guidelines for the Compliance of Paper and Board Materials and Articles¹⁴:

COLLECTION FROM END-CONSUMERS AND SORTING PRACTICES

Separate paper and board collection: This is the most common collection method in Europe. Paper and board products are typically collected from homes or bring in systems, separated from graphic paper and sorted into grades of the European Standard EN 643. Where this collection system is applied, liquid packaging and composite packaging are generally collected with other dry recyclables (plastics and metal) and sorted into special grades of EN 643.

Selective graphic paper collection and paper packaging collection: In some countries and regions in Europe, graphic paper is collected selectively from packaging paper. In this set-up, liquid packaging and other composite packaging is sometimes collected with the paper packaging fraction. This fraction is then recycled by the paper packaging recycling mills or the material is further sorted and used by specialised recycling mills (see chapter below).



(example of a PfR sorting plant¹⁵, source: PTS)

¹⁴ Food Contact Guidelines for the Compliance of Paper and Board Materials and Articles (http://www.cepi.org/food_contact_guidelines)

¹⁵ Grade numbers as specified in the EN 643: 1.02.00= Mixed paper and board, 1.04.00=Corrugated paper and board packaging, 1.11.00: Sorted graphic paper for deinking

Commingled collection: In some countries, paper packaging is collected together with other recyclable materials such as metal and plastics. In a subsequent sorting, the material is separated from non-paper packaging and delivered to paper recycling mills.

For more information on separate paper collection:
www.impactpaperec.eu

COLLECTION FROM TRADE AND INDUSTRY

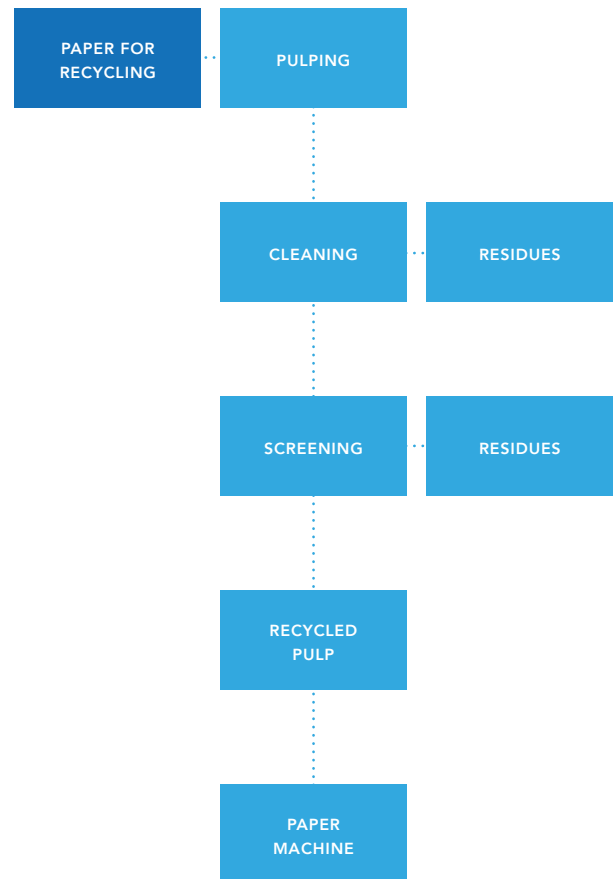
Paper and board-based products recovered from trade and industry are typically of a homogeneous composition with respect to the grades defined in EN 643 and often do not require subsequent sorting.

HOW A PAPER PACKAGING RECYCLING MILL WORKS

Most paper packaging recycling mills have equipment and processes based on the following:

- **Standard paper recycling mills.** Such mills produce high quality end-products based on EN643 groups 1 to 4 with a classic low consistency pulper (5% fibre concentration). Often such processes operate deflakers to separate fibre bundles into individual fibres, as well as coarse and fine screening cleaners. The aim is to separate the fibre from the other material. The final result is fibrous material suspended in water ready for papermaking (=recycled pulp).

This equipment and process can handle paper-based packaging with basic mechanical transformation. It can also handle paper containing inks, water soluble chemicals and small amounts of converting products, such as staples, adhesive tape or glues based on starch or other water-soluble glues. This equipment and process can also



handle small proportions of packaging with a thin non-paper layer on one side.

- **Specialised recycling mills.** These mills treat a mix of special grades (group 5 of EN 643) and grades from other groups (1-4 from EN 643). Each recycling mill determines the optimal mix and adds one or more piece of dedicated equipment, such as a horizontal high density drum pulper, a separate batch pulper with longer pulping time, deinking, fine cleaners, hot dispersion, special process and waste water systems.

These specialised recycling mills can treat paper-based packaging that has been layered with non-water soluble products such as wax, plastic film or other layers such as aluminium, polyester and polyethylene entering the recycling process in homogeneous lots. In order to optimise the recycling process, paper composite packaging, which cannot be handled in standard processes, should be delivered to specialised paper mills in EN 643 identified flows. As in standard mills, the final result of the process is also fibrous material suspended in water ready for papermaking.

WHAT ARE THE MOST CRITICAL ASPECTS IN A PAPER PACKAGING RECYCLING MILL?

- It is crucial that the paper packaging products contained in the paper for recycling are repulpable within standard operating time and equipment, otherwise too much material is lost and cannot be integrated in the recycled pulp.
- It is important that the resulting recycled pulp is optically and mechanically homogeneous. Optical and mechanical homogeneity ensures use of the recycled pulp for high quality products.
- It is important that the load of the industrial fine screening process is not too heavy, otherwise the

industrial process becomes inefficient (e.g. too energy consuming).

- It is important that adhesive impurities do not lead to microstickies at all nor to a macrosticky area that is too big. Stickies are tacky components in the recycled pulp and can cause problems in the paper machine equipment. They can also deteriorate the quality of the recycled paper product.
- Water soluble substances tend to accumulate in the process water loop of paper mills and interfere with papermaking chemistry. In general, non-paper materials which can be screened out by coarse or fine screens should be privileged as opposed to materials leading to fine particles accumulating in mills.
- There has to be a high enough yield of fibrous material from the paper packaging product in order to ensure the efficiency of the process.

The most important parameters are therefore repulpability, yield of fibrous material, coarse reject, flake content, stickies and technical quality. The executive summary describes how to avoid these issues.

European legislation requires paper to be separately collected, as this is a pre-requisite for recycling. There are different national collection schemes and recyclability protocols in place. Some countries collect all paper-based packaging in one stream. Other countries differentiate a separate paper and board fraction and collect some paper-based packaging along with the lightweight packaging stream. Provided that appropriate collection and sorting is organised, literally all paper packaging can be recycled. The paper industry has invested in a wide network of paper mills with innovative processes in order to allow recycling in standard or specialised paper recycling mills.

