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EU Ecolabel Criteria for printed paper, stationery paper, and paper carrier bag products

Final Technical Report

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Contents

Abstract

This Technical Report presents the EU Ecolabel criteria for *Printed paper, stationery paper, and paper carrier bag products*, as published in Commission Decision (EU) 2020/1803 of 27 November 2020 (EC, 2020b), and provides the supporting rationale and background research for each criterion.

The final criteria are the result of a broad consultation including interaction at two Ad-Hoc Working Group meetings, discussions with specialised stakeholders within the technical subgroup for recyclability aspects as well as dialogue with Commission colleagues and EU Ecolabel Board members.

The main criteria are split into the following:

- Recyclability that targets product circularity.
- Emissions to water and air.
- Waste management and quantity of paper for recycling from the manufacturing process.
- Energy use addressed by means of an energy management system.
- Substrate sourcing (requiring the use of EU Ecolabel substrate).
- Hazardous substances (horizontal restrictions for SVHCs and substances with certain CLP classifications plus specific restrictions in defined circumstances for biocidal products and biocidal active substances, cleaning agents, APEOs, halogenated solvents and phthalates, printing inks, toners and varnishes, and toluene recovery from rotogravure printing).

Decision (EU) 2020/1803 effectively merges revised criteria from two different Commission Decisions: EU Ecolabel criteria for converted paper products (2014/256/EU) and EU Ecolabel criteria for printed paper products (2012/481/EU). Commission Decision 2020/1803 establishes EU Ecolabel criteria for a new, combined product group: Printed paper, stationery paper, and paper carrier bag products.

This report consists of the following sections:

- Introduction, outlining the purpose of the report and a brief summary of the Preliminary Report, linking the environmental hotspots of the criteria proposed in this document.
- Product group specifications, including product group name, definition and scope, and other general indications related to this EU Ecolabel, such as application specification, general assessment and verification terms.
- EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products with the supporting rationale.
- Main changes to criteria compared to previous criteria versions.

A specific draft Preliminary Report (PR) was published for each product group in parallel with the Technical Report (November 2018) ahead of the first AHWG meeting held in December 2018. The PRs examine the product groups in the current legal, political and market context. The technical aspects of each product group are also considered from an LCA perspective in order to identify the main environmental hotspots.

This report is the final technical report published within the scope of the criteria revision project. The detailed criteria development process is reflected in the evolution of earlier draft versions of the Technical Report. Draft Technical Reports, Preliminary Reports, and Tables of Comments collected during the revision are all publically available at the following webpage: EU Ecolabel for Converted and Printed Paper

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1 Introduction

The EU Ecolabel is a voluntary labelling scheme created in 1992 and a key policy instrument within the European Commission's Sustainable Consumption and Production and Sustainable Industrial Policy (SCP/SIP) Action Plan (see COM(2008) 397) and the Roadmap for a Resource-Efficient Europe (see COM/2011/0571). The Roadmap was designed to move the economy of Europe onto a more resource-efficient path by 2020 in order to become more competitive and to create growth and employment.

The EU Ecolabel promotes the production and consumption of products with a reduced environmental impact over their life cycle and is aimed at the products with the best environmental performance on the market. However, it is appreciated that this may be difficult to judge accurately when multiple criteria are set on a pass-fail basis, as is generally the case with the EU Ecolabel approach.

The EU Ecolabel also has links with other policy instruments, such as Green Public Procurement (GPP, see COM(2008) 400), the Eco-Management and Audit Scheme (EMAS) (see Regulation (EC) No 1221/2009 and Regulation (EU) No 2018/2026) and the Ecodesign Directive (see Directive 2009/125/EC).

1.1 Methodology and sources of information

The entire life cycle of the product is considered, from the extraction of raw material through to production, packaging, distribution, use and disposal. The EU Ecolabel may define criteria that target environmental impacts from any of these life cycle phases, with the aim being to encompass the areas of greatest impact (life cycle hot spots). The criteria development process involves technical experts, non-governmental organisations (NGOs), Member State representatives and industry stakeholders. Because the life cycle of each product and service is different, the criteria are tailored to address the unique characteristics of each product or service type. They are typically revised every 4 years to reflect technical innovation such as alternative materials or production processes, reductions in emissions and market developments.

The development and revision processes of EU Ecolabel criteria are carried out in accordance with the EU Ecolabel Regulation (EC) No 66/2010 (EC, 2010a). An important part of the process for developing or revising EU Ecolabel criteria is the involvement of stakeholders through publication of draft technical reports and subsequent consultation exercises. The main consultation exercise takes the form of ad-hoc working group (AHWG) meetings, supported by other stakeholder interactions such as conference calls, email exchanges, site visits and forum discussions and written comments submitted via an online platform.

Articles 7(2) and 11(2) of Regulation (EC) No 66/2010 make provisions to encourage alignment between criteria for the EU Ecolabel and other suitable ISO 14024 Type I ecolabels for similar products. However, care must be taken to ensure that any such alignments are based on a scientifically sound rationale, do not create geographical distortions for potential applicants and, ultimately, that the proposed criteria are acceptable to the majority of EU Ecolabelling Board (EUEB) members who must vote on the final proposed criteria prior to their adoption.

Other ecolabel schemes of particular relevance to printed paper, stationery paper, and paper carrier bag products were identified. In addition, the main ecological labels in paper products such as Nordic Ecolabelling, Blue Angel, NF Environment, Paper by Nature, labels on forest management (FSC and PEFC), etc., were consulted in order to establish a comparison with criteria set in the EU Ecolabel and introduce measures to encourage harmonisation with other ecolabel schemes.

The results of the REFIT exercise for the EU Ecolabel show that the uptake of the schemes could be better and more efficient if a more focused approach was applied to maximise impacts on the ground (see COM(2017) 355).

The final version of the Technical Report provides the rationale and background research for the adopted criteria. The final Technical Report should be read in conjunction with the information contained in the Preliminary Reports, Technical Reports v.1.0, v.2.0, and v.3.0, and Tables of comments available on the project website.

The first proposal of the criteria was presented to stakeholders at the first AHWG meeting held as a webinar in December 2018. After the setting up of specialised subgroup for recyclability and stakeholders' consultation, a second version of the EU Ecolabel criteria was presented during the 2nd AHWG meeting in October 2019, in Brussels. The third version of the Technical Report was published in January 2020 ahead of the EU Ecolabelling Board meeting in February 2020. Following the EUEB feedback and some final revisions, the criteria passed through the inter-service consultation and were positively voted on by the EUEB in June 2020 and then officially adopted in Commission Decision (EU) 2020/1803.

The work was carried by the Joint Research Centre (JRC Seville). The technical support for the printed paper products was provided by LEITAT Technological Centre and for the converted paper products by the Institute of Sustainability in Civil Engineering (Institut für Nachhaltigkeit im Bauwesen - INaB) RWTH Aachen.

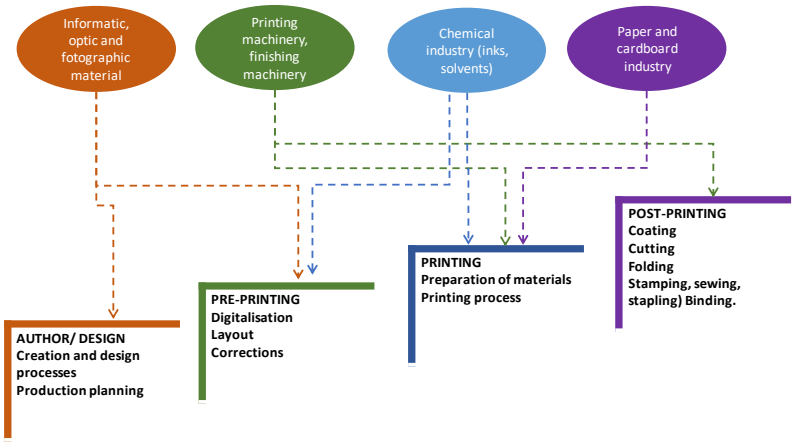
1.2 Summary of the preliminary reports and link to the EU Ecolabel criteria

The outcome of the analysis provides the rationales for the proposed scope and definitions. It also clarifies the reasoning behind the proposal to merge converted paper and printed paper product groups under one Commission Decision.

1.2.1 Product group name, scope and definitions

The printing industry usually carries out the design, pre-printing, printing and finishing stages. The latter includes binding, cutting and folding, along with storage, packaging and shipping.

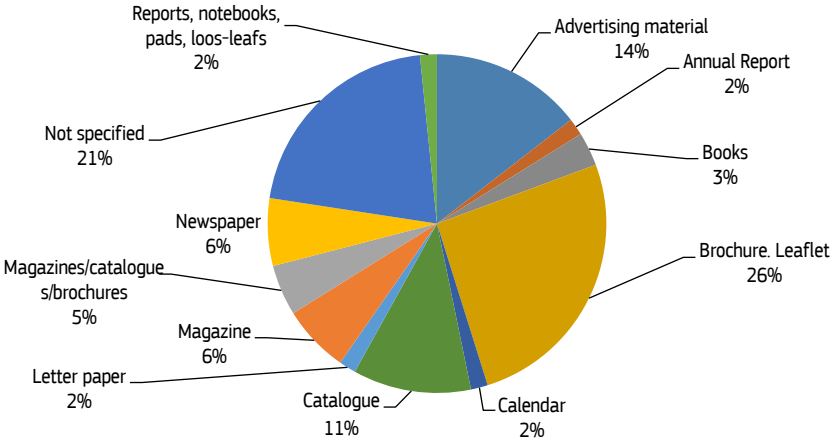
Figure 1. Providers and processes in the production of printed paper products



Source: ICEX, 2016.

Screening of EU Ecolabel licences for a product type shows that brochures and leaflets are the most relevant among printed paper products (26%), followed by advertising material (14%) and catalogues (10%).

Figure 2. Segmentation of the EU Ecolabel licences for printed paper products

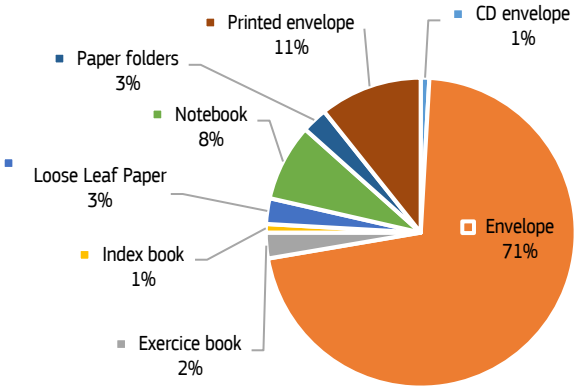


Source: ECAT.

ISO 4046-1 2016 defines "converting" as a set of processes or operations that are applied after manufacturing of basic substrate (paper or paperboard). It usually refers to transforming paper substrate into a new paper-based product with a different function and/or destination (i.e. book, envelope, paper towel, paper bag, box, or container, among others). Printing might form an integral part of the conversion process given that one product might be printed and converted (i.e. envelope). For reasons of clarity, the main product types that are group together under the revised scope and definition have been specified based on their functionality and/or end use. Envelopes are considered to fall within the stationery product category in line with the statistical classification of economic activities in the European Community (NACE). Wrapping paper was included in the revised

scope and grouped with paper carrier bags due to the similarities in the production process as well as the designated use. Packaging material is excluded from the scope; therefore a specific provision is needed for paper carrier bags and wrapping paper, which are proposed to form part of the product group.

Figure 3. Segmentation of the EU Ecolabel licences for converted paper products



Source: ECAT.

The magnitude of correlation between converted paper and printed paper justifies merging the two product groups into one common group: *printed paper, stationery paper, and paper carrier bag products* under a joint Commission Decision. This ensures the coherence between revised product groups and avoids redundancy. The Fitness Check study (evaluation study and stakeholder consultation) shows that the uptake of the schemes could be better and more efficient if a more focused approach was applied to maximise impacts on the ground (EC, 2017a). In order to improve the performance of the EU Ecolabel scheme, a more targeted approach should be developed. It should include bundling of closely related product groups where appropriate. The above-mentioned conclusions support the idea to merge both Decisions into one.

In general, the structure of the revised criteria reflects Commission Decisions 2012/481/EU and 2014/256/EU (EC, 2012c and EC, 2014).

Table 1. Structure of the revised criteria

Criterion	Structure of the revised EU Ecolabel criteria
Substrate requirements	Criterion 1
Fibres: sustainable forest management	
Hazardous substance restrictions	Criterion 2
Recyclability	Criterion 3
Emissions (from printing/converting process)	Criterion 4
Waste	Criterion 5
Energy use	Criterion 6
Training	Criterion 7
Fitness for use	Criterion 8
Information on the product	Criterion 9
Information appearing on the EU Ecolabel	Criterion 10

1.2.1.1 Product line

The proposal to adopt a service-oriented approach was discussed during the course of the revision. However, priority was given to product certification. Service-oriented criteria might stimulate an increase in the number of certified companies but they will not necessarily increment the product certification. Product certification encourages the environmental performance of the whole company, directly through specific thresholds for a production process, and indirectly through an increase of the environmental awareness at the site.

Blue Angel criteria (RAL-UZ 195) for printed matter apply a hybrid approach referring to the printing house when evaluating energy, waste management, and emissions, and to a singular product or defined product group when addressing substrate, chemicals, printing machines, etc (Blue Angel, 2015). The product line certification, as adopted by the Blue Angel was accepted as a compromise between the service and product oriented approach:

I. The product line approach is characterised by manufacturing on a recurring basis. It refers to a well-defined (possibly theoretical) product, whose description addresses the format, materials, inks, bindings used, etc. Here, the licence could be awarded to a product group or a certain type of product group that meets the general description. If there is any change in the description, the competent body (CB) should be notified.

II. The specific product approach addresses a pre-ordered and predefined concrete product manufactured on an individual basis, i.e. a phone book for a specific year. For this product the licence would have to be awarded on an individual basis.

1.2.1.2 Inserts

Inserts are often provided to the printer in the ready-to-use form that meets specifications established by a client. The capacity of an applicant (print house) to verify the compliance of inserts with the criteria, or to accept only EU-Ecolabel-certified inserts is limited from the supply chain perspective. Non-fixed inserts, which are easily separable from the final product, are considered as an individual item, thus not forming part of a certified end product.

1.2.1.3 Non-paper content

The Nordic Ecolabelling criteria for Printing companies, printed matter, envelopes and other converted paper products establish that a minimum of 90% of the total weight of the Nordic ecolabelled printed matter must consist of paper. For books, folders, ring binders, notepads and forms, the threshold is 80%.

Blue Angel criteria (DE-UZ 14b) for 'Finished products made from recovered paper for office and school demand' apply to finished products made from recycled paper or cardboard. Materials such as plastic or metal should meet a tolerance limit of 5% of the total mass of the product (Blue Angel, 2018a).

Based on the information collected, the material composition of envelopes (90% w/w paper content) has not changed since the last revision.

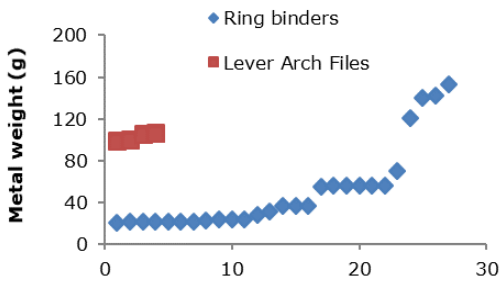
Table 2. Material input for envelope manufacturing

Material	Weight (kg)	Content (%)	Comments
Paper	0.0052987	93.9	Actual paper content of envelope
Plastic	0.0001990	3.53	
Chemicals	0.0001447	2.56	

Source: FEPE, 2018.

Metal elements used in stationery paper products for documents' storage (i.e. suspension files, ring binders and lever arch files) are closely related to product functionality and durability. The metal content varies according to product type, its size, and number of rings. In general, the metal content in lever arch files ranges from 99 g to 107 g, whereas for ring binders it is from around 20 g to 155 g (Figure 4). The storage capacity increases with the increment of the back size and ring diameter (Table 3).

Figure 4. Weight of metal content in ring binders and lever arch files



Source: Communication with Hamelin Brands.

Table 3. Typical characteristics of stationery paper products for documents' storage

Back size (mm)	Ring diameter or height (mm)	Storage (N° A4 sheets)
25	15	100
35	25	165
40	30	225
55	30	400
75	55	500
80	65	750

Source: Communication with Hamelin Brands.

Further information collected from ring manufacturers[1] shows that a threshold of 50 g for metal content established by Commission Decision 2014/256/EU (EC, 2014) might exclude all ring mechanisms with three rings and all except one type with four rings (47.5 g). The threshold for metal content was revised based on the functionality (storage capacity), as follows: 170 g for products with a storage capacity of at least 225 sheets, and 75 g for products with a storage capacity below 225 sheets.

For notebook covers, there is a recent tendency to use a plastic cover which also serves as a folder for storage purposes. However, protection of a notebook beyond its normal expected use phase is not in line with the principles of resource efficiency as the notebooks will be discarded at the end of the school year or when the pages are used. Therefore, for plastic content, the threshold of 13% w/w is maintained for all notebooks. To harmonise material composition requirements across different products addressed by the scope, a threshold of 10% w/w is established for the plastic content in books, catalogues, booklets or forms.

In line with the feedback collected, the use of PVC is specifically excluded from the scope of the product group. The exclusion of PVC aligns the revised criteria with the EU Ecolabel criteria for other product groups, such as Footwear or Furniture.

The following table summarises the limit thresholds for the non-paper parts of a product.

Table 4. The limit threshold for the content of non-paper product

Product	*Paper substrate content*	*Metal threshold*	*Plastic threshold*
Printed paper			
Printed paper	*90%*	*x*	*x*
For books, catalogues, booklets, forms, (...)	*80%*	*x*	*10%*
Stationery paper product			
Envelopes	*90%*	*x*	*x*
Sorters and part files	*70%*	*<30 g*	*<10%*
Tree flap folders			
Filing boxes			
Dividers			
Paper folders, (...)			
Exercise books,	*70%*	*<30 g*	*<13%*
Diaries			
Notebooks, (...)			
Lever arch Files	*70%*	*75 g for up to 225 sheets* *170 g for more than 225 sheets*	*<13%*
Ring Binders			
Folders with metal fasteners	*x*	*75 g for up to 225 sheets* *170 g for more than 225 sheets*	*<10%*
Suspension files	*x*		
Gift wrapping, paper bags	*100%*	*x*	*x*

Source: EC, 2020b.

[1] http://www.ring-alliance.com/

1.2.2 Summary of the key market aspects

1.2.2.1 Printed paper market analysis

The global printing industry was worth USD 980 billion by 2018. The sector is driven by growth in packaging and labels, whereas graphic applications have been suffering a decrease in production during recent years. Regarding printing technologies, digital is gaining importance over analogue printing.

The US is the world's biggest print market (32%). It is followed by China (17%) while the emerging markets are displacing the US and the EU in terms of production. European countries represent the third biggest region in terms of printed paper manufacturing, after Asia (37%) and North America (26%).

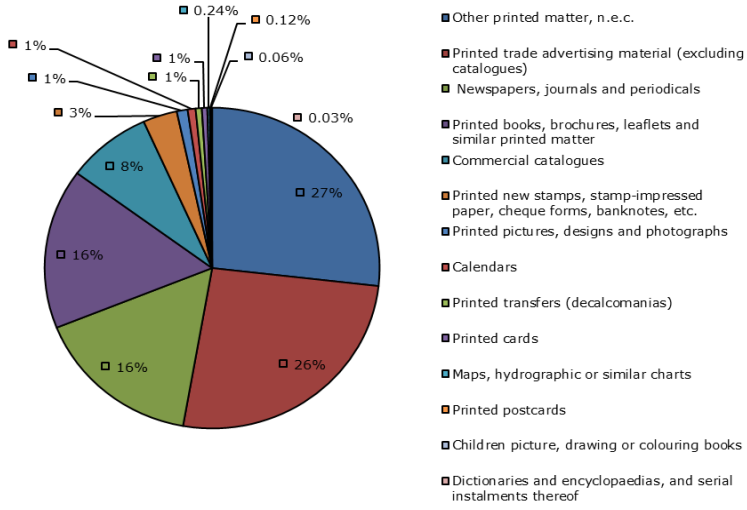
The EU paper printing industry generates an annual turnover of around EUR 52 billion, where printing activities account for EUR 44 billion. During recent years, the EU printing market has experienced a continuous decrease in terms of production. Germany is leading with a production value over EUR 10 billion, followed by the United Kingdom, Italy and France, which also have important production values exceeding EUR 4 billion each.

The EU printing industry produces different types of products; those with a high market share are printed advertising material (26%), commercial catalogues (8%), books, brochures and leaflets (16%), and newspapers and journals (16%). Another 27% are "other printed matter" which includes packaging products (Figure 5).

Printed paper products are in demand all over the world and therefore export represents a key activity for European companies. The total printed paper products EU exports, including intra-EU-28 and extra-EU-28, were worth EUR 17 984 million (40% of the European production value). The total import transactions in 2017, in the EU Member States, were worth EUR 13 430 million (30% of the European production value). These data include intra- and extra-EU transactions. The aggregated balance of trade for the European Union (EU-28) was positive, meaning that exports are higher than imports by EUR 4 554 million. Most of the imports (77%) and exports (69%) are carried out between EU Member States.

At European level, a decrease in the production of all paper products except packaging and labels is expected. New technologies and electronic media are gaining position in publications and commercial products. As a consequence, use of printed material as a communication medium is diminishing.

Figure 5. EU market value of printed paper by type of product (2016)



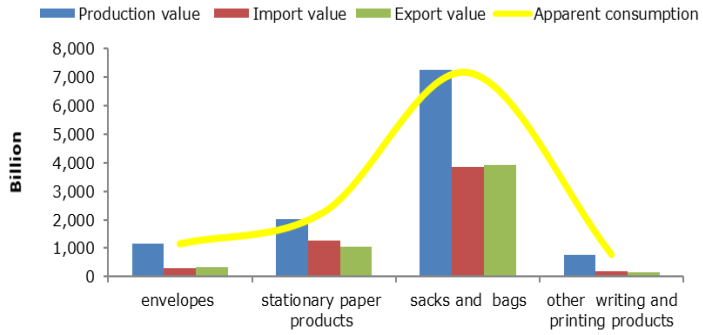
Source: EUROSTAT, 2016.

1.2.2.2 Converted paper market analysis

The European converted paper products industry is strongly affected by the emergence and expansion of digital media and paperless communication in most developed countries, with the consequent impact on the apparent consumption (Figure 6).

According to EUROSTAT, production volumes of converted paper products were at 3 507 tonnes in 2016. For the EU-28, import trade values of the converted paper products considered amounted to EUR 1 125 billion while exports were at EUR 625 billion. Imports registered slight changes, in particular imports of carrier bags and of writing material products increased by 8% and 2%, respectively, in 2017. Similar trends are registered for export trade values with even lesser variations.

Figure 6. The EU market production, import, export and apparent consumption value for converted paper products in 2016



Source: EUROSTAT, 2016.

1.2.3 Key environmental aspects and relation to the criteria proposal

1.2.3.1 Printed paper Life Cycle Assessment

To identify the most important aspects of the system examined, a screening LCA was performed. A critical review of published LCA studies was carried out to draw the main conclusions. This analysis aims at identifying the main environmental areas of concern and life cycle hotspots and estimating environmental improvements.

Most of the journal papers conclude that the source of the main impact of a printed product is the paper production. On the other hand, printing also has an important environmental contribution due to the electricity consumption and the chemicals used during the process.

Besides the LCA screening, a simplified LCA of two case studies was performed, analysing two standard products, a magazine and a book, both produced using offset printing. These LCA were performed by LEITAT, with primary data from the European LIFE+ project 'Greening Books'. The data are revised and updated for this project.

Different points were identified as relevant for the improvement of the environmental profile of printed papers:

- Paper production is the main contributor to the environmental impact; the selection and manufacturing of this paper have to be considered. The introduction of recycled fibre in paper production could lead to an environmental impact reduction.
- After fibres, water is the most relevant raw material.
- A clear environmental advantage for vegetable inks in comparison with mineral-based inks cannot be stated.
- Energy consumption is always relevant to the overall impact of a process. For this reason, electricity consumption during printing could be a significant impact contributor. Hence, introducing energy efficiency measures in printing facilities could reduce the environmental impact.
- The manufacturing process (including printing) is also related to VOCs generation.
- Decisions that are taken at the design stage can determine the amount of paper and ink used, as well as the use of other materials, and therefore should not be ignored.
- The end-of-life of printed products has significant life cycle impacts. For instance, the carbon footprint of newspapers could double if newspapers are disposed of to landfills instead of being recycled or incinerated.
- The book system is very sensitive to the number of users per book.

A summary of the hotspots identified during the LCA screening are presented in Table 5.

Table 5. LCA for printed paper products - Key impact parameters identified

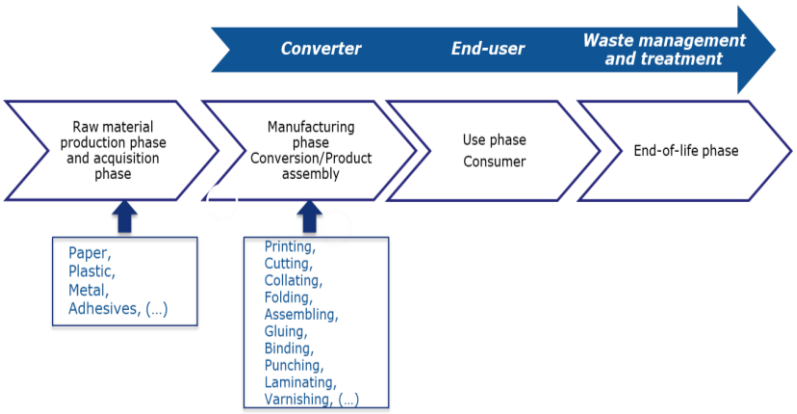
RAW MATERIALS	
Substrate	Origin: recycled fibres Certification: Type I ecolabels
Inks	Origin: vegetable inks or water-based inks
Adhesives	Recyclability: adhesives accepted in the recycling process Best environmental techniques
Other chemicals	Toxicity Best environmental performance
PRODUCTION	
Emissions	Emissions to air: VOCs Emissions to water
Energy and water consumption	Energy sources: renewable sources Energy consumption Best environmental practices: annual energy reduction goal Water consumption
Waste	Inks and toners Washing agents, etc. Unsorted waste control
Design	Eco design strategies
PACKAGING	
Quantity	Eliminate or reduce the packaging of the product Avoid unnecessary packaging
Materials	Use of more sustainable options
USE	
Lifespan	Reuse
END-OF-LIFE	
Consumer	Information regarding recyclability
Waste treatment	Recyclability of the product

Source: Preliminary Background Report, 2018.

1.2.3.2 Converted paper Life Cycle Assessment

The documents and LCA studies whose scope and definition include, as a minimum, the supply of raw materials and manufacturing of converted paper products were collected and reviewed. According to the LCA studies analysed, it was possible to identify the environmental hot spots across the product life cycle. The figure below illustrates the various life cycle stages of a converted paper product such as paper carrier bags, envelopes, notebooks, folders, etc.

Figure 7. Various life cycle stages of a converted paper product



The LCA studies reviewed and considered for the different converted paper products indicate that[2]:

- the use of recycled paper in paper carrier bags has a positive effect on both energy- and material-related impacts;

[2]For more information, please check documents available on the project website: https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/410/documents

- envelopes with windows made of reduced/recycled plastic have a reduced environmental impact;
- notebooks with spiral binding (plastic or fibre cover) generally have a higher impact;
- among stationery products for storage, lever arch files have the highest impact, followed by archive boxes.

In these products, the bulk of the impacts (more than 70%) will occur at the upstream raw materials acquisition/production phase. For GWP, the contribution from raw materials acquisition/production, though less than in the case of other impacts, is still predominant, followed by contributions from the manufacturing or converting phase. In the case of paper carrier bags, 33% of the GWP comes from the raw material production phase while 21% is from the carrier bags manufacturing phase. Further analysis of impacts occurring at the raw materials acquisition phase has shown significant contributions related to the production of the pulp and paper used in these products. For all impact categories considered, pulp and paper production contributes to about 90% of the total impacts.

Considering the contribution from the non-paper contents of converted paper products, metal components have a higher share of impacts compared to plastics. When comparing two notebooks with the same writing area (one with metal coil binding and the other without), the former can be attributed 29% to 43% more impacts than the latter for marine, freshwater and terrestrial eco-toxicity, and 17% for particulate matter formation. Chemicals including ink appear to contribute very little to the impacts of the raw material acquisition of converted paper products. In the case of envelopes, inks contribute barely 3% to all impacts except terrestrial eco-toxicity where the contribution is 19%.

Potential savings in energy consumption can be achieved by using recycled paper. The LCA study showed that paper carrier bags with 85% recycled content lead to 38.6% less primary energy use compared to 100% virgin paper bags. Also, in the case of acidification and eutrophication potential, just 15% virgin fibre contributes to 24% and 48% of the impacts respectively.

As regards consumption of raw materials or natural resources, reducing the window's plastic content by 2% leads to savings of 9% in abiotic depletion and reduces impacts by 5% for global warming potential and 3.7% for acidification.

Table 6. Link between the hot spots and the revised EU Ecolabel criteria for converted paper products

Environmental aspects related to converted and printed paper	EU Ecolabel criteria	Comments in the related criteria
Abiotic depletion	Criterion 1 – Paper and board substrate	It ensures a reduction in energy use, which is the main source of impacts in the pulping, papermaking and board making processes, in particular for the use of recycled paper.
		It limits the emissions to air of CO_2e arising mainly from the energy consumption in the pulping, papermaking and board making process.
	Criterion 6 – Energy use	It promotes energy efficiency practices in the converting and printing processes, ensuring that production sites reduce their energy consumption following a continuous improvement approach. It limits energy use in printing processes through maximum energy consumption thresholds for various printing technologies.
Global warming potential	Criterion 1 – Paper and board substrate	It limits the emissions to air of CO_2e arising from the pulping, papermaking and board making process.
		It ensures a reduction in energy use, which is the main source of CO_2e emissions in the pulping, papermaking and board making processes.
Photochemical oxidation	Criterion 2 – Excluded or limited substances and mixtures	It limits the use of washing agents, varnishes, inks dyes and solvents containing VOCs mainly responsible for tropospheric ozone depletion.
	Criterion 5 - Emissions	It limits the emissions of VOCs in the converting and printing processes responsible for ozone depletion, which increases the risk of death from respiratory diseases.
Human toxicity	Criterion 1 - Substrate	It limits the hazardous substances and mixtures that can be included in paper, board and pulp, limiting environmental and health risks for employees and consumers.
	Criterion 2 – Excluded or limited substances	It limits the hazardous substances and mixtures that can be included in the converting and printing processes to avoid environmental and health risks for employees and consumers.
Abiotic depletion elements	Criterion 1 – Paper and board Substrate	It ensures that pulp, paper and board production sites have appropriate waste management systems in place, maximising the recovery of materials and ensuring safe disposal of hazardous waste.
	Criterion 1 – Paper and board substrate	It promotes sustainable sourcing of paper fibres through the use of sustainable forest management and chain of custody certificates. Resource conservation is also encouraged through the use of recycled paper in the manufacture of pulp, paper and board.
	Criterion 6 - Waste	It ensures that converted and printed paper production sites have appropriate waste management systems in place, minimising waste generation, maximising the recovery of materials and ensuring safe disposal of hazardous waste.
	Criterion 4 - Recyclability	It ensures that converted and printed paper products are recyclable at end of life by limiting the use of substances and components that can hinder the recycling process, for example wet strength agents, adhesives, varnishes, lamination and components, especially inks that are not easily removable.
Eutrophication	Criterion 1 – Paper and board Substrate	It limits, during pulp, paper and board production, emissions of substances to water that have nutrient-enriching effects and lead to high oxygen demand.
Acidification	Criterion 1 – Paper and board Substrate	It limits emissions of SO_2 from pulp, paper and board production responsible for health hazards due to acid rain.

Environmental aspects related to converted and printed paper	EU Ecolabel criteria	Comments in the related criteria
Water pollution	Criterion 5 – Emissions	It limits the direct discharge of silver, chromium and copper to the municipal sewage system by applying hazardous waste treatment on waste water releases.
Exposure to Substances of Very High Concern	Criterion 2 – Excluded or limited substances and mixtures	It restricts the use in printing and converted paper processes of substances that have been identified as hazardous or toxic to humans and other organisms.
Exposure to substances that are carcinogenic, mutagenic and/or toxic for reproduction		
Exposure to substances that contribute to aquatic toxicity, acute toxicity and specific target organ toxicity		

2 Assessment and verification

Assessment and verification
The specific assessment and verification requirements are indicated within each criterion.
Where the applicant is required to provide declarations, documentation, analyses, test reports or other evidence to show compliance with the criteria, these may originate from the applicant and/or his supplier(s) and/or their supplier(s), etc. as appropriate.
Competent bodies shall preferentially recognise attestations that are issued by bodies accredited in accordance with the relevant harmonised standard for testing and calibration laboratories, and verifications by bodies that are accredited in accordance with the relevant harmonised standard for bodies certifying products, processes and services.
Where appropriate, test methods other than those indicated for each criterion may be used if the competent body assessing the application accepts their equivalence.
Where appropriate, competent bodies may require supporting documentation and may carry out independent verifications or site inspections to check compliance with these criteria.
Changes in suppliers and production sites pertaining to products to which the EU Ecolabel has been granted shall be notified to Competent Bodies, together with supporting information to enable verification of continued compliance with the criteria.
As a prerequisite the printed paper, stationery paper and paper carrier bag product(s) shall meet all applicable legal requirements of the country or countries in which the product is placed on the market. The applicant shall declare the product's compliance with this requirement.

Rationale behind the General Assessment and Verification

The assessment and verification text appearing at the beginning of the Annex generally refers to the different types of evidence (e.g. declarations, test reports) that are considered relevant proof of compliance for criteria. This text is necessary in order to establish the framework and general rules for verification procedures so that they do not need to be repeated in every individual assessment and verification text.

Each EU Ecolabel criterion text is followed by specific assessment and verification requirements stating which type of evidence should be provided to the Competent Body that is assessing the application. It is important to clarify here that, when evidence is required from the supply chain, it is possible for the evidence to be submitted directly by the supplier to the Competent Body (this may be important when the proof requires information that may be commercially sensitive).

When evidence is required from tests or analyses, these should preferentially be carried out by laboratories that are accredited in accordance with relevant harmonised (ISO or EN) standards. However, this may not always be possible and in some cases it may be satisfactory to accept evidence from in-house testing or testing by third parties that are only accredited with relevant national standards. The same situation applies to test reports.

When a test method is specified in the assessment and verification text for a particular EU Ecolabel criterion, this method should be followed unless the applicant can demonstrate to the Competent Body that they have used another method that produces equivalent results. In such cases, the justification for equivalence must be clearly demonstrated and the Competent Body should share this knowledge with other Competent Bodies.

Even in cases where evidence is provided exactly in accordance with the specific assessment and verification text for a particular EU Ecolabel criterion, it must be understood that the Competent Body reserves the right to request further information, to visit the site and even to consider independent means of testing and verification. If the applicant objects to such actions, this could potentially jeopardise the award of the EU Ecolabel.

For any criteria that relate to supplied chemicals or materials, it is understood that suppliers can change with time, that one supplier can supply multiple different types and grades of chemical/material and that, even for a given supplier and given chemical/material, variations in time are possible depending on the upstream supply chain and other factors. Consequently, any significant changes in the supplied chemicals/materials must be communicated to the Competent Body and supported by any relevant evidence (e.g. supplier declarations) to demonstrate ongoing compliance with EU Ecolabel criteria.

The final paragraph in the general assessment and verification text has been inserted in order to make it clear that non-compliance of the EU Ecolabel product with all applicable legal requirements of the country or countries in which the product is placed on the market may result in the full or partial revocation of the EU Ecolabel licence.

3 Criteria proposal

3.1 Criterion 1 – Substrate

Criterion 1 - Substrate
The paper substrate, including paperboard used in a final product shall bear the EU Ecolabel for "Graphic paper" in accordance with Annex I to Commission Decision (EU) 2019/70[3].
Assessment and verification: *the applicant shall provide a copy of a valid EU Ecolabel certificate according to Annex I to Commission Decision (EU) 2019/70 for each paper substrate used in EU Ecolabel printed paper, stationery paper or paper carrier bag product(s).*
The applicant shall provide the description of the EU Ecolabel substrate(s), including the trade names and amounts of paper used. The list shall also include the names of the suppliers of the papers used.

Rationale behind the criterion

Considering the entire life cycle of a product, production of paper substrate is the main contributor to all environmental impact categories considered. Papermaking represents 45-90% of GWP[4] of products such as printed magazines or books. For envelopes, LCA studies indicated that between 26% and 90% of impacts, depending on the impact category, will occur at the upstream production phase that is mainly allocated to the pulp or papermaking process[5]. The use of paper with a reduced environmental impact along the pulp and papermaking process and the use of recycled fibre are indicative measures that are likely to mitigate that impact.

The harmonisation with the EU Ecolabel for graphic paper according to Annex I to Commission Decision EU 2019/70 (EC, 2019), benefits from the knowledge gained and consensus built during the revision of this product group and leads to compatibility across the scheme. The criterion aims at minimising the main environmental impacts of paper production during its life cycle. For more information about the environmental criteria for paper substrate, please see: Final Technical Report: Graphic Paper, Tissue Paper and Tissue Products (JRC, 2019).

Information from board producers indicates that there is no specific manufacturing process for pulp destined for board production, and the key difference lies in the papermaking phase when board can undergo lamination, if requested by the client. The current EU Ecolabel criteria for graphic paper do not fix any grammage limitation on eligible paper, thus also allowing paperboard to be licensed; therefore, adopting requirements for graphic paper will not lead to inconsistencies related to paper and board machine reference values.

The revised EU Ecolabel criteria for graphic paper are built on Commission Implementing Decision 2014/687/EU of 26 September 2014 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council. Thus, the corresponding reference document (BREF) encompasses both pulp and board making process.

Board lamination is usually performed on the board production machine. Laminating provides a thicker board, a coloured board or a barrier by applying PE or PET, aluminium foil, etc. depending on customer needs and production location. This can be on one or both sides/surfaces according to client specifications. Lamination is mainly addressed under Criterion 3.

The former EU Ecolabel criteria for printed paper required the use of EU-Ecolabel-certified paper substrate, whereas converted paper products required a conformity check. Accordingly, three optional proposals of how to address the revised substrate requirement were analysed and discussed:

1 The paper substrate used in converted and printed paper products shall have been awarded the EU Ecolabel for "Graphic paper, tissue paper and tissue products" in accordance with Commission Decision (EU) 2019/70 (EC, 2019).

2 The paper substrate used in converted and printed paper products shall have been awarded the EU Ecolabel in accordance with Commission Decision (EU) 2019/70 or shall have been awarded another EN ISO 14024 Type I ecolabel that is nationally or regionally officially recognised in the Member States and that fulfils Criterion 3 on Fibres and Criterion 4 on Restricted hazardous substances and mixtures of Commission Decision (EU) 2019/70 and the related verification and assessment requirements.

3 The paper substrate used in converted and printed paper products shall have been awarded the EU Ecolabel for "Graphic paper, tissue paper and tissue products" in accordance with Commission Decision (EU) 2019/70 or shall be in conformity with Criteria 1 ("Emission to air"), 2 ("Energy use"), 3 ("Fibres"), 4 ("Restricted hazardous substances and mixtures") and

[3]Commission Decision (EU) 2019/70 of 11 January 2019 establishing the EU Ecolabel criteria for graphic paper and the EU Ecolabel criteria for tissue paper and tissue products. OJ L15, 17.1.2019, p.27.
[4]Global Warming Potential (GWP).
[5]For more information, see: Preliminary Background Report

5 ("Waste management") of the EU Ecolabel as established in Commission Decision (EU) 2019/70 for "Graphic paper, tissue paper and tissue products" and related verification and assessment requirements.

What do other ISO Type I ecolabels say?

Blue Angel criteria for Finished products made from recovered paper for office and school demand (Blue Angel, 2018a) and for Printed matter (Blue Angel, 2015) specify that paper or cardboard used in a product needs to be certified in accordance with Blue Angel criteria for Recycled paper (Blue Angel, 2018b), or for Environmentally Recycled Cardboard (Blue Angel, 2014)

Nordic Ecolabelling criteria for Printing companies, printed matter, envelopes and other converted paper products (Nordic Ecolabelling, 2019) requires at least 25% of inspected or eco-labelled paper per each individual printing method (% weighted calculation). In this calculation, Nordic ecolabelled paper has a weight of 1.0, Nordic inspected paper 0.8 and EU Ecolabel 0.7.

Main outcomes from public consultations

An important argument for not recognising other Type I ecolabel papers is the lack of full equivalency in the ambition level for fibre sourcing, energy consumption, emissions and requirements on chemicals.

The availability of substrate is one of the key elements that will stimulate the success of the paper-based products certification. Having in mind that during the course of the criteria revision there was a limited availability of EU Ecolabel graphic board, the JRC recommended a compliance check for paper substrate verification. Nevertheless, in line with the feedback of the EU Ecolabelling Board collected after the EUEB meeting in June 2019, it was decided that paper substrate should be awarded EU Ecolabel licence in accordance with Commission Decision (EU) 2019/70.

In order to address the current market situation as well as to allow the necessary time to certify the graphic board, the transition period of the revised EU Ecolabel criteria is extended to 18 months.

3.2 Criterion 2 – Restricted substances

Criterion 2 - Restricted substances

The basis for demonstrating compliance with each of the sub-criteria under criterion 2 shall be the applicant providing a list of all the relevant chemicals used together with appropriate documentation (safety data sheet and/or a declaration from the chemical supplier). As a minimum, all process chemicals used by the applicant in relevant printing or converting processes must be screened.

3.2.1 Horizontal restrictions: 1) SVHCs and 2) CLP

Criterion 2.1 - Restrictions on Substances of Very High Concern (SVHCs)

All ingoing chemicals used in the production process by the applicant and any supplied materials that form part of the final product shall be covered by declarations from suppliers stating that they do not contain, in concentrations greater than 0,10 % (weight by weight), substances meeting the criteria referred to in Article 57 of Regulation (EC) No 1907/2006 of the European Parliament and of the Council[6] that have been identified according to the procedure described in Article 59 of that Regulation and included in the candidate list for substances of very high concern for authorisation. No derogation from this requirement shall be granted.

Assessment and verification: *The applicant shall provide a declaration that the product has been produced using supplied chemicals or materials that do not contain any SVHC in concentrations greater than 0,10% (weight by weight). The declaration shall be supported by safety data sheets of process chemicals used or appropriate declarations from chemical or material suppliers.*

The list of substances identified as SVHCs and included in the candidate list in accordance with Article 59 of Regulation (EC) No 1907/2006 can be found here:

***http://echa.europa.eu/chem_data/authorisation_process/candidate_list_table_en.asp*.**

Reference to the list shall be made on the submission date of the EU Ecolabel application.

Criterion 2.2 - Restrictions on substances classified under Regulation (EC) No 1272/2008 of the European Parliament and of the Council[7]

Unless derogated in Table 1, the product, and any component articles therein, shall not contain substances or mixtures in concentrations greater than 0,10% (weight by weight) that are assigned any of the following hazard classes, categories and associated hazard statement codes, in accordance with Regulation (EC) No 1272/2008:

- Group 1 hazards: Category 1A or 1B carcinogenic, mutagenic and/or toxic for reproduction (CMR): H340, H350, H350i, H360, H360F, H360D, H360FD, H360Fd, H360Df.
- Group 2 hazards: Category 2 CMR: H341, H351, H361, H361f, H361d, H361fd, H362; Category 1 aquatic toxicity: H400, H410; Category 1 and 2 acute toxicity: H300, H310, H330; Category 1 aspiration toxicity: H304; Category 1 specific target organ toxicity (STOT): H370, H372; Category 1 skin sensitiser: H317*.

*only applies to dye formulations, colourants, surface finishing agents and coating materials used.

- Group 3 hazards: Category 2, 3 and 4 aquatic toxicity: H411, H412, H413; Category 3 acute toxicity: H301, H311, H331; Category 2 STOT: H371, H373.

The use of substances or mixtures that are chemically modified during the production process, so that any relevant hazard for which the substance or mixture has been classified under Regulation (EC) No 1272/2008 no longer applies, shall be exempted from the above requirement.

Table 1. Derogations to restrictions on substances classified under Regulation (EC) No 1272/2008 and applicable conditions.

Substance / mixture type	Applicability	Derogated hazard class, category and hazard statement code	Derogation conditions

[6]Regulation (EC) No 1907/2006 of the European Parliament and of the Council of 18 December 2006 concerning the Registration, Evaluation, Authorisation and Restriction of Chemicals (REACH), establishing a European Chemicals Agency amending Directive 1999/45/EC and repealing Council Regulation (EEC) No 793/93 and Commission Regulation (EC) No 1488/94 as well as Council Directive 76/769/EEC and Commission Directives 91/155/EEC, 93/67/EEC, 93/105/EC and 2000/21/EC (OJ L 396, 30.12.2006, p.1).

[7]Regulation (EC) No 1272/2008 of the European Parliament and of the Council of 16 December 2008 on classification, labelling and packaging of substances and mixtures, amending and repealing Directives 67/548/EEC and 1999/45/EC, and amending Regulation (EC) No 1907/2006 (OJ L 353, 31.12.2008, p. 1).

Mineral oils and distillates	Heatset, coldset or digitally printed paper products	Aspiration hazard, category 1, H304	The applicant shall demonstrate to the Competent Body that all relevant instructions included in the safety data sheet regarding safe handling and storage and suitable exposure controls and personal protection are in place and declare that these are being complied with.
Nickel	Metal components	Skin sensitization, category 1, H317, Carcinogenicity, category 2, H351, Specific Target Organ Toxicity, repeated exposure, category 1, H372	The applicant must provide information to the consumer regarding the use of nickel for metal electroplating, coating or alloying.

Assessment and verification: *the applicant shall provide a list of all relevant chemicals used in their production process, together with the relevant safety data sheet or chemical supplier declaration and any relevant declarations from component article suppliers.*

Any chemicals containing substances or mixtures with restricted classifications under Regulation (EC) No 1272/2008 shall be highlighted. The approximate dosing rate of the chemical, together with the concentration of the restricted substance or mixture in that chemical (as provided in the Safety Data Sheet or supplier declaration) and an assumed retention factor of 100%, shall be used to estimate the quantity of the restricted substance or mixture remaining in the final product.

Since multiple products or potential products using the same process chemicals may be covered by one license, the calculation only needs to be presented for the worst-case product covered by the EU Ecolabel license (e.g. the most heavily printed product).

Justifications for any deviation from retention factor of 100% (e.g. solvent evaporation) or for chemical modification of a restricted hazardous substance or mixture must be provided in writing to the competent body.

For any restricted substances or mixtures that exceed 0,10% (weight by weight) of the final printed paper, stationery paper or paper bag product, or of relevant component articles therein, a relevant derogation must be in place and proof of compliance with any relevant derogation conditions must be provided

Rationale behind the criterion

Aim

The principal aim of Criteria 2.1 and 2.2 is to ensure the correct implementation of the requirements stipulated in Articles 6(6) and 6(7) of the EU Ecolabel Regulation ((EC) No 66/2010) for this product group.

Link to environmental impacts/benefits

Criteria 2.1 and 2.2 effectively prevent or minimise the possibility of EU Ecolabel products creating a risk of exposure of users to a wide range of hazardous substances during the normal lifetime of the product and of the release of hazardous substances to the wider environment when the product reaches its end of life. These benefits are not typically well captured by life cycle assessment methodologies.

Brief explanation of legal and technical aspects

In order to correctly match the intention of Articles 6(6) and 6(7) of the EU Ecolabel Regulation, the criteria only need to focus on the final product and not on consumables used to make the product.

The structure of the criteria for SVHC restrictions and CLP restrictions follows the general recommendations of the EU Ecolabel Chemicals Task Force about how Articles 6(6) and 6(7) should be interpreted.

SVHC restrictions (2.1): The 0.1% limit is particularly useful for SVHC declarations since it aligns perfectly with communication requirements that are stipulated in the REACH Regulation. The SVHCs are restricted to 0.10% at the level of ingoing materials and substances, and not at the level of the final product. This more stringent approach is possible without any major increase in assessment and verification difficulties thanks to the communication requirements set out by REACH (specifically in Articles 7(2) and 33 of REACH):

- Article 7(2) requires importers or producers to notify ECHA if a SVHC is present in articles they import or produce in concentrations exceeding 0.1% (w/w) and add up in total to more than 1 tonne of a particular SVHC per actor per year.
- Article 33 is even more relevant, since any recipient (i.e. a business-to-business transaction) or consumer (business-to-consumer transaction) must, upon request, be informed within 45 days of the presence of any SVHC present in the article(s) they have purchased if the concentration of the SVHC exceeds 0.1% (w/w). The weak point of Article 33 is that this communication requirement is only triggered by a specific request and only if the answer is positive (i.e. that there is a

SVHC present at a level >0.1% w/w). There is no obligation to respond if no SVHC is present at a level >0.1% w/w, even if it is simply to confirm that there is no issue.

Since printed or converted paper products may include separable components, it is worth mentioning here that the 0.1% threshold for SVHC and CLP restrictions should apply to the individual component level, not simply the weight of the entire complex article. This is in line with the European Court of Justice ruling on case 106/14 in September 2015 regarding communication requirements on SVHCs. The 0.1% limits should apply to any component that can be considered an individual article in itself.

CLP restrictions (2.2): There is no longer any reference to risk phrases (e.g. R45, R50) when mentioning the classification of substances and mixtures because these were linked to the Dangerous Substances Directive (67/548/EEC) which was repealed by the CLP Regulation of June 2015. Instead, reference is exclusively made to hazard statements and classes (e.g. H350, H400).

The term "*toxic, hazardous to the environment, carcinogenic, mutagenic or toxic for reproduction (CMR)*" from Article 6(6) was translated into specific CLP hazard categories by the EU Ecolabel Chemicals Task Force and resulted in the Group 1, Group 2 and Group 3 hazards as listed in the criterion proposal.

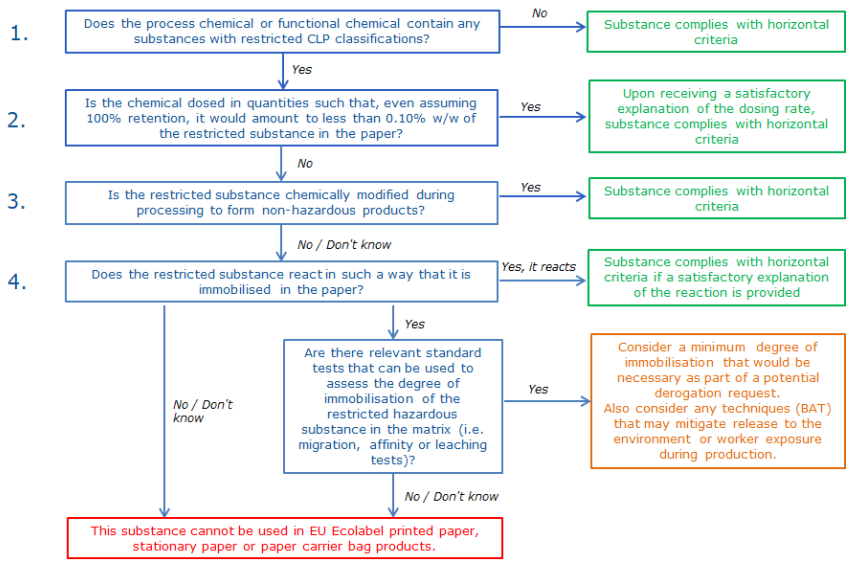
Depending on the nature of the product group and its normal use, the potential to also restrict category 1 skin sensitisers (H317) or category 1 respiratory sensitisers (H334) may be considered. These are far more relevant in products such as textiles and rinse-off cosmetics, due to the higher degree of skin contact. Nonetheless, the skin sensitisation hazard could perhaps be relevant to some printed paper, stationery paper and paper carrier bag products (due to the potential for prolonged skin contact when holding or carrying books, folders, envelopes or bags) and so the H317 restriction for skin sensitisers is listed in the proposed CLP criterion with a scope limited to certain process chemicals that, once cured and dried, are most likely to end up in contact with users' skin.

In order to demonstrate compliance with the CLP restriction criteria, the EU Ecolabel applicant has to be aware of all of the chemical substances or mixtures that have been used during the processing of the product. The following pieces of information are needed:

- list of chemical substances or mixtures used;
- safety data sheets or relevant supplier declarations;
- information about dosing rates and chemistry of any reactions that take place.

Armed with the above information, each chemical product can then be cross-checked against the following flow chart:

Figure 8. Flow chart for checking compliance with CLP restrictions



According to the flow chart above, the easiest means to demonstrate compliance is simply not to use chemicals containing hazardous substances in the first place.

When considering whether or not it is technically feasible to substitute the chemical or not, consideration has to be given to the functionality that the chemical imparts (e.g. brightness, gloss, scratch resistance). If less hazardous alternatives do exist, then a

case has to be made for why the more hazardous chemical is used. Maybe it is more efficient, maybe its performance is better proven, etc.

If the quantities of the restricted hazardous substance(s) involved are small then applicants should check their dosing rates and calculate if its use can be justified based on the fact that it would account for less than 0.10% of the final product weight.

The last chance for justifying the use of a chemical containing restricted hazardous substances without any specific derogation is to assess whether or not the substance reacts in such a way as to no longer be hazardous. Reactivity should be considered in terms of chemical reaction instead of physical immobilisation. For example, a monomer reacting to form a polymer is a clear example of a relevant chemical reaction but the depositing of a pigment in a coloured matrix is simply immobilisation and thus not a relevant reaction.

Finally, if a restricted hazardous substance cannot comply with the previous four steps but its use is considered fundamentally important to specific products or desirable product functionalities, then a derogation request should be made by the industry to the JRC.

Any derogation request should explain clearly what substance(s) are involved, their CLP classification(s), why they should be derogated and suggested conditions that could be attached to any such derogation (e.g. worker exposure control, maximum dosing rate, minimum functionality imparted or minimum degree of immobilisation achieved). A representative of EuPIA, the European Printing Inks Association, offered to collaborate with both the gathering of hazard information about inks and the potential consideration of necessary derogation requests.

For the assessment and verification of Criterion 2.2, which is based on the percentage of substances in the final product, in order to address the dynamic nature of the printing industry and so different printed products that may be printed to different degrees, the 'worst-case' product covered by the licence (i.e. the most heavily printed on the lightest paper) could be used as a case to apply the percentage calculations and if it passes, then all other products using the same chemicals can be considered to pass.

What do other ISO Type I ecolabels say?

The Nordic Ecolabel requirements for "Printing companies, printed matter, envelopes and converted paper products", version 5.12 state that:

- SVHCs must not be added to chemicals or materials used;
- no chemicals used must be classified as: H300, H301, H304, H310, H311, H317, H334, H330, H331, H340, H341, H350, H351, H360, H361, H362, H370, H371, H372, H373, H400, H410, H411, H412, H413; H420, EUH029, EUH031, EUH032 or EUH070.

The very broad CLP restrictions in the Nordic Ecolabel effectively require a number of exemptions, such as (i) chemicals for film and form production (H317, H411 and H412 exempted); (ii) algaecides and energy-curable inks, toners and varnishes (H400, H410, H411, H412, H413, H420 exempted); (iii) toluene-based washing agents and inks for gravure printing; (iv) chemicals containing chrome trioxide and copper sulphate for gravure cylinder preparation; (v) isocyanate-containing adhesives; (vi) non-SVHC cobalt complex dyes for foil printing; (vii) washing agents (H304 exempt); (viii) mineral-oil-based production chemicals for digital printing (H304 exempt).

The Blue Angel criteria for "Finished products made from recycled paper for office and school supplies", DE-UZ 14b, state that:

- No dyes, toners, printing inks, surface finishing agents, coating materials or adhesives that are classified as: H300, H301, H304, H310, H311, H330, H331, H340, H341, H350, H350i, H351, H360F, H360D, H360FD, H360Fd, H360Df, H361f, H361d, H361fd, H362, H370, H371, H372, H373, H400, H410, H411, H412, H413, EUH059, EUH029, EUH031, EUH032, EUH070.

Main outcomes from public consultations

Although the intention of Article 6(6) of the EU Ecolabel Regulation (EC 66/2010) focuses on the final product and not on consumables, the restriction of SVHCs at the level of ingoing chemicals was generally welcomed. A restriction of "not added" was requested but the JRC preferred to set a specific limit (0.10%) that declarations could commit to.

For the CLP restrictions in Criterion 2.2, a number of derogation requests were received:

- A derogation for UV-curing inks and varnishes was requested (for H412 and H413 hazard codes). However, upon closer examination it was found that the hazardous ingredients would be chemically modified such that they would no longer be present in the product. Therefore, no derogation was considered necessary.
- A derogation was requested for mineral oils for the hazard code H304. Even though the nature of the hazard (may be fatal if swallowed and enters airways) is not a genuine risk to users of the products, technically a derogation would be needed if the oils remain at levels exceeding 0.10%.

— A derogation was requested for nickel since it is by far the most commonly used coating for metal components used in these products (e.g. arch levers, ring binders). The derogation was granted for the same reasons as for steel parts in EU Ecolabel furniture (see Decision (EU) 2016/1332). However, unlike EU Ecolabel furniture, no nickel leaching limit was considered as a necessary derogation condition because there is no significant risk of prolonged skin contact with these products.

Main differences between the previous criteria and the new criteria

With the general shift of CLP restrictions in Criterion 2.2 from a consumables-focused approach to a final product approach, concern was expressed about the lack of restrictions on hazardous substances in inks. To allay these concerns, a new stand-alone hazardous substance criterion specifically for inks used in printed paper products was proposed (see Criterion 2.6 in Section 3.2.5

3.2.2 Specific restrictions – Biocidal products and biocidal active substances

Criterion 2.3 - Biocidal products and biocidal active substances
Printed paper, stationery paper and paper carrier bag products shall not be treated with any biocidal products, including those of type 7 (film preservatives) and of type 9 (fibre, leather, rubber and polymerised materials preservatives). Only in-can preservatives (i.e. biocidal product type 6: preservatives for products during storage) present in printing inks, varnishes, lacquers and any other formulations used during the production processes and preservatives used for liquid cooling and processing systems (i.e. biocidal product type 11) shall be permitted, subject to their: - having been approved by Regulation (EU) No 528/2012 of the European Parliament and of the Council[8] for product type 6 or product type 11 uses, as appropriate, or - being under examination pending a decision on approval by Regulation (EU) No 528/2012 for product type 6 or product type 11 uses, as appropriate; If any biocidal active substance meeting the above condition(s) is assigned the hazard statement code H410 or H411 (hazardous to the aquatic environment, chronic hazards, category 1 or 2), its use shall only be permitted if the bioaccumulation potential (log Pow octanol/water partition coefficient) is < 3,0 or if the bioconcentration factor (BCF) is ≤ 100. ***Assessment and verification:*** *the applicant shall declare which biocidal products have been used in the production process, state the nature of the use of the biocidal product (i.e. product type 6 or 11) and provide copies of safety data sheets and any relevant declarations or test reports from the manufacturer of the biocidal products.*

Rationale behind the criterion

Aim

Criterion 2.3 aims to prevent the intentional presence of biocidal active substances in the products and to minimise the use of biocidal active substances in process chemicals to the maximum extent considered plausible.

Link to environmental impacts/benefits

The non-use of biocidal products on the final products avoids the impact of the release of such substances to the wider environment during use or after disposal of the treated product and also avoids issues with these substances being present as trace contaminants in any recycled pulp if the product was recycled at the end of life.

The permitting of in-can preservatives is necessary to allow water-based process chemicals to be used instead of solvent-based ones. This can be considered a trade-off where the avoidance of VOC emissions in the workplace is achieved at the cost of very small quantities of biocidal active substances being used in the process chemical.

These benefits and trade-offs are not typically well captured by LCA methodologies.

Brief explanation of legal and technical aspects

The overarching legal framework for the placement of biocidal products on the market and their subsequent use is the Biocidal Products Regulation (BPR) (EC, 2012a). Biocidal active substances are approved at European Union level, while biocidal products (which contain biocidal active substances as key ingredients) are normally authorised at Member State level. Applications are

[8]Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products (OJ L 167, 27.6.2012, p. 1-123).

submitted via a dedicated IT platform (R4BP 3) which permits information to be shared and exchanged between the applicant, ECHA, Member State competent authorities and the Commission.

The possibility for allowing the use of biocidal products with active substances that are still "pending approval" is because of the reality that a number of active substances are still currently in the "Review Programme".

Water-based inks, varnishes and lacquers cannot be produced without the use of in-can preservatives. If the benefits from reductions in VOC emissions (EC, 2012b) are to be realised, water-based alternatives need to be used in many applications.

Biofouling of water-based formulations can be caused by bacteria, fungi or yeasts and generally results in the immediate disposal of the contaminated lot or batch. The biological growth of such microorganisms can result in a change in pH, a change in colour, the production of metabolic gases (sometimes highly odorous compounds), a change of viscosity and can sometimes be noted visibly via the formation of biofilms or colonies.

What do other ISO Type I ecolabels say?

The Nordic Ecolabel requirements for "Printing companies, printed matter, envelopes and converted paper products", version 5.12 state that:

- Active substances (biocides) in algicides and dampening solution additives must not be potentially bioaccumulable (a bioaccumulable substance has BCF ≥100 or log Kow ≥3.0.

The Blue Angel criteria for "Finished products made from recycled paper for office and school supplies", DE-UZ 14b, do not state any specific requirements for biocidal products or biocidal active substances.

Main outcomes from public consultations

The only relevant biocidal product group relating to in-can preservatives, which would be necessary in some formulations that may be used in the printing process, is product type 6 (preservatives for products during storage). The biocidal products type 11 (preservatives for liquid-cooling and processing systems) is specifically mentioned as these can be used in circulation systems in print houses.

It was also requested that the criterion be better aligned with the approach in the Blue Angel. The Blue Angel uses a significantly different product group structure to the EU Ecolabel. Consequently, it was considered necessary to ensure that these requirements are intended to apply to in-can preservatives in the formulations used in print houses, or just in the production of paper. A check of the Blue Angel criteria for different product groups revealed inconsistencies in the applicable scopes associated with the stakeholder comments. It was not deemed appropriate to align the Blue Angel requirements for biocidal products on paper substrates (i.e. applicable at the paper mill) with the EU Ecolabel requirements for biocidal products in printed paper products (i.e. applicable at the print house).

Main differences between the previous criteria and the new criteria

The requirements on the upper limits of bioaccumulation potential are effectively unchanged in terms of ambition level. Specific reference has now been made to the non-use of biocidal products for preservation of the final product and the general terminology has been adjusted to align with that of the BPR.

3.2.3 Specific restrictions – Cleaning agents

Criterion 2.4 - Cleaning agents
Cleaning agents used for routine cleaning operations in printing processes and/or sub-processes shall: - not contain solvents with a flashpoint < 60°C in concentrations > 0,10% (by weight); - not contain benzene in concentrations > 0,10% (by weight); - not contain toluene or xylene in concentrations > 1,0% (by weight); - not contain aromatic hydrocarbons (≥C9) in concentrations > 0,10% (by weight); - not contain any ingredients based on halogenated hydrocarbons, terpenes, n-hexane, nonylphenols, N-methyl-2-pyrrolidone or 2-butoxyethanol in concentrations > 0,10% (by weight). These restrictions do not apply to cleaning agents used in special formulations that are only occasionally used, such as dried ink removers and blanket revivers. The restriction on toluene does not apply to cleaning agents used in rotogravure printing processes.

Criterion 2.4 - Cleaning agents
***Assessment and verification**: the applicant shall declare the different cleaning agents that are used and whether they are used for routine cleaning procedures or for special procedures such as dried ink removal or blanket revival. A safety data sheet shall be provided for each cleaning agent used. For the routinely used cleaning agents, the safety data sheets shall be supported by a declaration of compliance with the relevant restrictions listed above from the supplier of the cleaning agent.*

Rationale behind the criterion

Aim

This criterion aims to prevent the use of the most dangerous types of solvents in cleaning agents and to exclude or restrict the presence of highly hazardous hydrocarbon compounds in cleaning agent formulations. Such chemicals would not be restricted by the horizontal Criterion 2.2, because these chemicals would not remain in the final product in quantities >0.10% (w/w).

Link to environmental impacts/benefits

The non-use of low-temperature-flashpoint solvents reduces the risk of spontaneous combustion events and thus improves the safety of working conditions during cleaning operations. Using lower contents of highly toxic hydrocarbons such as benzene, toluene and xylene is also beneficial for worker safety. These benefits and trade-offs are not typically well captured by LCA methodologies.

Brief explanation of legal and technical aspects

A wide range of washing and cleaning solutions might be used in a single print house where each solution is optimised for:

- the ink used (e.g. conventional inks, UV-cured inks, hybrid inks or dispersion varnishes);
- the type of printing technology (e.g. sheet-fed or web-fed, coldest or heatset printing);
- cleaning of very particular or niche parts (e.g. rubber materials, damping rollers, brush rollers or impression cylinders).

It is important to know that the cleaning solution will not damage any of the materials that it will potentially come into direct contact with. Particular care also has to be taken with safety concerns regarding possible explosion risks when solvent vapours may come into contact with air. Washing and cleaning solutions may be diluted with water when water-soluble particulates and paper fibres need to be removed or be used undiluted when ink fountains or inking rollers are used. Specifically formulated washing and cleaning solutions must also be used for rollers and cylinders (e.g. cylinder cleaning pastes). Washing solutions are examples of combustible liquids and can be classified as follows.

Table 7. Classification of combustible liquids

Flash point	Hazardous characteristics	Washing solution type
< 0°C	Highly inflammable	Special grades of petroleum spirit
< 21°C	Easily inflammable	Special grades of petroleum spirit
< 21-55°C	Inflammable	White spirit
< 55-100°C	None	White spirit
> 100°C	None	High-boiling
> 150°C	None	Cleaning solution on vegetable oil basis

(*Source***:** Bernd Schwegmann**)**

In 1995, the German offset printing industry made a commitment to only use cleaning agents that fulfil a number of criteria based on health and/or technical grounds.

Table 8: Offset printing industry criteria on cleaning agents

Criterion	Health grounds	Technical grounds
Flash point: >55°C	Means a lower evaporation rate and therefore lower contamination of the air	No particular explosion protection measures necessary; lower consumption of cleaning agent
Benzene content: <0.1%	Can cause cancer	Aromatic compounds can cause damage to seals and roller or blanket materials
Toluene and xylene content: <1%	Workplace limit concentration: 50 and 100 ppm	
Aromatic compounds (≥C9): <1%	hazardous substances: (only low workplace limit concentrations permitted)	
Absence of halogenated hydrocarbons	Neurotoxic; ozone-depleting substances	Can cause shrinkage or swelling of blankets

Criterion	Health grounds	Technical grounds
Absence of terpenes	Sensitizing; can cause skin irritation	Can damage various materials in the printing machine
Absence of n-hexane	Neurotoxic; workplace limit concentration 50 ppm	Very low flashpoint (-22°C); other hydrocarbon-based washing agents can be used
Absence of secondary amines and amides	Possible formation of carcinogenic nitrosamines under certain conditions	Corrosion of brass. Other anticorrosive agents are available
Absence of nonylphenols	Reprotoxic	Substitutes available: e.g. Sorbitan laurate as an emulsifier
Absence of N-methyl-2-pyrrolidone (NMP)	Reprotoxic, easily absorbed through the skin, corrosive/irritant to skin; workplace limit concentration (steam) 20 ppm	
Absence of 2-butoxyethanol	Workplace limit concentration 10 ppm (since Jan. 2012); on the basis of toxicological data and GHS classification criteria: "Toxic in contact with skin or if inhaled"; high vapour pressure	

(*Source*: BG ETEM, 1995 and HSE, 2002)

The previous EU Ecolabel criteria only focused on aromatic hydrocarbons <0.1% or limited use of hydrocarbon-based washing agents. The German industry criteria refer to benzene, toluene, xylene and aromatic compounds ≥C9 (all of which are potentially hydrocarbons). In the UK, the Printing Solvent Substitution Scheme (HSE, 2002) also sets requirements on the aromatic hydrocarbon content in a number of different process chemicals used in print houses. Based on the criteria that have been promoted in the UK and in Germany for a number of years already, it was considered appropriate to adjust the EU Ecolabel criterion for washing agents to better align with these industry standards. However, for aromatic hydrocarbons (≥C9), the stricter limit of 0.1% (instead of the 1% in the DE standard) is introduced.

What do other ISO Type I ecolabels say?

The Nordic Ecolabel requirements for "Printing companies, printed matter, envelopes and converted paper products", version 5.12 state that:

- 95% of the total quantity of washing agents purchased each year must comply with the hazard code restrictions defined in Appendix I (exemptions apply for H304 and toluene-based agents used in rotogravure);
- points can be awarded for the recovery, reuse or non-generation of washing agent solution waste;
- points can be awarded if the washing agent is Nordic ecolabelled;
- points can be awarded for the low vapour pressure of organic solvents used in washing agents.

The Blue Angel criteria for "Finished products made from recycled paper for office and school supplies", DE-UZ 14b, do not state any specific requirements for cleaning agents (or washing agents).

Main differences between the previous criteria and the new criteria

The horizontal restriction on SVHCs applies in the same way to the new criterion as to the previous criterion, with the one difference being that in the new one a declaration on SVHCs for ingoing chemicals has the specific limit of 0.10%.

The restrictions on aromatic hydrocarbons are now much stricter and less flexible. Specific exemptions (e.g. to toluene-based cleaning agents for rotogravure printing) are now explicitly stated in the criterion text for clarity.

3.2.4 Specific restrictions – Alkyl phenol ethoxylates, halogenated solvents and phthalates

Criterion 2.5 - Alkyl phenol ethoxylates, halogenated solvents and phthalates

The following substances or preparations shall not be present in concentrations exceeding 0,10% (by weight) in any inks, dyes, toners, adhesives or cleaning agents used in the printing process or related sub-processes to produce the printed paper, stationery paper or paper carrier bag product:

- alkyl phenol ethoxylates and their derivatives that may produce alkyl phenols by degradation;
- halogenated solvents that at the time of application are classified with any of the hazard classes listed in point 2.2
- phthalates that at the time of application have been assigned reproductive toxicity hazard classes (category 1A, 1B or 2) and one or more of the following associated hazard statement codes: H360F, H360D, H360FD, H360Fd, H360Df, H361, H361f, H361d, H361fd or H362 in accordance with Regulation (EC) No 1272/2008.

Criterion 2.5 - Alkyl phenol ethoxylates, halogenated solvents and phthalates
Assessment and verification: *the applicant shall provide safety data sheet(s) and a declaration(s) from its chemical supplier(s) demonstrating that APEOs or other alkylphenol derivatives, halogenated solvents or relevant phthalates are not present in these chemicals in quantities exceeding 0,10% (by weight).*

Rationale behind the criterion

Aim

This criterion aims to prevent the use of inks that contain certain groups of hazardous substances of concern. Such chemicals would not be restricted by the horizontal Criterion 2.2, because these chemicals would probably not remain in the final product in quantities >0.10% (w/w).

Link to environmental impacts/benefits

The non-use of these hazardous compounds of concern reduces the need for their production in the first place and brings benefits in terms of worker safety in the print house and the avoidance of these substances being released to users due to use or to the wider environment at the end of life.

In general, the ozone depletion potential (ODP) of halogenated solvents is the life cycle impact category of most direct concern. Although the compounds with the highest ODP potential have already been phased out or are being phased out, the ozone depletion mechanism is widely understood to involve free chlorine radicals (UNEP, 2001), which are not present in non-halogenated solvents. The benefits of non-use of halogenated solvents would therefore be reflected in LCA methodologies if compared to a baseline scenario in which they are used.

Brief explanation of legal and technical aspects

Alkylphenol ethoxylates (APEOs): These are a broad group of substances formed by the alkylation of phenol with different alkenes to produce alkylphenols with different chain lengths (controlled by the choice of alkene in the reaction). These substances have a range of properties that make them suitable for use in many different applications such as fuel additives, ingredients in lubricants, in polymers and especially as surfactants in non-ionic detergents. They may also be used in as reactants in the production of fragrances, antioxidants and flame retardants.

As per Regulation (EC) No 552/2009, the use of NP (Nonylphenol) and NPE (Nonylphenol Ethoxylate) in concentrations higher than 0.1% has been restricted as per entry 46 of Annex XVII to the REACH Regulation in cleaning products, the processing of textiles and leather and in a number of other specified uses. Both of these compounds have been added to the ECHA Authorisation List (Annex XIV to REACH) as per Regulation (EU) 2017/999, which means that they cannot be used after their sunset date (4 January 2021) unless they are specifically authorised (the deadline for authorisation requests was 4 July 2019).

Although NPE and OPE do not possess any of the hazards that would qualify them to be listed as Substances of Very High Concern (SVHCs), which is a normal prerequisite before being placed on the Authorisation List, there are concerns that their degradation products (including NP and OP) are toxic to fish and aquatic species and their use can also result in degradation products with estrogenic activity being released to the aquatic environment. The criteria for EU Ecolabel printed paper, stationery paper and paper carrier bag products are very much in line with the general idea of moving away from the use of APEOs altogether.

A comprehensive literature review on the environmental fate of nonylphenol by Soares et al. (2008) showed that NP is an important degradation product of NPE in waste water treatment plants and tends to absorb to sewage sludge solids (about 90% of all NP leaves the waste water plant as sludge, with the remainder being found in the final effluent). The low water solubility of NP increases its potential for bioaccumulation and decreases its availability for microbial biodegradation. Due to its vapour pressure (2.07×10^{-2} Pa) and Henry's Law constant (8.39×10^{-1} Pa m^3/mol), it is possible for NP to pass from the aquatic environment to the atmosphere.

Nonylphenol has been shown to induce breast tumour cell proliferation (Soto et al., 1991), to mimic the natural hormone 17β-oestradiol by competing for receptor sites that natural oestrogen would bind to (Lee and Lee, 1996; White et al., 1994) and to interfere with the proper functioning of androgens and subsequently the development of male reproductive systems (Lee et al., 2003).

The main alternatives for APEOs are alcohol ethoxylates which degrade more rapidly (Campbell, 2002) although the environmental fate of low-water-solubility degradation products may be a concern (Soares et al., 2005).

Halogenated solvents: Halogenated solvents may be used in printing inks, paints, coatings, adhesives and plastics (directly relevant to printed paper, stationery paper and paper carrier bag products) and also in textile processing, urethane foam production and in industrial machinery cleaning operations.

In general, there is a shift away from the use of halogenated solvents toward halogen-free alternatives, as exemplified by the ZDHC Roadmap to Zero programme promoted in the footwear and apparel sector, which places restrictions on:

- 1,2-dichloroethane (CAS No 107-06-2, harmonised classification H350),
- methylene chloride (CAS No 75-09-2, harmonised classification H351),
- trichloroethylene (CAS No 79-01-6, harmonised classification H341, H350 and H412),
- tetrachloroethylene (CAS No 127-18-4, harmonised classification H351 and H411).

These four well-known examples of halogenated solvents all have harmonised classifications for CMR hazards. In general, the Industrial Emissions Directive (IED, Directive 2010/75/EU) has placed special requirements on facilities that use halogenated solvents classified as CMR (e.g. see Article 59(5), Article 82(8), Article 82(9) and Part 4 of Annex VII to the IED).

According to information published in the draft BREF document for surface treatment using organic solvents (EC, 2017), the use of halogenated solvents in powerful cleaning agents used for industrial machinery can be replaced by ethanolamine. The same draft document states that the use of halogenated solvents is already considered obsolete in Germany.

In the EU Ecolabel context, the criteria for paints and varnishes (Decision 2014/312/EU) prohibit the use of halogenated solvents in Criterion 7d) regardless of their classification. A similar approach has been applied in Decisions 2012/481/EU and 2014/256/EU for printed paper and converted paper products and is maintained in the revised criteria.

Phthalates: Phthalates have found applications in many different manufacturing sectors and products such as children's toys, furniture, food wrap, medical devices, building materials, cables and packaging. The best known example is as a plasticiser in flexible PVC but other uses that are directly relevant to printed paper, stationery paper and paper carrier bag products also exist, for example as a solvent or additive in inks or coatings.

Phthalates tend to be categorised as *high* or *low* depending on the number of carbon atoms in the chemical "backbone". Backbones with 3-6 carbon atoms are considered *low* phthalates and those with 7-13 carbon atoms *high* phthalates.

Table 9. Summary of main phthalate restrictions and concerns

Acronym, full name and CAS No.	CLP classifications of concern and applications*	Restrictions in place
DEHP, Bis(2-ethylhexyl)phthalate, 117-81-7	H360FD (harmonised). Perfumes, flexible PVC products (shower curtains, garden hoses, diapers, food containers, plastic film for food packaging, bloodbags, catheters, gloves, and other medical equipment such as tubes for fluids, etc.)	Entry 51 of Annex XVII to REACH as per Regulation (EC) No 2018/2005: not to be used as substances or mixtures, individually or in any combination of the four phthalates, in a concentration equal to or greater than 0.1% by weight of the plasticised material** in toys, childcare products and other articles with some specific exemptions.
BBP, Benzyl butyl phthalate, 85-68-7	H400, H410, H360Df (harmonised). Perfumes, hairsprays, **adhesives** and glues, automotive products, vinyl floor coverings	
DBP, Dibutyl phthalate, 84-74-2	H400, H360Df (harmonised). Plastics such as PVC, adhesives, **printing inks**, sealants, grouting agents used in construction, additive to perfumes, deodorants, hairsprays, nail polish, and insecticides.	
DIBP, Diisobutyl phthalate, 84-69-5	H360Df (harmonised). Nitro cellulose plastic, nail polish, explosive material, lacquer. Similar application and properties as DBP: used as a substitute, e.g. in PVC, paints, **printing inks and adhesives**	
DNOP, Di-n-octyl-phthalate, 117-84-0	H361, H317, H413 (individual entries). Medical tubing and blood storage bags, wire and cables, carpetback coating, floor tiles, and **adhesives**, cosmetics and pesticides.	Entry 52 of Annex XVII to REACH: not to be used as substances or mixtures, in concentrations greater than 0.1% by weight of the plasticised material**, in toys and childcare articles which can be placed in the mouth by children.
DINP, Di-isononyl phthalate, 28553-12-0	H400, H361 (individual entries). Mostly in PVC as a plasticiser; remaining in rubbers, **inks, adhesives** and sealants, paints and **lacquers**.	
DIDP, Di-isodecyl-phthalate, 26761-40-0	H400, H410, H411 (individual entries). Mostly in PVC as a plasticiser; remaining in rubbers, anti-corrosion paints, anti-fouling paints, sealing compounds, and textile inks.	

*Past and present applications.
**The term "plasticised material" includes the following relevant interpretations: surface coatings, finishes, printed designs, adhesives, sealants, paints and inks.

***Exemptions include articles for industrial or agricultural use, aircraft, motor vehicles, measuring devices for laboratory use, food contact materials, medical devices and electrical and electronic equipment.

What do other ISO Type I ecolabels say?

The Nordic Ecolabel requirement for "Printing companies, printed matter, envelopes and converted paper products", version 5.12 state that:

— APEOs and their derivatives must not be added to chemicals or materials;

— halogenated solvents are excluded if they adversely affect the classification of the mixture as per the horizontal CLP restrictions that are consumable-based;

— classified phthalates are excluded by the horizontal CLP restrictions that are consumable-based.

The Blue Angel criteria for "Finished products made from recycled paper for office and school supplies", DE-UZ 14b, state that:

— aliphatic hydrocarbons in inks must have a chain length of C10-C20 (and some other specific potential requirements);

— printing inks must have an aromatic hydrocarbon content of <1%;

— PAH values in the ink must not exceed the limits defined in Regulation (EC) No 1272/2013;

— DIBP (DiIsoButyl Phthalate) shall not be contained in adhesives.

Main differences between the previous criteria and the new criteria

Only minor changes have been made to the criterion: (i) the expansion of the H360 hazard codes to all the different permutations possible and (ii) an alignment of the wording in the assessment and verification text with that published in Criterion 4(d) for EU Ecolabel graphic paper in Decision (EU) 2019/70.

3.2.5 Specific restrictions – Further restrictions applying to printing inks, toners and varnishes

Criterion 2.6 - Further restrictions applying to printing inks, toners and varnishes

Note: for the purpose of this criterion and unless stated otherwise, the restrictions equate to the non-presence of the hazardous substance or mixture in concentrations exceeding 0,10% (by weight) in the ink, toner or varnish formulation.

The following restrictions shall apply to all substances or mixtures used in printing inks, toners and varnishes for use in the printing process or sub-processes used to produce EU Ecolabel printed paper, stationery paper or paper carrier bag products:

- no substances or mixtures with assigned carcinogenic, mutagenic and/or reproductive toxicity hazard classes (category 1A, 1B or 2) and one or more of the following hazard statement codes: H340, H350, H350i, H360, H360F, H360D, H360FD, H360Fd, H360Df, shall be used;
- no substances or mixtures with assigned acute toxicity (oral, dermal, inhalation) hazard classes (category 1 or 2) and one or more of the following hazard statement codes: H300, H310, H330, shall be used;
- no substances or mixtures with assigned acute toxicity (oral, dermal) hazard classes (category 3) and one or more of the following hazard statement codes: H301, H311, shall be used;
- no substances or mixtures with assigned specific target organ toxicity (single or repeated exposure) hazard classes (category 1) and one or more of the following hazard statement codes: H370, H372, shall be used;
- no pigments or additives based on antimony, arsenic, cadmium, chromium (VI), lead, mercury, selenium, cobalt or any compounds thereof shall be used and only traces of those metals up to 0,010% (by weight) as impurities shall be permitted.
- no azo dyes, which by reductive cleavage of one or more azo groups may release one or more of the aromatic amines listed in Appendix 8 of entry 43 of Annex XVII to Regulation (EC) No 1907/2006, shall be used (see indicative list in Appendix I to that Annex);
- the following solvents: 2-Methoxyethanol, 2-Ethoxyethanol, 2-Methoxyethyl acetate, 2-Ethoxyethyl acetate, 2-Nitropropane and Methanol shall not be used;
- the following plasticisers: chlorinated naphthalenes, chlorinated paraffins, monocresyl phosphate, tricresyl phosphate and monocresyl diphenyl phosphate shall not be used;
- diaminostilbene and its derivatives, 2,4-Dimethyl-6-tert-butylphenol, 4,4'-Bis(dimethylamino)benzophenone (Michler's Ketone) and Hexachlorocyclohexane shall not be used.

Assessment and verification: *the applicant shall provide a list of all the printing inks and related products used in the production of EU Ecolabel printed paper, stationery paper or paper carrier bag products, together with a safety data sheet and declaration of compliance with this criterion for each printing ink, toner and varnish from the supplier/producer of each product.*

Rationale behind the criterion

Aim

The main aim of this criterion is to address concerns that restrictions on hazardous substances present in inks were being removed by changing the focus of Criterion 2.2 from a consumable-based approach to a final-product-based approach.

Link to environmental impacts/benefits

The restrictions on these hazardous compounds of concern reduce the need for their production in the first place and bring benefits in terms of worker safety in the print house and the avoidance of these substances being released to users due to use or to the wider environment at the end of life. Such criteria send a strong signal to market suppliers and can help shift ink formulations to less toxic ones. These benefits and trade-offs are not typically well captured by LCA methodologies.

Brief explanation of legal and technical aspects

The European Printing Ink Association (EuPIA) exclusion policy for printing inks and related products is a voluntary commitment of the European printing ink industry that began in 1996 and is now in its 3rd edition (published in November 2016 and recently corrected in December 2018) (EuPIA, 2016). During the more than 20 years of its existence, the exclusion policy has had to react and adapt to the implementation of the REACH and CLP Regulations, developments in classification rules and substance reclassifications due to new toxicological evidence.

The EuPIA exclusion is currently focused on a hazard-based approach, which is not dissimilar to the way in which Article 6(6) of the EU Ecolabel Regulation has been applied as per the recommendations of the EU Ecolabel chemicals task force.

The exclusions are split into seven different groups (A to G):

A. Raw materials* used in formulations classified as acutely toxic, category 1 and 2 (i.e. H300, H310, H330); acutely toxic by inhalation category 3 (i.e. H331); CMR category 1 (i.e. H340, H350, H360); STOT single exposure category 1 (i.e. H370).

B. Raw materials* used in formulations classified as acutely toxic category 3 (i.e. H301 and H311); toxic to reproduction (if threshold exists); STOT repeated exposure category 1 (H372).

C. Pigments shall not be based on the following heavy metals or their compounds: antimony*, arsenic, cadmium, chromium (VI), lead, mercury or selenium. (*There is a specific exemption for antimony in certain non-bioavailable pigments).

D. The following dye colourants (Basic Yellow 2, Basic Orange 2, Basic Violet 14, Solvent Blue 7 and Basic Brown 4) shall not be used in addition to any soluble azo dyes that can decompose to form category 1 carcinogenic aromatic amines.

E. The following solvents shall not be used: 2-Methoxyethanol; 2-Ethoxyethanol; 2-Methoxyethyl acetate; 2-Ethoxyethyl acetate; Monochlorobenzene; Dichlorobenzene; Volatile chlorinated hydrocarbons such as trichloroethylene, perchloroethylene and methylene chloride; Volatile fluorochlorinated hydrocarbons; 2-Nitropropane; Methanol.

F. The following plasticisers shall not be used: Chlorinated naphthalenes; Chlorinated paraffins; Monocresyl phosphate; Tricresyl phosphate and Monocresyl diphenyl phosphate.

G. The following other compounds shall not be used for any particular purpose: Diaminostilbene and derivatives; 2,4-Dimethyl-6-tertiary-butylphenol; 4,4'-Bis(dimethylamino)benzophenone (Michler's Ketone); Hexachlorocyclohexane.

*Raw materials are understood as substances and mixtures used as ingredients in formulations.

Annex 2 to the EuPIA exclusion policy (EUPIA, 2016) makes an exemption for the use of formaldehyde in microcapsules used in scent varnishes. Such an exclusion would not be relevant to this EU Ecolabel product group since fragranced products are excluded from the scope.

What do other ISO Type I ecolabels say?

A comparison of the requirements in the existing EU Ecolabel, Nordic Ecolabel, Blue Angel and EuPIA documents indicates the following:

- **Existing EU Ecolabel criteria**: Cd, Cu (except Cu-phthalocyanine), Pb, Ni, Cr(VI), Hg, As, Ba (if soluble), Se and Sb. Co only allowed up to 0.1% (w/w). All of these excluded heavy metals are allowed up to 0.01% (w/w) to account for impurities.
- **Nordic Ecolabel criteria**: sum total of Pb, Cd, Hg and Cr(VI) must be < 0.01% in printing inks, toners, inks, varnishes, foils and laminates.
- **Blue Angel criteria (DE-UZ 195)**: Pb, Cd, Cr(VI), Co, Hg, Ni and Cu (except Cu phthalocyanine). Mn only allowed up to 0.5% by mass.
- **EuPIA exclusion policy**: no pigment colorants based on Sb (some exceptions apply), As, Cd, Cr(VI), Pb, Hg or Se.

The common denominators are the exclusions on Cd, Pb, Cr(VI) and Hg. There is a lack of consistency for all of the other heavy metals.

Main outcomes from public consultations

During the course of the project, the JRC highlighted the apparently divergent approaches to heavy metal restrictions in inks that have been applied by the different initiatives (i.e. EUPIA exclusion policy, EU Ecolabel, Nordic Ecolabel and Blue Angel).

In particular, the ban on cobalt-based additives in the Nordic Ecolabel was cited as something that the EU Ecolabel could align with.

Main differences between the previous criteria and the new criteria

The previous criteria focused only on heavy metals in printing inks, toners, varnishes, foils and laminates. The new criteria do not apply to foils and laminates since the new criteria are strongly influenced by the EUPIA policy.

Consequently, the restrictions on printing inks are much broader now and include CLP hazard code restrictions at the level of ingredients added to printing inks, toners and varnishes. The restriction on cobalt-based additives and pigments is added. For clarity, there is a note specifically stating that the restrictions equate to the non-presence of the hazardous substance or mixture in concentrations exceeding 0.10% (by weight) in the ink, toner or varnish formulation.

3.2.6 Specific restrictions – Toluene recovery from rotogravure printing

Criterion 2.7 - Toluene recovery from rotogravure printing
Any rotogravure printing processes used to produce EU Ecolabel printed paper, stationery paper or paper carrier bag products must have a solvent recovery system in place and be able to demonstrate a toluene recovery efficiency of at least 97%. ***Assessment and verification:*** *the applicant shall provide a declaration of compliance with this criterion supported by a description of the solvent recovery system and a mass balance of toluene that demonstrates a recovery of at least 97% during the most recent completed calendar year. In case of a new or a rebuilt production plant, the calculations shall be based on at least three months of representative running of the plant.*

Rationale behind the criterion

Aim

The stand-alone criterion on toluene was considered necessary when changing the focus of Criterion 2.2 from a consumable-based approach to a final-product-based approach. In the old Criterion 2.2, a specific exemption for the use of toluene-based inks was made subject to a toluene recovery rate of 92%.

Link to environmental impacts/benefits

Although the rotogravure process uses large quantities of the hazardous solvent toluene, the recovery of the toluene has major economic and environmental benefits. This recovery of solvent on site means that print houses buy more concentrated ink (e.g. 50% solvent content) which they then dilute to the required viscosity (e.g. 70% solvent content). This not only reduces the need to produce more toluene but also reduces potential VOC emissions and represents a much better use of solvent than simply burning it in an afterburner.

Environmental benefits should be able to be shown clearly from a life cycle assessment perspective due to reduced specific solvent consumption (and the embodied energy associated with it) and also in the reduced fuel consumption and reduced emissions of VOCs and CO_2 from afterburners.

Brief explanation of legal and technical aspects

The rotogravure printing process is particularly well suited for large printing volumes due to economies of scale. The rotogravure industry is estimated to use some 100 000 t/yr in 32 printing plants and 125 presses in Europe) (EC, 2017).

Residual toluene contents remaining in printed paper do not exceed 0.1% w/w (0.04% w/w is likely and only immediately after printing). This residual content would then decrease rapidly after printing due to evaporation of toluene traces.

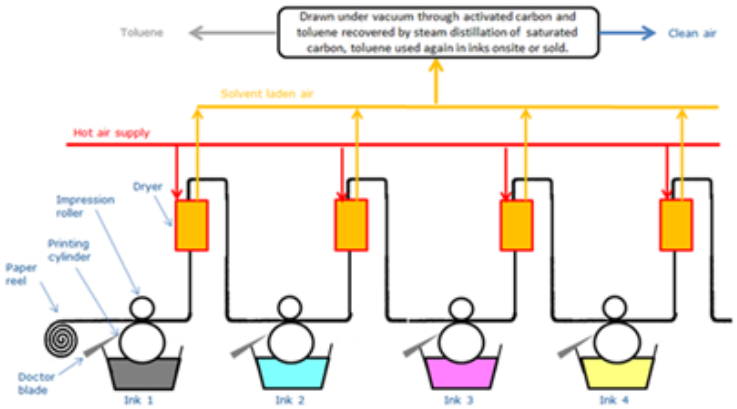
According to the ECHA C&L inventory, toluene (CAS No. 108-88-3) has a harmonised classification of H225, H315, H304, H336, H373 and H361d.

The recovery unit consists of activated carbon filters connected in series. Once the activated carbon is saturated with toluene, it is regenerated with steam and the steam/toluene mixture is separated by gravity once the steam has condensed to water after cooling. Thanks to the fact that rotogravure processes only use mono-solvent inks, the recovered toluene is of suitable purity for reuse in the process. Recovery rates of more than 95% are possible.

A narrow focus to calculate the toluene recovery rate would consist of comparing the input air volume and toluene concentration with the output air volume and toluene concentration. The estimate from these data could be supported by records of the quantities of actual toluene recovered from the activated carbon regeneration and subsequent distillation. A more holistic perspective would be to also consider fugitive emissions (both from evaporation of traces of toluene remaining in the final product and from diffuse emissions whenever ink (either from new ink being prepared or from old ink from cleaning operations or cylinders being cleaned) comes into contact with the open atmosphere. The fugitive emissions from printing and cylinder cleaning operations can be greatly reduced by the fully encapsulated processes. This criterion must apply to the entire rotogravure printing process and not simply to print runs for EU Ecolabel products.

A recovery of 97% is proposed to reflect recent modifications to ink compositions, which mean that the ink takes more time to solidify and thus more time is available for toluene to evaporate to the recovery system.

Figure 9. General illustration of the process flow for rotogravure printing (one side)



Source: JRC, 2020

What do other ISO Type I ecolabels say?

The Nordic Ecolabel requirements for "Printing companies, printed matter, envelopes and converted paper products", version 5.12 state that:

— the recovery rate of toluene for gravure printers must be at least 92%.

The Blue Angel criteria for "Finished products made from recycled paper for office and school supplies", DE-UZ 14b, do not state any requirements for toluene.

Main outcomes from public consultations

Stakeholders generally welcomed the increase in ambition for the toluene recovery rate.

Main differences between the previous criteria and the new criteria

Apart from the criteria structure in which the toluene recovery rate is placed (previously as an exemption to a horizontal restriction, now as a stand-alone criterion), the single major difference is that the required recovery rate has increased from 92% to 97%.

3.3 Criterion 3 – Recyclability

The criterion addresses various product categories, considering their differences, with the key objective to ensure material circularity. For paper products, the aim is to obtain recycled paper of a similar quality to that of the original product.

The criterion is divided into four parts that address: separation of the non-paper components from paper components, product repulpability, adhesives removability, and deinking.

The technical subgroup on recyclability was formed after the 1st AHWG Meeting in order to provide technical support for the criterion revision. The revised criterion is a result of the technical subgroup communication and stakeholder feedback.

Table 10. Recyclability of different paper products

Product	Good to recycle*	Alternatives
Self-adhesive labels	1	*Burn instead recycle*
Business forms	4-5	
Carbon paper	1	*Burn*
Cartons	5	
Catalogues	5	
Tinted paper	3	*Burn or use in small quantities in the recycling process*
Coloured paper	3	*Burn or use in small quantities in the recycling process*
Copy paper	4	
Corrugated board	5	
Daily newspaper	5	
Envelopes – self-adhesive	3	*Burn or use in small quantities in the recycling process*
Envelopes – water-moistened		
Filter paper	1	*Burn if contaminated*
Food packaging	4-5	
Label paper	5	*Use in new cartons or corrugated board*
Laser – printed paper	4	
Magazines	5	
Paper packaging	5	
Photographic paper	1	*Should be collected as special (hazardous) waste*
Plastic laminated product	2	*Burn*
Postcards	5	
Printed promotional material	5	
Sack paper	5	*Use in new cartons or corrugated board*
Sticky notes	1	*Burn instead of recycle*
Thermal paper	2	*Burn*
Waxed paper/cartons	3-4	
Wet strength paper	5	*Use in new cartons or corrugated board*
Window envelopes	3	*Burn or use in small quantities in the recycling process*

*Where 1 represents poor recyclability, and 5 very good recyclability.

Source: Environmental Council of the Swedish Printing Industries, 2008

3.3.1 Removability of non-paper parts

Criterion 3.1 – Removability of non-paper parts

The non-paper parts of stationery paper product such as metal bars or plastic covers shall be easily removable to ensure that those components will not hinder the recycling process. Small non-paper elements such as staples or envelope windows are exempted from this requirement.

Assessment and verification: *the applicant shall provide a declaration of compliance with the criterion supported by at least one of the following documents: a declaration issued by a product manufacturer or designer, paper collecting company, recycling company or an equivalent organization. The declaration shall be supported by a list of non-paper materials used in a product.*

Rationale behind the criterion

Eco-design is a key aspect of circular economy policy. It enforces waste prevention, resource efficiency and recycling. An appropriate product design enables the manufacturing of goods that could be recirculated as quality recyclates. Criterion 3.1 addresses easy separation of non-paper elements from paper parts, i.e. removal of metal or plastic elements before entering the paper for recycling stream.

EN 643 on the European List of Standard Grades of Paper and Board for Recycling defines paper and board for recycling as natural fibre-based paper and board suitable for recycling, consisting of (CEPI, 2013):

— paper and board in any shape;

— products made predominantly from *paper and board* which may include other constituents that cannot be removed by dry sorting, such as coatings, laminates, spiral bindings, etc.

Some non-paper parts are often not easily removable due to their small size, making the requirement impractical to implement. For this reason, the criterion specifically mentions the exemption for staples or envelope windows.

The easy removability of non-paper parts depends on how these are incorporated into the final product. Therefore, the verification of the former criterion has been expanded to the declaration of compliance released by a manufacturer or product designer.

3.3.2 Repulpability

Criterion 3.2 – Repulpability
The product shall be suitable for repulping. Wet strength agents shall not be used except for paper carrier bags and wrapping paper, where they can be used only if the product repulpability can be proven. Lamination, including polyethene and/or polypropylene, shall only be used to increase the durability of products with a life span of at least 1 year. This includes books, binders, folders, exercise books, calendars, notebooks and diaries. Lamination shall not be used in magazines, paper carrier bags, or wrapping paper. Double lamination shall not be used in any product. ***Assessment and verification:*** *the applicant shall provide a declaration of compliance with the criterion supported by the following documentation.* *For printed paper products and stationery paper products, the applicant shall declare the non-use of wet strength agents.* *For paper carrier bags and wrapping paper, the applicant shall provide a declaration of the non-use of wet strength agents. Otherwise, the applicant shall demonstrate product repulpability supported by the result(s) of test report(s) according to the PTS method PTS-RH 021, the ATICELCA 501 evaluation system or equivalent standard methods that are accepted by the competent body as providing data of equivalent scientific quality.* *The applicant shall provide a declaration of the non-use of lamination for newspapers, magazines, paper carrier bags, wrapping paper, or stationery paper products. Otherwise, the applicant shall provide the result(s) of test report(s) proving repulpability according to the PTS method PTS-RH 021 or ATICELCA 501 evaluation system or equivalent standard methods that are accepted by the competent body.* *For laminated products, the applicant shall provide a declaration of non-use of double lamination.* *Where a part of a paper product is easily removable (for example a metal bar in a suspension file, a magazine insert or a plastic cover or a reusable exercise book cover), the repulpability test may be made without this component.*

Rationale behind the criterion

For the objective of the criterion, repulpabilty has been defined as the process that aims to convert paper back into pulp.

Wet strength agents

Wet strength agents improve paper strength by reducing the breakdown of hydrogen bonds between cellulose fibres in the presence of water. Wet-strength paper incorporates a resin adsorbed onto paper fibres, which cross-links on heating or aging. From the recyclability perspective, wet strength agents might cause a deterioration effect due to the formation of aggregates. Repulpability of paper that contains wet strength agents requires specific process conditions and even then some wet-strength papers cannot be sufficiently repulped (Bajpai, 2015).

The information exchange during the revision of the EU Ecolabel criteria for graphic paper revealed that wet-strength agents are not used in a graphic paper grade, instead being designated for tissue paper or cellulosic filter production (Zakaria 2004, Bajpai 2018, Onur et al 2019). It was nevertheless proposed to ensure that wet strength agents are not used in all products, including printed matter. Due to functionality reasons, wet strength agents are likely to be present in carrier bags and wrapping paper. The criterion recognises the technical requirements for these products as long as their recyclability can be proven.

Coating, varnishing and lamination

Coating (i.e. varnishes, aqueous or UV, among others) is applied on the product surface during the finishing phase. It provides additional protection (durability) and achieves various visual effects.

Lamination refers to adhering a layer of plastic to a paper mainly to increase product durability (i.e. barrier properties or mechanical resistance). Film laminates, for example polypropylene, polyesters, nylon, are usually applied by finishers or converters using either a wet method, which relies on solvents or water, or a thermal method, which uses heat to adhere the film and paper together. Plastic films used in lamination act as a water penetration barrier, lowering the yield of the recycling process. Double lamination further reduces product repulpability.

The discussion with the recyclability technical subgroup revealed that, due to the different recyclability potential, paper coating should be addressed by the deinkability requirement, whereas paper lamination should be covered by the repulpability criterion. It was agreed that the use of lamination was justified only for products with a lifespan of at least 1 year: books, exercise notebooks, binders, folders, diaries. Magazines are considered to have a life span of less than a year, therefore lamination should not be used. It was agreed that double lamination should not be accepted.

3.3.2.1 Assessment and verification

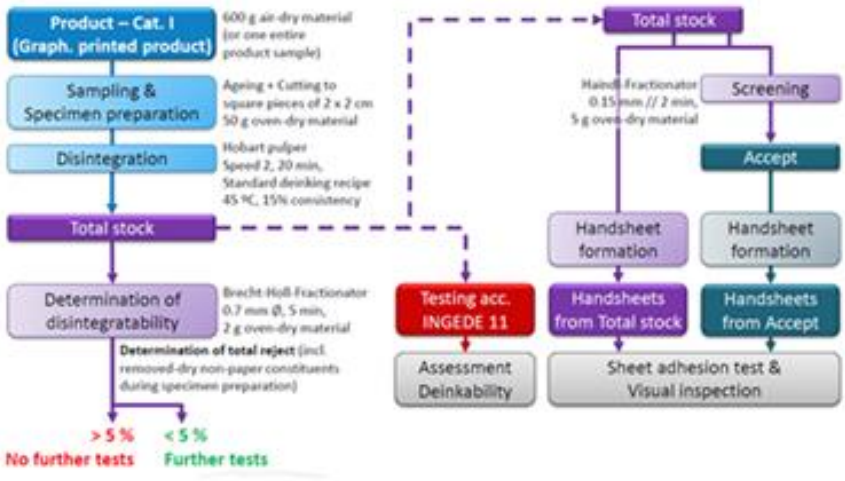
The PTS-Method PTS-RH 021 and the ATICELCA 501 evaluation system were developed to assess the recyclability of paper and board packaging. They have some important differences, mainly in the pulping time and methodology to measure screen rejects.

ATICELCA 501 (ATICELCA, 2019) applies to all cellulose-based materials and products and is based on the provisions of the EN 13430 standard and annexes (CR 13688). The test assesses the efficiency of the recycling process as regards the loss of material and costs related to maintenance measures, and the quality of the recycled paper as regards suitability for use in paper products.

The method simulates some of the main phases of industrial papermaking from paper for recycling and assesses four levels of recyclability (levels A+, A, B and C) and a 'non-recyclability with paper' level. The parameter with the worst value determines the recyclability level. In the case of non-recyclability, the material or product is not suitable for a collection with paper stream. It can however be used in other industrial processes or sent for energy recovery.

PTS-Method PTS-RH: 021/97 (PTS, 2019): assesses the recyclability of printed graphic products and paper and board packaging. Recyclability is determined by defibration (repulpability) and also by the capacity to form undisturbed paper sheets. Category I product indicates fibre for recycling suitable for the graphic grade, whereas Category II product denotes suitability for use for packaging papers.

Figure 10. PTS method process scheme for Category I products



Source: PTS, 2019

For Category I, only products with total rejects of less than 5% of the total weight of the product passes the test and are further evaluated for undisturbed sheet formation (deinkability assessment, sheet adhesion and visual adhesion inspection). Total rejects allowed for Category II products are <50% of the product weight and a deinkability test is not required.

The ATICELCA method differentiates between coarse rejects (waste rejects) and fibre flakes while the PTS method measures screen rejects from 0.7 mm screen slots. The PTS method indicates specific parameters and tests for the graphic line and

packaging line while the ATICELCA method does not. In particular, the PTS method includes a deinkability test according to INGEDE Method 11. The table below summarises the main differences between the two methods.

Both methods are suitable to verify compliance with Criterion 3.2.

Table 11. Comparison of the ATICELCA 501 and PTS-RH: 021/97 methods

PARAMETER	Method	
	ATICELCA 501	**PTS-RH 021/97**
GRAPHIC AND PACKAGING	*Same parameters*	*Separate parameters*
PULPING TIME	*10 min*	*20 min*
COARSE REJECTS (5 mm screen slots) [required result]	*YES [=<40%]*	*NO*
FLAKES (0.15-0.7 mm screen slots) [required result]	*YES [>40%]*	*NO*
SCREEN REJECTS (0.7 mm screen slots) [required result]	-	*YES [<5%, <50%]*
MACROSTICKIES	*YES*	*NO*
OPTICAL INHOMOGENEITIES	*YES*	*YES*
ADHESION TEST	*YES*	*YES*
DEINKABILITY TEST	*NO*	*YES (for graphic line)*

Source: PTS, 2019 and ATICELCA, 2019

3.3.3 Removability of adhesives

Criterion 3.3 – Adhesives removability

This criterion applies to printed paper, stationery paper, and paper carrier bag products.

Adhesive labels that constitute 0,50% w/w or more of the final product shall prove the compliance with this requirement. Non-adhesive labels are exempted from fulfilling the criteria.

Unless otherwise specified, adhesives may be used only if their removability can be proven with a score of at least 71 on the EPRC Adhesive Removal Scorecard.

Pressure sensitive adhesive coatings shall be used only if their removability can be proven with at least a positive removability score according to the EPRC Adhesive Removal Scorecard.

Water based adhesives are exempted from fulfilling this requirement.

Assessment and verification: *the applicant shall provide a declaration of compliance with the adhesive removal scorecard according to the guidelines of the European Paper Recycling Council (EPRC). The declaration shall be supported by adhesive removability test results according to INGEDE Method 12, or equivalent standard methods that are accepted by the competent body as providing data of equivalent scientific quality.*

For water-based adhesives, a declaration of the water-based nature of the adhesive shall be provided by the adhesive manufacturer. Safety data sheet of adhesive shall be accepted as prove of compliance only if it indicates that the adhesive used in the product is water –based.

Adhesive applications listed in the Annex of the "Assessment of Printed Product Recyclability, Scorecard for the Removability of Adhesive Applications", are considered compliant with the requirement.

Rationale behind the criterion

There are different ways to classify adhesives, e.g. according to the polymers that impart mechanical strength to the adhesive film (e.g. ethylene vinyl acetate or polyvinyl acetate), or according to the type of carrier, etc. Paper converters choose the adhesive application that meets the desired product functionality and, generally, use polymers that are dissolved or dispersed in water or that are hot-melted for their application.

The presence of adhesives in a final product may hamper the recycling process due to the possible formation of deposits that reduce the machine speed and require costly downtime for cleaning. Moreover, the deposits might cause quality defects and can interfere with subsequent printing and converting operations (Venditti et al, 2007).

Whether the adhesive film is destroyed during the recycling process depends not only on the process conditions and physico-chemical properties of the adhesive formulation, but also on the geometry of the adhesive film. The thickness is of key relevance, as the first step of the repulping process is mechanical. The thin adhesive application film might break into tiny particles, whereas thicker film is more stable with regards to fragmentation, forming large macrostickies that can be easily sorted and removed. It is therefore important to assess if the adhesive film may disintegrate into small particles that cannot be removed by sorting facilities, and if these particles have the potential to re-agglomerate and form stickies. Generally, in order to re-agglomerate, the adhesive particles must be thermoplastic adhesive films or thermosetting adhesive films[9].

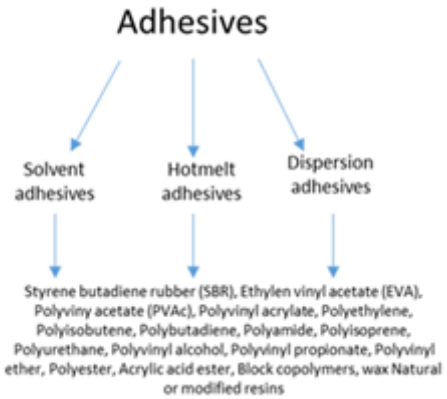
Generally, stickies are classified in three groups: macro, micro and secondary stickies. Macrostickies have no upper limit, starting from a size of 100 µm or 150 µm, including tacky particles. Microstickies are particles smaller than 100 µm or 150 µm but bigger than 1-5 µm. The last category is secondary or potential secondary stickies. The formation of secondary stickies is generally caused by thermoplastic materials that enter the recycling process (paper coating binders, printing inks, wax, wet strength resin, papermaking additives and adhesives). The mechanism of their formation is still unknown. This group includes dissolved and colloidal or dispersed stickies, which are smaller than microstickies and which allegedly cause major problems after modification of their temperature, pH or chemical environment as they are known to agglomerate into bigger particles and to form deposits on the paper machine or paper (Sarja, 2007).

Hot-melt adhesives are used for magazines, diaries, book bindings and folders. They do not usually hinder the recovery process. Application of non-water-soluble or non-redispersible hot-melt adhesives is, under specified conditions, exempted from the performance of the INGEDE adhesive removability test:

- softening temperature of the adhesive (according to R&B): 68 °C minimum;
- layer thickness of the adhesive (non-reactive adhesive): 120 µm minimum;
- layer thickness of the adhesive (reactive adhesive): 60 µm minimum;
- horizontal dimension of the application (in either direction): 1.6 mm minimum.

INGEDE Method 12 is generally applicable to all adhesive films. In the case of adhesive films that disintegrate during fragmentation into small particles (less than 100 µm), INGEDE Method 4 which is used for the evaluation of fragmentation according to INGEDE Method 12 is not suitable. Due to the lack of a standardised measurement method, water-based adhesives are exempted from the requirement of Criterion 3.3.

Figure 11. Adhesive contaminant deposits frequently identified in paper machine deposits (adapted from Putz, 2000)



Source: Putz, 2000

Labels that adhere to the product will most probably be mechanically sorted and removed from the process. Considering their limited weight content, it was agreed to exempt from the requirement adhesive labels that constitute less than 0.50% w/w of the final product.

Last but not least, in order to reflect the key terminology used by the adhesives industry, the following definitions are considered[10]:

[9]Communication with the Association of the European Adhesive & Sealant Industry (FEICA).
[10]Communication with the Association of the European Adhesive & Sealant Industry (FEICA).

1. 'Adhesive application' refers to processed adhesives used in finished paper products (typically applied as films). The physico-chemical properties responsible for the behaviour of the "adhesive applications" during the paper recycling process depend on the composition of the adhesive, the setting mechanism and the geometry (mainly thickness) of the application.

2. 'Pressure-sensitive adhesive (PSA) coatings' means adhesives with still mobile molecules on their surfaces, even after setting, can produce sufficient adhesion by pressing their cohesive films (coating) against the surface to be bonded. Since they can be "activated" by pressure, they are also called "pressure-sensitive adhesives (PSA)"(i.e. labels or tapes). PSA can be formulated to feature a wide variety of physico-chemical properties. Since, in paper recycling, the separation of non-paper components is mainly achieved by mechanical sorting, it is desirable for the PSA coatings to have a "minimum size", a sufficient thickness.

3.3.3.1 Assessment and verification

INGEDE Method 12 is currently the only method suitable for carrying out a quantitative assessment to gain a thorough understanding of how adhesive film affects the paper recycling process. The European Paper Recycling Council (EPRC) Assessment for the Removability of Adhesive Application evaluates the results of INGEDE Method 12 and establishes a scoring system on a Removal Scorecard:

I. Score 71 to 100 points - *Evaluation of removability*: **Good;**
II. Score 51-70 points - *Evaluation of removability*: **Fair;**
III. Score 0-50 points - *Evaluation of removability*: **Tolerable;**
IV. NEGATIVE - *Evaluation of removability*: **Insufficient**.

What do other ISO Type I ecolabels say?

Nordic Ecolabelling requires at least 51 points for the prescribed INGEDE Method 12 which corresponds to "Good" or "Fair" removability. In addition, adhesives, including PSA, can be awarded maximum points for recycling if they score at least 51 points on the EPRC Removal Scorecard (adhesive for laminates and adhesive for foils for foil printing are exempted). Blue Angel recommends that adhesive applications should be removable according to the EPRC guidelines on removability. No scoring system is defined and there is an exemption for redispersible (water-based) adhesives. The Austrian Ecolabel requires the removability of hot-melt adhesives according to the EPRC Removal Scorecard without specifying a score.

3.3.4 Deinkability

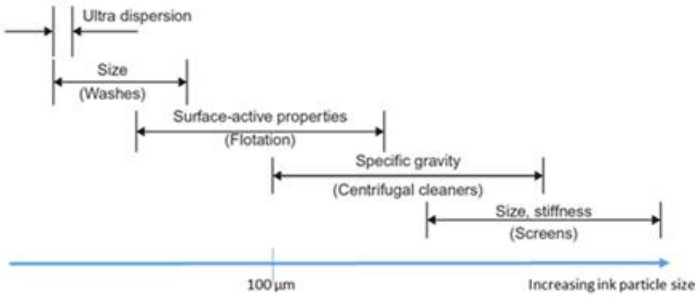
Criterion 3.4 – Deinkability
This criterion applies to printed paper products and envelopes based on white paper. The deinkability shall be proven. The printed product is considered compliant with the requirement if all individual parameters analysed have a positive score and the final score is at least 51 on the EPRC Deinkability Scorecard, or equivalent. Envelopes shall be exempted from performing deinkability test. For envelopes, internal printing shall only be used for the privacy reasons and in envelopes composed of paper with a grammage of less than 135g/m^2, or with opacity level lower than 98%. The internal printed surface shall be less than 80% of the total interior surface minus the glued area and shall be printed with light colour shades. ***Assessment and verification:*** *the applicant or ink manufacturer shall provide a declaration of compliance with deinkability scores according to the guidelines of the European Paper Recycling Council (EPRC). The declaration shall be supported by deinking test results according to INGEDE Method 11, or equivalent standard methods that are accepted by the competent body as providing data of equivalent scientific quality.* *For envelopes, the applicant shall provide a declaration of compliance with the requirement, supported by specifications of the weight/m^2 of the paper used according to UNE-EN ISO 536 or opacity according to ISO 2471, colour of printing ink, and % coverage of any internal printing pattern.* *Printing technologies and material combinations listed in the Annex of the "Assessment of Printed Product Recyclability, Deinkability Score" shall be considered compliant with the requirements.* *Testing of printing technologies or inks must be performed on the paper type(s) that is used in a product. The test certificate can be used for prints with the same ink on the same type of substrate if the ink coverage is equal or lower than on the tested product.*

Rationale behind the criterion

The aim of this section is to address the deinkability properties of paper for recycling intended for the graphic grade.

The deinking process consists of (1) detachment of the ink film from the paper, (2) ink fragmentation into a suitable size and (3) its removal from the pulp slurry. Screening and centrifugal cleaners are used in the process (Bajpai, 2014). Small particles (<10 µm) are usually removed by washing, whereas the medium-sized particles (10–100 µm) are removed by flotation, which is the main technique used for the deinking of graphic papers[11]. Bajpai (2014) correlates the optimal efficiency of the flotation process with an ink particle size of 20-100 µm, whereas Faul, A. (2010) suggests a range of 4 µm to 180 µm. The effectiveness of the flotation process will also be influenced by the process chemistry, ink hydrophobicity and, possibly, the rigidity of the ink particles.

Figure 12. Ink removal efficiency of various methods and particle sizes



Source: adapted from Bajpai, 2014

Unconventional offset printing, i.e. thermochromic (Vukoje et al 2016), along with toner (laser, photocopy) and flexographic printing might prove difficult for deinking by means of the alkaline flotation process (CEPI, 2012). Cross-linked ink particles (i.e. UV) are too large for flotation. In some cases, a disperser and a second flotation loop is used, but it increases the complexity and cost of the process.

Table 12. Overview of deinking capacity for different printing techniques (Vukoje et al., 2016)

Prints	Deinkability	Nature of ink particles	Problems
Offset	Good	Hydrophobic	Bad ink detachment after aging process
Gravure	Good	Hydrophobic	-
Flexographic	Poor	Hydrophilic	Small size and hydrophilic nature of the ink particles are suitable for flotation process
Digital	Poor	Hydrophilic	Generating numerous ink particles below 100 µm
Inkjet	Poor	Hydrophilic	Ink may stain the fibre and forms small particles
Hot-melt-based inkjet prints	Poor	Fused during drying – residual toner	Sticky deposits
Toner	Poor	Fused during printing	Formation of larger particles, flat and plate-like particles
Liquid toner	Poor	Too soft to pass the screens	Large visible ink film specks
UV-cured	Poor	Formation of cross-linked films which are difficult to break down	Visible speck contamination by large flat and plate-like particles

Carré et al. (2005) studied the deinkability performance of several commercial digital printing techniques The results of the study can be summarised as follows:

- UV inks: their presence leads to unacceptable speck contamination, and their mechanical dispersion will not be sufficient to hide their presence.
- Liquid toner: large visible inked film specks are observed which cannot be removed by flotation or screening; their mechanical dispersion will not be sufficient to hide their presence.
- Holt-melt-based inkjet prints: residual toner will fuse during drying, leading to sticky deposits.
- Water-based pigment-based inks (home and office inkjets): due to their hydrophilic nature, the inks cannot be floated.

EN 643 (CEPI, 2013) enumerates a list of paper for recycling grades that are predominantly used for deinking. The standard allocates paper products suitable for deinking to characteristics of printed paper products. Paper products not suitable for

[11] http://thedpda.org/paper-recycling-and-deinking and correspondence with recycling industry.

deinking belong to unwanted materials. To the best of our knowledge, this refers to most flexographic printing, inkjet, liquid toners and some UV-cured inks (CEPI, 2013) (for more details, please see Annex 2).

In general, according to EN 643 (CEPI, 2013), stationery paper products (except for envelopes) are not considered a paper for recycling grade that is suitable for deinking. Consequently, the deinkability criterion is structured to primarily address printed matter.

Envelopes

Flexographic water-based inks are commonly used for printing on the inside of envelopes. The small size and hydrophilic nature of ink particles contribute towards poor deinkability of envelopes. However, the use of water-based inks represents industry best practice (EC, 2009). The trade-off for diminished deinkability is a reduction in VOC emissions.

The conclusions from the current revision recognise that the development of deinkable flexographic water-based inks is an improvement to strive for in the future. The new developments in using cationic or anionic resins could lead to deinkability in a flotation process.

The availability of deinkable flexo-inks is nevertheless still relatively limited and more expensive than conventional flexo-inks (by about 60% at the time of the criterion assessment). These inks have not been widely adopted in the envelope sector. They require more water for machine cleaning, and for the binder used (therefore, they are not suitable for very low paper grade envelopes). For the inner printing of envelopes, flexo-inks left over from the general printing processes are used in a diluted form. This helps to save costs and reduce waste from inks[12].

Main outcomes from public consultations

Feedback received from industry pointed out that *'Method 11 (*INGEDE) *is not appropriate for all printing technologies or inks (...) modern printing techniques, such as digital inks, should be accommodated under a different concept, as there is a significant body of evidence that these products can be deinkable even if they do not pass Method 11, and if Method 11 is even relevant for these technologies'*[13]. Indeed, Bhattacharyya et al. (2012) demonstrated at the laboratory scale a good deinkability of digitally printed paper products in the near-neutral deinking process. Runte and Putz (2018) and Pschigoda, L.E. (2019) reported good deinkability of the digitally printed paper products mixed with conventional printed matter by means of the two-loop deinking method[14].

However, the predominant outcome of the consultation acknowledged that the industrial deinking processes should be designed to treat the existing blend of input paper for recycling. INGEDE Method 11 in its current version and in combination with the EPRC Scorecard is a commonly accepted indicator to assess how an individual printed product will perform in an industrial deinking process. A pilot plant's test results for the deinkability of digitally printed paper products are accepted to be accurate. Nevertheless, digitally printed paper products are not collected separately and the input paper for recycling would therefore be a mixture of different paper products from the trade of paper. It is therefore not pragmatic to set a specific requirement for a specific type of printing technique used. In addition, the few existing pilot plants are equipped and operated differently, making it difficult to have a standard and correlated testing procedure. Accordingly, a horizontal requirement is introduced for all types of inks used on EU Ecolabel printed paper products.

3.3.4.1 Assessment and verification

The EPRC Assessment for the Removability of Adhesive Application evaluates the results of INGEDE Method 12 and establishes a scoring system on the Removal Scorecard.

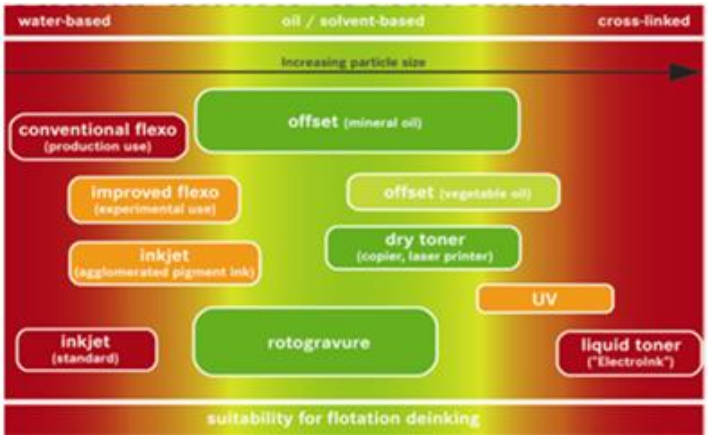
The EPRC Deinkability Assessment evaluates the result of INGEDE Method 11 (test method) and establishes a scoring system on the Deinkability Scorecard. The deinkability of printing inks are proven if the printed matter on which they are used have a positive score (EPRC):

- good deinkability corresponds to 71-100 points;
- fair deinkability corresponds to 51-70 points;
- tolerable deinkability corresponds to 0-50 points.

The chart below systemises different printing techniques according to their deinking capacity.

[12]Communication with European Federation of Envelope Manufacturers (FEPE).
[13]Internal communication with industry stakeholders.
[14]INGEDE Method 11 is based on a one-stage flotation process.

Figure 13. Compatibility of different printing technologies with alkaline flotation deinking



Source: Faul, 2010

Note: The following colours are used to reflect the deinkability of printed paper:

- Below 0 points: red;
- 0 to 40 points: orange;
- 40 to 50 points: transition orange to yellow;
- 50 to 70 points: yellow;
- 70 to 80 points: transition yellow to green;
- 80 to 100 points: green.

Out of more than 700 tests carried out, 70% have a positive deinkability score and the average score is above 70. Deinking by flotation is highly efficient in the case of hydrophobic inks such as conventional offset and gravure printing inks. These printing techniques have been proven to reach deinkability EPRC scores ranging from 71 to 100 and are therefore exempted from further deinkability testing. In general, for the categories that passed the test (no parameter with a negative score), the average score is more than 50 (EPRC). This implies that to prove the deinkability of printed paper products a minimum score of 51 should be met.

Envelopes

During the recyclability subgroup meeting it was emphasised that interior printing is mandatory for envelopes for privacy reasons (product's functionality). It was agreed to allow inner printing only when necessary (to reduce the transparency of paper used). The intensity of the printing pattern was also proposed to be addressed.

Opacity defines the amount of light that passes through the paper. It determines the extent to which print on a particular side of the paper will be visible from the reverse side. The higher the opacity, the lower the amount of light that can pass through (Jurič et al, 2013). The ISO 2471:2015 Standard specifies a method for the measurements of opacity (paper backing) of paper by diffuse reflectance. The method is restricted to white and near-white papers and boards. Most printing papers fall within an opacity range of 80% to 98% (Henry, 2010). According to information collected, 94% is the usual opacity value for 80g/m^2 offset. The rest vary between 92% and 98%. The grammage of paper used in envelopes falls within the range of 80 g/m^2 to 115 g/m^2. Paper in the grammage range of 80-135 g/m^2 lacks total opacity[15].

Envelopes are exempted from the obligation to perform the deinkability test (INGEDE Method 11). Nevertheless, they should meet a specific requirement that limits the inner printing to 80% of the surface area. It is agreed that the use of inner printing is justified for envelopes made up of paper with a grammage of less than 135 g/m^2 or an opacity level below 98%.

What do other ISO Type I ecolabels say?

Nordic Ecolabelling requires a result of least 51 points in accordance with the ERPC's points system for all tested paper types. This corresponds to "Good" or "Fair" deinking. Blue Angel recommends that finished products should be deinkable, stating that "The product should comply with the recyclability requirements of the EPRC".

Main outcomes from public consultations

The deinkability criterion proposal for the 2nd AHWG Meeting was to require 50% of the maximum score for each individual parameter tested under INGEDE Method 11. The rationale behind this was to ensure a good score for all deinkability parameters

[15]Communication with stakeholders.

while taking into consideration their relevance. This proposal was seen as too demanding and not harmonised with the valid and workable EPRC scorecard.

The vast majority of stakeholders recommended harmonising the requirement with the EPRC approach. Accordingly, printed products are considered compliant with the deinkability requirement if they reach a minimum score of 51 on the EPRC Deinkability Scorecard, based on the results of INGEDE Method 11.

Equivalent test methods may also be used as long as they are accepted by the competent body as providing data of an equivalent scientific quality. This might be the case when a competent and independent third party demonstrates in writing that the test method used reproduces results that are in correlation with those obtained with the INGEDE method.

The inclusion of envelopes under the deinkability criterion is a newly introduced requirement under the EU Ecolabel. Envelopes are exempted from the obligation to perform a deinkability test (INGEDE Method 11), but they should meet specific requirements that limit the interior printing to 80% of the surface. It is agreed that the use of interior printing is justified for envelopes made up of paper with a grammage of less than 135 g/m^2 or an opacity level below 98%.

3.4 Criterion 4 – Emissions

3.4.1 Emission to water from rotogravure printing

Criterion 4.1 - Emission to water from rotogravure printing
The specific amount of Cr and Cu at the point of discharge must not exceed, respectively, 20 mg per m^2 and 200 mg per m^2 of printing cylinder surface area used in the press. ***Assessment and verification:*** *discharges of Cr and Cu shall be checked at rotogravure printing plants after treatment and immediately prior to discharge. A representative composite sample of Cr and Cu discharges shall be collected at least every 3 months. At least one annual analytical test shall be carried out by an accredited laboratory to determine the content of Cr and Cu from the composite sample according to EN ISO 11885 or equivalent standard methods that are accepted by the competent body as providing data of equivalent scientific quality.* *Compliance with this criterion shall be assessed by dividing the content of Cr and Cu, as determined by the annual analytical test, by the cylinder surface used in the press during the printing. The cylinder surface used in the press during printing is calculated by multiplying the cylinder surface (= 2πrL, where r is the radius and L the length of the cylinder) by the number of printing productions during a year (= number of different printing jobs).*

Rationale behind the criterion

Chromium (VI) compounds hold a harmonised CLP classification as highly toxic to aquatic life (Aquatic Acute 1 and Aquatic Chronic 1), carcinogenic 1B, and skin sensitiser 1[16]. Copper compounds (e.g. copper (II) oxide, copper sulphate, copper chloride) are also classified as highly toxic to aquatic life (Aquatic Acute 1 and Aquatic Chronic 1).

Usually, printing facilities are not equipped with a waste water treatment plant. Nowadays, many flexography and non-publication rotogravure sites subcontract the cylinder manufacturing and engraving. Consequently, they transfer responsibility for the emissions to water from the electroplating of cylinders to specialised suppliers (JRC, 2020). Liquid waste is removed from the site by dedicated waste treatment companies through well-established waste handling processes, which are subject to permitting under national or local waste regulations.

What do other ISO Type I ecolabels say?

The Nordic Ecolabelling sets an emission threshold for printing companies, requiring a maximum of 25 mg of chromium (Cr-tot) and of 90 mg of copper (Cu) per tonne of product for rotogravure printers. The measurement is done after the treatment and not at the point of discharge (Nordic Ecolabelling, 2019). The Blue Angel's requirement foresees separate treatment of chromium-containing waste water and establishes a threshold of 0.08 mg Cr/L before effluents mixing, independent of the production volume (Blue Angel, 2015).

The ambition level of Criterion 4.1 cannot be directly compared with other schemes for the following reasons: (1) very limited data on Cr and Cu emission levels have been provided by the existing licence holders; (2) different units - data reported in the STS BREF (JRC, 2020) is expressed as mg/L, Blue Angel and Nordic Ecolabelling refer to mg/L and mg/tonne, respectively, whereas the EU Ecolabel criterion is expressed as metal concentration per printing cylinder surface area; (3) there are no BAT-AELs proposed for Cu and Cr emissions in the BREF, mainly because of the common outsourcing of the treatment.

Table 13. Reported values of metal concentration from two publication rotogravure printing installations

Pollutant	Plant 1	Plant 2
	Average concentration (mg/L)	Average concentration (mg/L)
Cu	0.39	0.144
Cr(VI)	0.01	0.278
Cr Total	0.08	0.003

Source: STS BREF (JRC, 2020)

Main outcomes from public consultations

On the basis of the information collected, the revised reference values required under Criterion 4.1 were reduced as follows: for Cr(VI) to 20 mg/m^2 from 45 mg/m^2, and for Cu to 200 mg/m^2 from 400 mg/m^2. The proposed revised reference values represent an approximate 50% reduction of each parameter.

It was agreed that the requirement for silver emission established under the former version of the criterion be withdrawn. The photographic processes are mostly obsolete and no longer used on an industrial scale.

[16]European Chemicals Agency, C&L Inventory.

3.4.2 Emission from installations covered by Directive 2010/75/EU of the European Parliament and of the Council[17] or equivalent installations

Criterion 4.2 – Emission from installations covered by Directive 2010/75/EU of the European Parliament and of the Council or equivalent installations

The following requirements shall apply to printing processes covered by Annex I and VII to Directive 2010/75/EU or to equivalent printing processes outside the EU that meet specifications of Annex I and VII to Directive 2010/75/EU.

4.2 (a) Volatile Organic Compounds (VOCs) and chromium (VI) emissions from publication rotogravure printing

Fugitive VOC emissions, as calculated by the solvent mass balance, should be lower or equal to 2,0% of the solvent input, and TVOC[18] in waste gases shall be lower or equal to 16,0 mg C/Nm^3.

Emissions of Cr(VI) to air shall not exceed 15,0 mg/tonne paper. Abatement equipment for reduction of emission to air shall be installed

4.2 (b) Volatile Organic Compounds (VOCs) emission from heatset web offset printing

Total VOC emissions as calculated by the solvent mass balance should be lower or equal to 0,03 kg VOCs per kg of ink input; alternatively fugitive VOC emissions as calculated by the solvent mass balance should be lower or equal to 8% of the solvent input and TVOC emissions in waste gases should be lower or equal to 12,0 mg C/Nm^3.

4.2 (c) Volatile Organic Compounds (VOCs) emission from flexography and non – publication rotogravure printing

Total VOC emissions as calculated by the solvent mass balance should be lower or equal to 0,24 kg VOCs per kg of ink input; alternatively fugitive VOC emissions as calculated by the solvent mass balance should be lower or equal to 9,6% of the solvent input and TVOC emissions in waste gases should be lower or equal to 16,0 mg C/Nm3.

Assessment and verification: *the applicant shall provide detailed calculations and test data showing compliance with this criterion, together with related supporting documentation.*

For total or fugitive VOC emissions, as applicable, solvent mass balance calculation shall be based on the production during 12 months of operation. The solvent mass balance shall be in line with the definition laid down in Part 7(2) of Annex VII to Directive 2010/75/EU. In case of a new or a rebuilt production plant, the calculations shall be based on at least three months of representative running of the plant.

A declaration of the VOC content in, inks, washing agents, damping solutions or other corresponding chemical products shall be provided by the applicant or a chemical supplier.

The solvent mass balance shall be performed on yearly basis. A written evaluation shall be done by a responsible staff member. Upon request, the evaluation shall be provided to the competent body.

For the monitoring of total TVOC emissions to air in waste gases, any stack with a TVOC load less than 10 kg C/h should be monitored at least once a year according to EN 12619, or equivalent. In the case of a TVOC load less than 0,1 kg C/h (as an annual average), or in the case of an unabated and stable TVOC load of less than 0,3 kg C/h, the monitoring frequency may be reduced to once every three years or the monitoring may be replaced by calculation provided that it ensures the provision of data of an equivalent scientific quality.

For any stack with a TVOC load higher or equal to 10 kg C/h the monitoring shall be continuous according to EN 15267-1, EN 15267-2, EN 15267-3 and EN 14181. For continuous measurement, the data shall represent daily average over the period of one day based on valid hourly or half-hourly averages.

The VOC destruction in the abatement system (e.g. thermal oxidation, adsorption to activated carbon) shall be determined, with a frequency of at least every three years, by combined measurements of VOC concentration in raw gas and clean gas.

The measurement data of waste gas shall be registered and available upon request for the competent body.

The applicant shall provide a description of the system in place, together with a documentation related to the control and the monitoring of Cr(VI) emissions. The documentation shall include the test results related to the reduction of Cr(VI) emissions to the air.

Rationale behind the criterion

The main sources of VOC release are the fugitive emissions from printing machines and other equipment, VOCs from ink solvents remaining on printed products, and VOCs in the waste gas (EC, 2009). For heatset web offset printing, organic solvents in inks as well as cleaning and dampening solutions are the main source of VOC emissions to air. Installations are commonly equipped with thermal waste off-gas treatment techniques. Most installations in the sector apply integrated dryer-oxidisers at each press.

[17]Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334, 17.12.2010, p. 17).
[18]Total volatile organic carbon, expressed as C (in air).

In the last decade the use of isopropyl alcohol (IPA) in the dampening solution in sheet-fed and heatset web offset printing has been widely reduced and/or substituted by IPA-free dampening solutions. The concentration of IPA varies between 8% and 15%. The reduction of isopropanol to 0-3% in the dampening solution for sheet-fed printing is possible[19].

Table 14. Reported average values for TVOC emissions to air in waste gases in 2015 (JRC, 2020)

Applied technique	Number of values	Average	Max	Min
		mg C/Nm³		
Thermal oxidation	14	6.4	17.0	2.1
Recuperative thermal oxidation	5	2.4	3.5	1.2
Regenerative thermal oxidation	6	8.0	15.0	2.0
TRO-3	1	1.7		

Source: JRC, 2020

Publication rotogravure uses toluene as a mono-solvent system. Publication printing inks contain a toluene concentration of approximately 50%. The dilution is carried out on site to obtain a mixture of 70–80%. The solvent is evaporated by heat and air in the drying section. The reuse and recovery of solvent nowadays exceeds 95% of the mass input. The trace concentration of toluene that remains on the printed product at the moment of leaving the printing line is less than 0.04%, and gradually declines over time (see Section 3.2.6). Table 15 shows the toluene mass balance of two plants (Amino et al, 2002). For flexography and rotogravure printing, reported values of total organic solvent consumption show a range from 40 g up to 390 g of solvent per kg of printed surface. An average of 1.78 kg of VOCs per kg of purchased ink input is used in the production and auxiliary processes of the plant.

Table 15. Toluene balance of two rotogravure printing plants

	Plant 1 (t/year)	Plant 2 (t/year)
Total toluene consumption (fresh and recovered)	2 571	2 179
Toluene in waste	11	0
Toluene in sold products	10	10
Toluene recovered and reused on site	1 694	1 428
Toluene recovered and sold	599	613
Emissions		
Toluene emissions after treatment	1.1	4
Fugitive toluene emission *	265	133
Total toluene emission	266.1 (10%)**	137 (6%)**

* Including 10 tonnes of toluene in sold product.
** Consumption (%).

Source: Aminal et al, 2002

3.4.2.1 Types of printing installation

The structure of Criterion 4 recognises the differences between the two main groups of printing installations on the market, as follows:

1. Criterion 4.2: Installations that are addressed by the scope of the IED, and

2. Criterion 4.3: Installations that are outside the scope of the IED.

For Criteria 4.2 and 4.3, in order to ensure that non-European sites are treated equally and can apply for the certification, it is specified that the criterion addresses installations that (1) are covered by Annexes I and VII to Directive 2010/75/EU and (2) equivalent non-EU installations that meet the specifications of Annexes I and VII.

[19]For more information about the best available techniques for surface treatment using organic solvents, please see STS BREF (JRC, 2020).

Installations addressed by the IED

Across Europe, around 50 000 installations undertaking the industrial activities listed in Annex I to the IED are required to operate in accordance with a permit granted by the authorities in the Member States. This permit should contain conditions set in accordance with the principles and provisions of the IED[20]. In general, installations with an organic solvent consumption capacity of more than 150 kg per hour or more than 200 tonnes per year are covered by Annex I. For these installations, emission limit values, equivalent parameters and technical measures shall be based on BAT without prescribing the use of any technique or specific technology (Article 15).

The activities specified in Chapter V (Annex VII, Part 1 (9)) of the IED are subject to at least the emission limit values set out in Part 2 of that Annex, or are subject to the requirements of a reduction scheme, set out in Annex VII, Part 5, that provides for an equivalent level of emission reduction (Article 59). These installations should, through the reduction scheme, be able to achieve an emission reduction equivalent to that obtained through the application of emission limit values. The reduction scheme option aims to promote the implementation of primary reduction measures such as the use of low-solvent or solvent-free substances.

The referenced emission limit values based on BAT-AELs (Best Available Technique (BAT) reference document (BREF) on surface treatment using organic solvents, STS BREF (JRC, 2020) in short[21] are expected to become mandatory in 2024. The data collected during the development of the STS BREF are considered as representative of the European printing industry.

The information gathered from the current licence holders does not indicate if the installation falls under the scope of the IED and, due to the allocation of mass balance to the mass of paper, if the VOC emission is lower than the BAT-AELs. The general limit value for VOCs of 3 kg/tonne of paper, as proposed during the course of the project, does not reflect the differences and best practices of the different printing techniques. In this sense, it might be easily achievable for some printing installations and, by contrast, challenging for others, i.e. flexography and rotogravure printing.

In line with the BAT-AELs, the VOC emission can be notified as a result of either mass balance calculation or direct measurement. The IED solvent mass balance methodology is well known to the printing industry. The BREF-compliant mass balance reflects the VOC emission per kg of solid mass input. (*Note: The formulation of the former version of the criterion required allocation of the VOC emissions to the mass of printed paper. Therefore, the result would be influenced by the grammage of paper and/or intensity of printing).* In order to ensure that the proposed reference values are robust, best-practice-oriented and representative of the European printing industry, the verification of the criterion is harmonised with BAT-AELs.

The revised emission reference values correspond to 80% of the upper end of the BAT-AEL range for each respective printing technique considered.

Table 16. EU Ecolabel reference values for the VOC emissions from printing processes based on BAT-AELs

Parameter	Unit	BAT-AEL	Proposed revised EU Ecolabel threshold
Heatset web offset printing: SMB of Total VOC emissions or % of Fugitive emission *(As an alternative to the BAT-AEL as specified in point 1, the BAT-AELs as specified in point 2 can be used)*			
1. Total VOC emissions as calculated by the solvent mass balance	kg VOCs per kg of ink input	<0,01 -0,04*	**<0,03**
2. Fugitive VOC emissions as calculated by the solvent mass balance	Percentage (%) of the solvent input	< 1–10*	**<8**
TVOC	mg C/Nm3	< 1–15	**<12**
Publication rotogravure printing			
3. Fugitive VOC emissions as calculated by the solvent mass balance	Percentage (%) of the solvent input	<2.5	**<2**
4. TVOC	mg C/Nm3	<10-20	**<16**
Flexography and non-publication rotogravure printing *(As an alternative to the BAT-AEL as specified in point 5, the BAT-AELs as specified in point 6 can be used)*			

[20]https://ec.europa.eu/environment/industry/stationary/ied/legislation.htm

[21]The STS BREF (JRC, 2020) addresses installations for the surface treatment of substances, objects or products using organic solvents, in particular for dressing, printing, coating, degreasing, waterproofing, sizing, painting, cleaning or impregnating.

Parameter	Unit	BAT-AEL	Proposed revised EU Ecolabel threshold
5. Total VOC emissions as calculated by the solvent mass balance	kg VOCs per kg of ink input	<0,1 -0,3	**<0,24**
6. Fugitive VOC emissions as calculated by the solvent mass balance	Percentage (%) of the solvent input	<< 1–12	**<9,6**
TVOC	mg C/Nm^3	<< 1–20	**<16**

Source: EC, 2020a and JRC, 2020

What do other ISO Type I ecolabels say?

The Blue Angel sets a limit of 3% by volume of IPA or ethanol content in the dampening solution and indicates a threshold of 4 kg/t[22] for sheet-fed offset printing, and 2 kg/t for coldset web offset printing.

The Nordic criteria for printing companies establish a scoring system according to the intensity of the VOC emission. A VOC emission of 5 kg/tonne of paper is granted 50% of the maximum score available.

Main outcomes from public consultations

Limited data reported by the EU Ecolabel licence holders indicate the following ranges of emission values: for sheetfed offset: 1.5 kg/t to 4.5 kg/t of paper, for rotogravure printing 0.3 kg/t to 1.5 kg/t of paper, for offset 0.5 kg/t to 2.4 kg/t of paper, and for heatset of 0.6 kg/t to 1 kg/t of paper. Additionally, the emission values reported for rotogravure printing ranged from 8 mg/Nm^3 to 22 mg/Nm^3 (three sources).

Additionally, the levels of Cr^{6+} emissions to air ranged from 4.5 to 13 mg/tonne.

For Criterion 4.2, a split view was observed among stakeholders as to the proposal to base the emission threshold values on BAT-AELs, as follows:

1. It is appropriate to use the BREF (BAT-AELs) as industry is well acquainted with this approach, and the reference values used are based on robust data.

2. Revising the currently valid reference values without changing the methodology in order to continue referring to the mass of paper is a well-known approach.

Some stakeholders were in favour of maintaining the current formulation of the criterion as long as the specific VOC emission threshold values relate to the type of printing technique. An additional consultation was conducted in order to clarify the most appropriate way to formulate the criterion.

To ensure the ongoing compliance with the criterion, it was proposed to calculate the solvent mass balance on an annual basis and to make the results available to the competent body, if requested. The waste gas measurement data should also be registered and be available to the competent body upon request.

3.4.2.2 Monitoring of emissions to air

In line with BAT 10 of the STS BREF (JRC, 2020), the following techniques should be considered to compile an adequate annual solvent mass balance as defined in Part 7(2) of Annex VII to the Industrial Emissions Directive (2010/75/EU).

BAT 10 specifies the rules to monitor total and fugitive VOC emissions by compiling, at least on an annual basis, a solvent mass balance of the solvent inputs and outputs of the plant, as defined in Part 7(2) of Annex VII to Directive 2010/75/EU.

Table 17. BAT 10 - Solvent mass balance of the solvent inputs and outputs of the plant (EC, 2020a)

Technique	Description
Implementation of a solvent tracking system	A solvent tracking system aims to keep control of both the used and unused quantities of solvents (e.g. by weighing unused quantities returned to storage from the application area.
Full identification and quantification of the relevant solvent inputs and outputs, including the associated uncertainties	This includes:

[22]Kilogram of solvents purchased versus tonnes of paper used in the printing processes.

Technique	Description
	•identification and documentationof solvent inputs andoutputs, (e.g. emissions in waste gases,emissions from each fugitive emission source, solvent output in waste); •substantiated quantification of each relevant solventinput andoutput and recording of the methodology used (e.g. measurement, calculation using emission factors, estimation based on operational parameters); •identification of the main sources of uncertainty of the aforementioned quantification, and implementation of corrective actions to reduce the uncertainty; •regular update of solvent input and outputdata.
Monitoring of changes that may influence the uncertainty of the solvent mass balance data	Any change that could influence the uncertainty of the solvent mass balance data is recorded, such as: •malfunctions of the off-gas treatmentsystem: the date and period of timeare recorded; •changes that may influence air/gas flow rates, e.g. replacement of fans, drive pulleys, motors; the date and type of change are recorded.

Source: EC, 2020a

The solvent mass balance (SMB) is a powerful management tool that enables efficient control of the emissions from the printing processes and identification of those areas where changes might be necessary. The SMB provides a methodology for the following:

a) Calculation of the annual input (expressed in t/yr).

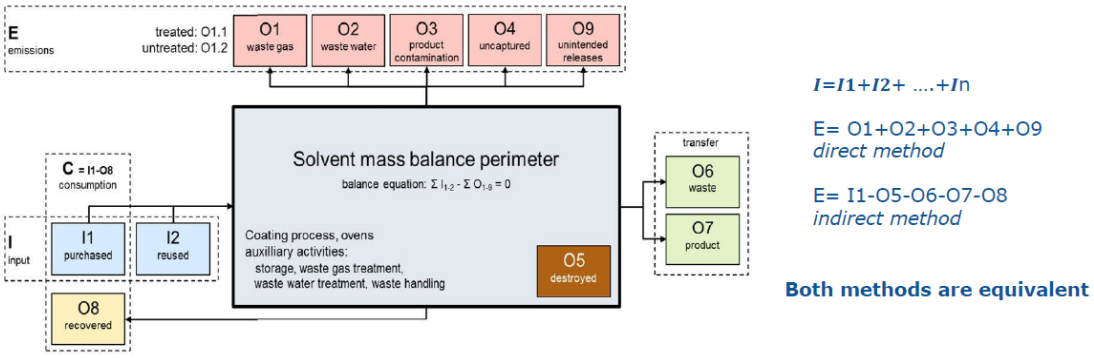
b) Reliable estimation of the fugitive emissions (expressed in t/yr).

c) Calculation of the fugitive emissions as a percentage of the input.

The method is designed to use, wherever possible, only information that is, or should be, readily available such as annual quantities of inks, dampening additives and cleaning agents used and information provided by suppliers on the VOC content of their products.

The annual input is the sum of the VOC content in inks, dampening additives and cleaning agents used in the year in question. It is calculated by multiplying the quantity of the product used by its VOC content percentage as provided by the supplier. The STS BREF (JRC, 2020) provides a detailed explanation about the SMB methodology including the rules for the calculation of fugitive emissions using conservative parameters.

Figure 14. Solvent mass balance (based on Annex VII to Directive 2010/75/EU)



Source: based on EC, 2010b

Following the indication of BAT 11, any stack with a TVOC load < 10 kg C/h needs to be monitored at least once a year according to EN 12619. For any stack with a TVOC load higher than or equal to 10 kg C/h, the monitoring shall be continuous according to EN 15267-1, EN 15267-2, EN 15267-3 and EN 14181. For continuous measurement, the data shall represent the daily average over the period of one day based on valid hourly or half-hourly averages. Last but not least, for a TVOC load of less than 0.1 kg/h (as an annual average), or in the case of an unabated and stable TVOC load of less than 0.3 kg C/h, the monitoring frequency may be reduced to once every 3 years, or the monitoring may be replaced by calculation provided that it ensures the provision of data of an equivalent scientific quality.

Emission levels associated with BAT refer to concentrations expressed as mass of emitted substance per volume of waste gases under the following standard conditions: Temperature 273.15 K, pressure 101.3 kPa, without correction of O_2 and expressed in the unit mg/Nm^3. Both continuous and periodical monitoring are considered:

— continuous monitoring: daily average over a period of one day based on valid hourly or half-hourly averages;

— periodical monitoring: average over the sampling period, average value of three consecutive measurements of at least 30 minutes each.

3.4.3 VOCs emission from printing processes not covered by Directive 2010/75/EU of the European Parliament and of the Council

Criterion 4.3 – VOCs emission from printing processes not covered by Directive 2010/75/EU of the European Parliament and of the Council
The following requirements shall apply to printing processes not covered by Annex I or by Annex VII Part 2 to Directive 2010/75/EU or to equivalent printing processes outside the EU that do not meet specification of Annex I and VII to Directive 2010/75/EU. Total VOC emissions as calculated by the solvent mass balance shall be lower or equal to: - 4,5kg VOC/tonne of paper for sheet fed offset printing; - 1,0kg VOC/tonne of paper for digital printing; - 2,0kg VOC/tonne of paper for heat set web offset printing; - 2,5kg VOC/tonne of paper for cold set web offset printing; - 3,0kg VOC/tonne of paper for other rotogravure, flexography, rotary screen printing, laminating or varnishing units. Alternatively, where off- gas treatment is applied fugitive VOC emissions as calculated by the solvent mass balance should be lower or equal to 10% of the solvent input and TVOC emission in waste gases should be lower or equal to 20 mg C/Nm^3. Volatile solvents from the drying process of heat-set offset, rotogravure and flexography printing shall be managed by means of solvent recovery or thermal treatment or any equivalent system, i.e. substitution by the use of water based inks. ***Assessment and verification:*** *the applicant shall provide a description of the system in place together with documentation and test results related to the control and the monitoring of emissions to air.* *For total or fugitive VOC emissions, as applicable, solvent mass balance shall be calculated on the production during 12 months of operation. The solvent mass balance shall be in line with the definition laid down in Part 7(2) of Annex VII to Directive 2010/75/EU. For the allocation of VOCs emission into mass of paper, all printed surfaces shall be calculated. In case of a new or a rebuilt production plant, the calculations shall be based on at least three months of representative running of the plant.* *For the monitoring of total TVOC emissions to air in waste gases, any stack with a TVOC load less than 10 kg C/h should be monitored at least once a year according to EN 12619, or equivalent. In the case of a TVOC load less than 0,1 kg C/h (as an annual average), or in the case of an unabated and stable TVOC load of less than 0,3 kg C/h, the monitoring frequency may be reduced to once every three years or the monitoring may be replaced by calculation provided that it ensures the provision of data of an equivalent scientific quality.* *A declaration of the VOC content in inks, washing agents, damping solutions or other corresponding chemical products shall be provided by the applicant or a chemical supplier.*

Rationale behind the criterion

For non-IED installations, it was agreed that the only possible way to address VOC emissions is to use the mass balance approach.

Installations not addressed by the IED (Annex I or Annex VII) are in general installations that consume less than 15 tonnes of organic solvents:

— Digital printing;

— Sheet-fed offset printing;

— Coldset web offset printing if < 200 t/yr or < 150 kg/yr;

— Heatset web offset printing < 15 t/yr;

— Publication rotogravure < 25 t/yr (in practice not existing);

— Other rotogravure, flexography, rotary screen printing, laminating or varnishing units < 15 t/yr.

The respective reference values are based on the Blue Angel criteria for printed matter, RAL-UZ 195, as well as feedback collected from the EU Ecolabel licence holders.

In reference to sheet-fed offset printing and coldset web offset printing, the following proposal was submitted:

— for sheet-fed offset printing < 4 kg VOCs per tonne of paper;

— for coldset web offset printing < 2 kg VOCs per tonne of paper.

However, data provided by the EU Ecolabel licence holders do not allow a further increase of the ambition level, as indicated in the table below.

Table 18. Comparison of the VOC emission data collected from EU Ecolabel licence holders with Blue Angel requirements and revised EU Ecolabel reference values

Printing technology	EU Ecolabel (licence holders)	Blue Angel (RAL-UZ 195)	Revised thresholds
Sheet-fed offset printing	1.5 – 4.5 kg VOCs/t of paper	≤ 4.0 kg VOCs/t of paper	≤ 4.5 kg VOCs/t of paper
Cold-set web offset printing	0.5 – 2.4 kg VOCs/t of paper	≤ 2.0 kg VOCs/t of paper	≤ 2.5 kg VOCs/t of paper

The revised criterion will most probably not be relevant for publication rotogravure and for heatset web offset, given that these installations usually have solvent consumption levels higher than 15 t/yr. Nevertheless, for clarity, these printing techniques are also addressed. Additionally, thermal waste gas abatement is probably not installed in installations consuming less than 15 t/yr of solvent. The alternative allowed by IED BATc (and IED Annex VII) is the reduction of solvent input in relation to ink or paper (i.e. use of water-based inks) in order to achieve the emission level when thermal waste gas abatement using solvent-based inks/cleaners is in place.

3.5 Criterion 5 – Waste

3.5.1 Waste Management System

Criterion 5.1 - Waste Management System
The facility where the product is manufactured shall have in place a system for handling waste, which addresses and documents the measures taken to reduce the amount of solid and liquid waste, including waste paper, ink waste, cleaning agent solution and dampening solution waste as defined by local or national regulatory authorities. The waste management system shall be documented or explained and shall include information on at least the following procedures: - handling, collection, separation and use of recyclable materials from the waste stream; - recovery of materials for other uses, such as incineration for raising process steam or heating, or agricultural use; - handling, collection, separation and disposal of hazardous waste, as defined by the relevant local and national regulatory authorities; - continuous improvement objectives and targets relating to the reduction of waste generation and the increase of reuse and recycling rates. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion, together with a description of the procedures adopted for waste management. The applicant shall provide a waste management plan for each of the sites concerned. Where the waste management is outsourced, the sub- contractor shall provide a declaration of compliance with this criterion as well.* *Applicants registered with EU Eco-Management and Audit Scheme (EMAS) and/or certified according to ISO 14001 shall be considered as having fulfilled this criterion if:* *1) the inclusion of waste management for the production site(s) is documented in the company's EMAS environmental statement, or* *2) the inclusion of waste management is sufficiently addressed by the ISO 14001 certification for the production site(s).* *3) the inclusion of waste management for the production site(s) is documented in the company's EMAS environmental, or* *4) the inclusion of waste management is sufficiently addressed by the ISO 14001 certification for the production site(s).*

Rationale behind the criterion

The Waste Framework Directive (2008/98/EC) provides guidance for the planning and implementation of a comprehensive waste management scheme. A waste management system is a valuable tool that ensures control over the material flow, and drives waste prevention, and preparation for reuse, recovery, recycling and safe disposal. One of the limiting factors to implement a comprehensive waste management strategy is the availability of possible routes for waste treatment, either internally or externally. Although it is possible to achieve a zero waste to landfill target, this requires access to end markets, which should be developed over time and will vary depending on local infrastructure and demand. Therefore, no specific waste treatment routes are required.

The revised Criterion 5.1 addresses all types of waste generated at the site. There is a potential overlap between the EU Ecolabel criteria and the Eco-Management and Audit Scheme (EMAS). The companies that wish to participate in EMAS should develop an environmental management system (EMS) and commit to continuously improving their environmental performance. ISO 14001 could also be used as an equivalent standard to achieve objectives set by EMAS.

What do other ISO Type I ecolabels say?

The Nordic Ecolabelling criteria for printing companies (Nordic Ecolabelling, 2019) establish a mandatory requirement that ensures sorting at source and appropriate waste removal. A waste management plan in place needs to specify waste categories, quantities and disposal routes. If the printing company is certified with ISO 14001 or EMAS or has an environmental licence from the authorities, these are considered proof of the existence of a waste management plan. Optional waste-related requirements are based on a points system. A maximum of 10 points can be awarded to printing houses that have implemented technologies for prevention, reduction and recovery of specified waste categories.

Blue Angel RAL-UZ 195 (Blue Angel, 2015) sets requirements for waste management and indicates thresholds for printing technologies. As a minimum, the following key figures of the previous 3 years need to be included in the waste management plan:

- Annual amount of waste based on the paper waste code numbers (Ttese include the waste code numbers 15 01 01 (paper and cardboard packaging) and 20 01 01 (paper and cardboard));
- Disposal routes for paper waste code numbers;

- Annual percentage mass of waste paper of total paper quantity purchased.

Blue Angel allows certification of products that are not compliant with the requirement as long as the reasons for non-compliance are analysed and justified. In this case, measures to reduce the amount of waste should be documented and implemented.

Main outcomes from public consultations

The wording of the criterion is adapted to reflect the main objective, which is to ensure the implementation of a long-term waste management strategy.

The revised criterion analyses data collected from licence holders (manufacturing of 13 products in four Member States), as indicated in Sections 3.5.2. and 3.5.1.

3.5.2 Paper for recycling from printing facilities

Criterion 5.2. - Paper for recycling from printing facilities

This criterion applies to printed paper products. The amount of waste paper 'X' produced shall not exceed the values reported in the following table

Printing method	Maximum waste paper (%)
Sheet offset	23
Cold-set, newspaper	10
Cold-set, form printing	18
Cold-set rotation (except newspapers)	19
Heat-set rotation	21
Rotogravure printing	15
Flexography printing	17
Digital printing	10
Screen printing	23

Where:

X = annual tonnes of waste paper produced during the printing (including finishing processes) of the eco-labelled printed paper product, divided by annual tonnes of paper purchased and used for the production of eco-labelled printed paper product.

Where the printing house carries out finishing processes on behalf of another printing house, the amount of waste paper produced in those processes shall not be included in the calculation of 'X'.

Where the finishing processes are outsourced to another company, the amount of waste paper resulting from the outsourced work shall be calculated and declared in the calculation of 'X'.

Assessment and verification: *the applicant shall provide a description of the calculation of the amount of waste paper, together with a declaration from the contractor collecting the waste paper from the printing house. The outsourcing terms and calculations on the amount of paper waste involved in the finishing processes shall be provided.*

The period for the calculations shall be based on the production during 12 months. In case of a new or a rebuilt production plant, the calculations shall be based on at least 45 subsequent days of stable running of the plant.

If the calculation of annual tonnes of waste paper produced during the printing of the eco-labelled printed paper product is not technically feasible, the applicant may provide calculations regarding the total amount of paper for recycling produced annually in the printing house.

Rationale behind the criterion

The current general market tendency is to reduce the intensity of average print runs and the size of the printed product. Products with a small production volume per machine (short runs) generate a higher quantity of paper waste.

The amount of residual paper from heatset offset printing is usually higher than from other printing techniques. This is due to a significant amount of paper being used to achieve a proper balance between ink and dampening solution. This operation is necessary to ensure (calibrate) the printout's quality. This implies that products with a high production volume (per machine) will generate a lower quantity of waste.

What do other ISO Type I ecolabels say and main outcomes from public consultations

Table 19: Revised summary of requirements for the quantity of paper for recycling generated in function of the printing technique

Printing method	Waste paper requirement (%)					
	Current EU Ecolabel	Nordic Ecolabelling average[23]	Blue Angel maximum amount of waste[24]	Data reported from licence holders		**Revised EU Ecolabel reference value**
				Average	Maximum	
Sheet offset	23	23	20	17.2 (5 prod)	22.5 (5 prod)	**23**
Coldset, newspaper	10	10	10	-	-	**10**
Coldset rotation (except newspapers)	19	19	18	17,4 (1 prod)	17,4 (1 prod)	**19**
Heatset rotation	21	21	20	12,5 (2 prod)	16,3 (2 prod)	**21**
Gravure printing	15	12	15	10,4 (4 prod)	12,4 (4 prod)	**15**
Flexography	11	15*	11	-	-	**11**
Digital printing	10	10	10	7,2 (1 prod)	7,2 (1 prod)	**10**
Screen printing	23	-	-	-	-	**23**

*Refers to envelopes.

Over the course of the project more ambitious revised reference values were proposed. Nevertheless, during the 2nd AHWG Meeting it was agreed that the ambition level of the previous criterion was still challenging. It was therefore proposed to not change the former reference values for paper waste generated during printing.

For Criterion 5.2 and 5.3, the calculation of waste stemming only from the manufacturing of ecolabelled products was assumed to be highly complex, if even possible.

During the CB Forum in June 2017[25], the assessment and verification aspects of the criteria were discussed extensively. The feedback collected during the meeting can be summarised as follows:

- There are two options to verify the criterion: (1) calculate the percentage for the specific waste rate per EU Ecolabelled product, or (2) calculate an annual average for the percentage of paper waste generated by the plant.
- It is important to calculate the threshold value in proportion to the relative amount of products produced.
- A site respects the criteria for the EU Ecolabel, their entire process will be compliant with the EU Ecolabel process.

Accordingly, the following was agreed:

When information on waste is available at the individual product level, each individual product must be below the applicable waste threshold in order for the product to be accepted into the scheme. If the information does not exist at the product level, then the

[23]Data are subtracted from Nordic Background report Printing companies, printed matter, envelopes and other converted paper products Version 5.0 15 December 2011. Average data are based on literature data and licence/pilot data from 2010.
[24]Data are subtracted from Basic Criteria for Award of the Environmental Label for Printed matter (RAL-UZ 195) of Blue Angel. January 2015.
[25]EU Ecolabel June 2017 CB Forum Agenda. Available online at:
https://circabc.europa.eu/webdav/CircaBC/env/eueb/Library/CB%20Forum/CB%20Forum%202017/June%20Ambitionle2017/Minutes/ERRATUM_EU%20Ecolabel%20CB%20Forum%20Minutes%20June%202017.pdf

company has to create a sincerity declaration indicating that they attest that all products are theoretically below the applicable threshold.

3.5.3 Paper for recycling from stationery paper products and carrier bags production sites

Criterion 5.3 – Paper for recycling from stationery paper products and carrier bags production sites

The criterion refers to stationery paper products and paper carrier bag products. The amount of waste paper 'X' shall not exceed:

- 19% for envelopes;
- 15% for writing stationery products, excluding diaries;
- 20% for diaries and filing stationery products printed on one side;
- 30% for filing stationery products printed on both sides;
- 11% for paper bags and wrapping paper;

where, X = annual tonnes of waste paper produced during the manufacturing of the eco-labelled stationery paper and paper carrier bag product (including finishing processes), divided by annual tonnes of paper purchased and used for the production of eco-labelled stationery paper and paper carrier bag product.

Where the printing house carries out finishing processes on behalf of another printing house, the amount of waste paper produced in those processes shall not be included in the calculation of 'X'.

Where the finishing processes are outsourced to another company, the amount of waste paper resulting from the outsourced work shall be calculated and declared in the calculation of 'X'.

Assessment and verification: *the applicant shall provide a description of the calculation of the amount of waste paper, together with a declaration from the contractor collecting the waste paper from the printing house. The outsourcing terms and calculations on the amount of paper waste involved in the finishing processes shall be provided.*

The period for the calculations shall be based on the production during 12 months. In case of a new or a rebuilt production plant, the calculations shall be based on at least 45 subsequent days of stable running of the plant.

If the calculation of annual tonnes of waste paper produced during the manufacturing of the eco-labelled stationery paper and paper carrier bag product is not technically feasible, the applicant may provide calculations regarding the total amount of paper for recycling produced annually in the plant.

Rationale behind the criterion

The quantity of waste paper generated hinges on the product characterisation, e.g. different size and printing techniques, as well as on the intensity of production runs (Table 20). Higher waste paper percentages are registered for storage products as well as for items with a reduced format that require printing on both sides. For all types of printed matter alike, there is a fixed quantity of paper that is lost during the calibration; therefore, products with a high production volume (per machine) will generate a lower quantity of waste. The production volume relies on the order specification and is usually low for niche, specialised or particular products, e.g. for diaries each page needs to be printed with a different kind of information.

A comparison with the previous version of the criterion shows a general trend to increase the ambition level with the exception of folders/binders printed on both sides, which is harmonised with the industry feedback and common practice. Revised thresholds accommodate a broader range of products.

A survey involving 13 certified envelope manufacturers, and carried out in 2013 by the European Envelope Manufacturers Association (FEPE), indicates an average quantity of paper waste of 19% for both roll and sheet production processes. A similar study conducted in 2019 involving companies representing about 60% of the envelope market share in Europe confirmed these paper waste rates. Table 21. shows a breakdown of paper waste quantities according to waste origin.

Table 20: Paper waste generated from printing, laminating and cutting

Products for storage (filling products)	Printed sides	2016 (waste)	2017 (waste excl. cutting)
Licence folders	1	17%	
Binder outside cover A4	1	15%	18%
Binder inside cover	1	8%	
Insert sheets	1	14%	
Box Colorlife	2	25%	36%
Folder Colorlife	2	12%	14%
Box Nomadbox students	2	26%	
Folder Quickfile students	2	29%	
Folder PowerFile students	2	22%	
Folder Colorlife 17x22 (small format)	2		63%
Average		16%	20%

Source: Communication with stakeholders

Table 21: Average paper waste generation rates in envelope manufacturing

Paper waste source	Average
Packaging waste from paper reel (rindings + kernel)	1.8%
Technical waste (cutting side flaps + window)	11.8%
Set up (machine running and start/stops)	5.6%

Source: Communication with the European Federation of Envelope Manufacturers (FEPE)

Most of the paper waste from envelope production results from the technical aspects such as cutting of flaps and windows. Additionally, short runs that are typical for small orders require frequent stops and starts, leading to more paper waste.

Main outcomes from public consultations

Data provided by envelope manufacturers situate the paper waste rate at 19%.

In reference to paper bags, the information collected from one of the key manufacturers indicates that a level of 5% to 10% waste paper is possible for long runs[26].

For diaries, it was requested to consider an exception, as the rate of paper waste generated was observed by the industry to be close to 30%. However, the former threshold of 20% was supported by several stakeholders.

The table below summarises the data collected over the course of the project and includes revised reference values.

Table 22: Summary of paper for recycling rates per product type

	Nordic Ecolabelling (highest %)	Industry	Competent bodies (from licence holders)	Current threshold	Revised proposal
Products (based on tonnes of paper waste/tonnes of paper purchased)					
Envelopes	15%	19%		20%	**19%**
Paper bags and gift paper				10%	**10%**
Folders/binders (one-sided print)		20%		20%	**20%**
Folders/binders (two-sided print)		30%		20%	**30%**
Writing stationery products (excl. diaries)				20%	**15%**
Diaries		15%	20%	20%	**18%**

[26] Communication with stakeholders.

3.6 Criterion 6 – Energy use

Criterion 6 – Energy use
The site where the EU Ecolabel product is manufactured shall have established an energy management system addressing all energy consuming devices (including machinery, lighting, air conditioning, cooling). The energy management system shall include measures for the improvement of energy efficiency and shall include information on at least the following procedures: - establishing and implementing an energy data collection plan in order to identify key energy figures; - analysis of energy consumption that includes a list of energy consuming systems, processes and facilities; - identification of measures for more efficient use of energy; - continuous improvement objectives and targets relating to the reduction of energy consumption. ***Assessment and verification:*** *the applicant shall provide a declaration of compliance for the production site, supported by a description of the energy management system.* *The applicant certified according to ISO 50001,* EN 16247 *or an equivalent standard/scheme shall be considered as having fulfilled this requirement.* *The applicant registered with EMAS shall be considered as having fulfilled this requirement if the inclusion of energy management in the scope of EMAS for the production site(s) is documented in the EMAS environmental statement.* *The applicant certified according to ISO 14001 shall be considered as having fulfilled this criterion if the inclusion of energy management plan is sufficiently addressed by the ISO 14001 certification for the production site.* *The continuous improvement objectives and targets relating to the reduction of energy consumption shall be enforced on yearly basis. A written evaluation shall be done by a responsible staff member. Upon request, the evaluation shall be provided to the competent body.*

Rationale behind the criterion

LCA studies performing energy balance recognise printing operations as the relevant environmental hotspot (17%). A reduction between 3% and 8% of the total environmental impact could be achieved with a 20-50% reduction of the energy consumption in printing operations[27].

Criterion 5 focuses only on the energy consumption during the printing and converting process, because energy consumption (and CO_2 emission) for pulp and paper manufacturing are covered by Criterion 1, which is harmonised with the EU Ecolabel for copying and graphic paper according to Annex I to Commission Decision (EU) 2019/70.

Resource efficiency and energy savings are listed among the pillars of the Circular Economy targets. This requires a transition to the low-energy-consuming production processes. The energy audit identifies the areas with significant impact on the economic performance of the plant. This includes identification of the long-term energy management objectives.

Best Available Techniques

The STS BREF specifies under BAT 19 (JRC, 2020) that an energy efficiency plan is part of the EMS and entails defining and calculating the specific energy consumption of the activity, setting key performance indicators on an annual basis (e.g. MWh/tonne of product) and planning the periodic improvement targets and related actions. The plan should be adapted to the specificities of the plant in terms of process(es) carried out, materials, products, etc.

Table 23: BAT-associated environmental performance levels (BAT-AEPLs) for specific energy consumption

Sector	Product type	Unit	BAT-AEPL (yearly average)
Heatset web offset printing	All product types	Wh/m^2 of printed area	4-14
Flexography and non-publication rotogravure printing	All product types	Wh/m^2 of printed area	50-350
Publication rotogravure printing	All product types	Wh/m^2 of printed area	10-30

Source: STS BREF (JRC, 2020)

The associated monitoring is conducted through an energy efficiency plan and energy balance record that should be adapted to the specificities of the plant in terms of process(es) carried out, materials, etc. The energy consumption covers areas of activities that are addressed by the scope of the STS BREF (JRC, 2020). The allocation of the energy consumption to the specific production

[27]For more information, please see the Preliminary Background Report available at: https://susproc.jrc.ec.europa.eu/product-bureau//product-groups/410/documents

(EU Ecolabelled product) based on BAT might therefore not be feasible, unless a case-by-case analysis is performed. Specific energy efficiency levels associated with the best available techniques are related to specific energy consumption expressed as yearly averages and calculated using the following equation:

Specific energy consumption = energy consumption divided by activity rate

Where:

Energy consumption: unless otherwise specified, the total amount of heat (generated by primary energy sources) and electricity consumed by the plant, as defined in the energy efficiency plan (BAT 19), in MWh/year;

Activity rate: total amount of products processed by the plant or plant throughput, expressed in the appropriate units depending on the sector (e.g. kg/year, m^2/year).

Energy Management System

An Energy Management System (EMS) defines the energy policy, objectives, energy targets, action plans and processes. The EMS supports the achievement of a company's overall goals, providing an organisational basis for improved energy and carbon efficiency through the measurement, monitoring, control, and improvement activities (Jaffe et al 1994, Ates and Durakbasa 2012).

The international standard for energy management systems in companies is ISO 50001:2018 (Energy management systems – requirements with guidance for use). ISO 50001 focuses on reducing the usage of energy by organisations or companies (EMSPI, 2018). It provides a framework for creating a successful EMS and detailed guidelines on how to integrate the EMS into an organisation. It is a process standard that does not prescribe performance levels or provide thresholds for energy performance (Böttcher and Müller, 2014)

In particular, the organisation must set and implement energy action plans for specified goals for relevant functions and levels. The following criteria need to be met:

- Be in line with the energy policy.
- Be measurable (if feasible).
- Be monitored.
- Take into account Significant Energy Uses (SEUs).
- Be updated as appropriate.
- Take into account applicable requirements.

ISO 50001 requires the organisation to carry out an energy assessment at fixed intervals or after major changes in plants, facilities, systems or energy-using processes. This is aimed at analysing the energy use and consumption, identifying SEUs, investigating opportunities for improving energy-related performance and future energy use and consumption. Improvements in energy-related performance can be demonstrated using defined energy performance indicators.

ISO 50001 requires the establishment and implementation of an energy data collection plan that should include:

- The relevant variables relating to SEUs.
- Energy consumption in relation to SEUs and the organisation.
- Operational criteria for SEUs.
- Static factors, if applicable.
- Data set out in action plans.

Prior to or in the course of implementing an energy management system, such as ISO 50001, energy audits according to EN 16247:2012[28] are performed in order to identify energy flows and the potential improvement areas (Javied et al, 2015).

EMAS, though focusing on environmental management systems, also addresses energy-related aspects of a company. In particular, energy is one of the core environmental indicators for which total annual input/output has to be reported in EMAS.

Carbon Standard

The INTERGRAF Carbon Standard and the International Climate Calculator (ClimateCalc) that cover all the relevant areas in the life cycle of the specific product, from the paper profile to printing method, were suggested as possible schemes to collect data and define energy thresholds.

[28] 16247-1:2012 Energy audits – Part 1: General requirements.

The INTERGRAF recommendations (2013), being based on the Greenhouse Gas Protocol, are in line with ISO 14064-1 addressing GHG emissions at company/organisation level. Additionally, the recommendations are in line with ISO 16759:2013, which specifies the requirements for quantifying the carbon footprint of those processes, materials and technologies required to produce print media products using any form of printing technology based on a life cycle approach. The recommendations cover Scopes 1, 2 and 3 for sheet-fed and heatset offset as well as publication gravure printing but are representative of the overall printing industry.

The stakeholders indicated that: (1) 95% of the total energy consumption from the life cycle perspective is calculated; (2) the regulation of energy consumption only at the printing site covers less than 20% of the life cycle of the product, therefore paper production needs to be included (addressed by Criterion 1).

Given the current difficulties associated with the availability of energy consumption data, the recommendations provide an important aid that needs to be considered in future revisions of the EU Ecolabel.

What do other ISO Type I ecolabels say?

Nordic criteria require the calculation of annual energy consumption (kWh) per tonne of product and introduce energy consumption limits. The calculated energy consumption results from the division of the total energy consumed annually, including administration and normal building operation (from the electricity meter) per annual production. This does not include fuel, if any, used for the printer's own vehicles. The criteria distribute the energy consumption of each printing method in relation to the market average for each method The data are compiled by Nordic Ecolabelling from 68 printers using different technologies that sets a threshold of 3 500 kWh/tonne of product (Nordic Ecolabelling, 2019)

Table 24: Average energy consumption per printing technology

Printing method	Average energy consumption (kWh/tonne of product)
Sheet-fed offset (except packaging and offset printing of envelopes)	**1 253**
Coldset, news print	**365**
Coldset, forms	**997**
Coldset rotation (except news print and form printing)	**825**
Heatset rotation	**965**
Rotogravure printing	**864**
Flexographic printing (except envelope production)	**486**
Digital printing	**2 799**
Offset printing, envelopes	**436**
Envelope production with flexography	**552**
Offset, packaging	**1 564**

Source: Nordic Ecolabelling, 2019

The Blue Angel addresses energy efficiency (RAL-UZ 195) by requesting a printing company to establish an energy management system (Blue Angel, 2015) The energy management of a printing company, using rotogravure, flexographic, heatset or newspaper coldset web offset printing processes should follow either ISO 50001, European Eco-Management and Audit Scheme (EMAS) or the DIN EN 16247 Part 1: General requirements.

Main outcomes from public consultations

- 315 kW/t and 917 kW/t are consumed using heatset rotation and coldest offset, respectively.
- 6 000 kW/t and 4 500 kW/t are consumed using offset and heatset rotation, respectively.
- 8 500 kW/t and 83 000 kW/t are consumed with converted paper.

The data on energy consumption were collected in order to analyse the energy consumption across the current EU Ecolabel licences. Nevertheless, the data provided are not sufficient to build up a database that could serve as a reference for quantitative energy requirements. There is also a high discrepancy between energy consumption data:

According to the feedback collected, defining key performance indicators (KPIs) that provide a realistic and fair energy consumption comparison across companies is very complex. Addressing the total energy used by a plant would dilute the consumption required for a production process by including activities that are not covered by the scope of the criterion, e.g. administration. The differences in space heating and cooling across Europe would also need to be considered for a fair

comparison. The size of the printing companies and the average size of the print jobs should also be taken into account given that higher productivity involves less start-stop operations, which is in general related to lower energy consumption in comparison with lower productivity operations. All in all, collecting information on singular energy consumption (for a printing or converting line, and for a singular Ecolabelled product) was assumed to be highly complicated due to the nature of the process[29].

A quantitative analysis such as those used for Energy Star systems (EC, 2017b) seems not to be directly applicable to large-scale industrial printing technology. It includes energy-related products placed on the market or put into service. Nevertheless, the same product might require different energy consumption when considering different printing systems. The energy-to-end-product ratio is too variable to be useful for printing installations, as the amount of printed paper input/output does not always relate to the energy use - printing and drying varies with the amount of ink coverage and the processes used.

The majority of stakeholders did not recommend setting an energy consumption threshold. It was proposed to target energy consumption through 1) a requirement on paper substrate, 2) the introduction of ISO 50001 certification or another relevant standard that ensures long-term energy efficiency management.

Feedback collected from licence holders and competent bodies indicated that, though the number of certified sites is increasing, there are still very few plants that have been certified with ISO 50001. The criterion enumerates elements/activities that have to be included in the management system, in order to guide companies in the design of efficient management systems but also to encourage those companies that have been working on improving energy efficiency but have not yet obtained the certification.

The following elements of the energy management system shall be included:

- A list of energy consumers (machines including lighting, air conditioning and cooling).
- Establishing and implementing an energy data collection plan in order to identify key energy figures of the printing process.
- Identification of measures to improve the efficiency of energy use.
- Continuous improvement objectives and targets related to the reduction of the energy consumption.

The continuous improvement objectives and targets ought to be enforced on a yearly basis. Therefore an annual written evaluation of the energy management plan by a responsible staff member (e.g. manager) is requested.

3.7 Criterion 7 – Training

Criterion 7 - Training
All relevant members of staff participating in the day-to-day operation of the production site shall be given the knowledge necessary to ensure that the Ecolabel requirements are fulfilled and continuously improved. ***Assessment and verification****: the applicant shall provide a declaration of compliance with this criterion, together with details of the training programme, its content, and an indication of which staff have received what training and when. The applicant shall provide to the Competent Body also a sample of training material.*

Rationale behind the criterion

The involvement and awareness of employees is a key aspect that guarantees that the EU Ecolabel criteria are accomplished in the different manufacturing steps. No changes were proposed to the former formulation of the criterion.

[29]Communication with stakeholders.

3.8 Criterion 8 – Fitness for use

Criterion 8 – Fitness for use
The product shall be suitable for its purpose. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion supported by at least one of the following documents:* - *letter/document/statements issued by clients for a specific product, assuring that the product met their specifications and performs well in its intended application;* - *detailed description of procedure of handling consumer complaints;* - *documentation demonstrating the quality certification, in accordance with the standard ISO 9001, or equivalent* - *documentation demonstrating the paper quality, in accordance with the standard EN ISO/IEC 17050-1, which provides general criteria for suppliers' declaration of conformity with standards.*

Rationale behind the criterion

The assessment of "fitness for use" and common quality of the product differs across markets and needs to be adapted to a contract specification (customer requirements). Fitness for use is therefore linked to market conditions, regulated by specific quality specifications (internal) and/or by general technical specifications which are the core of the contract between producers and distributors. The verification for this criterion should be done by checking the compliance between internal quality controls and external specifications (i.e. technical description included in a tender), and should also check the grounds for claim. A product that is not fit for use will not be chosen by consumers.

A specific standard, EN 13590, is available for flexible carrier bags for the transport of various retail goods - General characteristics and test methods for the determination of volume and carrying capacity. In the Nordic Ecolabel, the company can obtain points by having a certified quality system for print quality in accordance with ISO 12647 or a standard based on ISO 12647.

ISO 12647 includes standard process control for various printing methods and processes and is split up into different parts:

- ISO 12647-1: describes the parameters and measurement methods. It essentially provides the basis for the subsequent print-related settings.
- ISO 12647-2: defines the process control settings for offset lithography.
- ISO 12647-3: defines the process control settings for newspaper printing, more specifically coldset offset lithography on newsprint.
- ISO 12647-4: defines the process control settings for publication gravure printing, which is used for high-volume magazines, catalogues, etc.
- ISO 12647-5: defines the process control settings for screen printing.
- ISO 12647-6: defines the process control settings for flexographic printing.
- ISO 12647-7: under preparation. It will cover off-press proofing processes.

ISO 12647 establishes quality control for various printing methods and therefore it was not considered an appropriate tool to verify the fitness for use of the final product. This is due to the individual requests of some customers that might render a product non-compliant with ISO 12647 (due for example to selected paper grade, size, finishing or layout). This could result in a product that is fit for use for the customer but not compliant with ISO 12647.

ISO/IEC 17050-1 specifies general requirements for a supplier's declaration of conformity of an object to the specified requirements, irrespective of the sector involved.

ISO 9001 specifies requirements for a quality management system (QMS). Organisations use the standard to demonstrate the ability to consistently provide products and services that meet customer and regulatory requirements. ISO 9001 is based on the plan-do-check-act methodology and provides a process-oriented approach for documenting and reviewing the structure, responsibilities, and procedures required to achieve effective quality management in an organisation[30]. Accordingly, the standard might be used to demonstrate the capacity to comply with consumer needs. The installation that is certified should demonstrate the conformity of the product or service provided by complying with the following requirements:

[30]https://asq.org/quality-resources/iso-9001

- to establish a quality management system;
- to analyse all the needs and expectations of its consumers, as well as the legal requirements relating to the products;
- to ensure that the characteristics of the products have been specified to comply with the customer and legal requirements;
- to manage the needs of the processes to ensure the expected results: fitness for use of the product and customer satisfaction;
- to control the defined characteristics of the product;
- to avoid non-conformities and to implement systematic improvement processes to: correct any problem during the manufacturing process, analyse the cause of the problem and take corrective actions, and deal with customer complaints.

Main outcomes from public consultations

Feedback collected indicated a preference to maintain the current formulation of the criterion and to extend the accepted verification options in order to address the broad range of products. Some stakeholders proposed ISO 9001 or a system in place for customer complaints. This would allow the verification of customer satisfaction from the registered feedback. A similar approach was used during EU Ecolabel revision for Lubricants (EC, 2018) which establishes the terminology 'applicant's clients' approval' as a possible tool to verify fitness for use. Accordingly, 'applicant's clients' approval' means a letter/document/statements issued by clients for a specific product, assuring that the product met their specifications and works correctly in its intended application.

Nevertheless, for stationery paper products, the final user is not a customer: the customer is a distributor. The end user of the product chooses the product according to their preferences and opinions (for example, the colour of the product). Recording complaints is not applicable for stationery paper products as there is no communication with the final consumer.

Considering feedback received and the characteristics of ISO 9001, it seems appropriate to include the standard in the verification text.

- A detailed procedure for handling customer complaints, in order to ensure constant improvement for the benefit of end users of the product.
- An 'applicant's client's approval', meaning a document assuring that the product met their specifications and works correctly in its intended application.

Moreover, for those cases when the quality certification is not available, other systems should be considered. For converted products, the customer is a distributor; compliance with the criterion could be verified considering two options:

3.9 Criterion 9 – Information on the product

Criterion 9 – Information on the product
The following information shall appear on the paper bag product: 'Please reuse this bag'. The following information shall appear on the printed paper product: 'Please collect used paper for recycling'. ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion, supported by an image of the product with the information required.*

Rationale behind the criterion

The stakeholders indicated that the use of different languages is an issue for European products, so the statement should not be mandatory but optional. Additionally, important information for the end user should be on the product and not on the packaging. It is agreed to maintain the currently valid formulations of the criterion for the respective product groups. In addition, for paper bags, it is important to inform customers of the need to reuse the product.

3.10 Criterion 10 – Information appearing on the EU Ecolabel

Criterion 10 - Information appearing on the EU Ecolabel
If the optional label with text box is used, it shall contain the following three statements: - low process emissions to air and water; - the product is recyclable; - paper with low environmental impact used. The applicant shall follow the instructions on how to properly use the EU Ecolabel logo provided in the EU Ecolabel Logo Guidelines: http://ec.europa.eu/environment/ecolabel/documents/logo_guidelines.pdf ***Assessment and verification:*** *The applicant shall provide a declaration of compliance with this criterion, supported by a high resolution image of the product packaging that clearly shows the label, the registration/licence number and, where relevant, the statements that can be displayed together with the label.*

Rationale behind the criterion

The discussion indicated the agreement of the stakeholders to maintain the criterion in its current form. A digital image of a product is considered sufficient to verify compliance with the criterion.

4 Main changes to criteria compared to previous criteria version

The key modifications of the EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products (Commission Decision (EU) 2020/1803) (EC, 2020) are summarised below and compared with the former EU Ecolabel criteria for printed paper products (EC, 2012c), and for converted paper products (EC, 2014) that were the subject of the revision.

1. Scope and definition

- To avoid unnecessary redundancy and ensure coherence between different product groups, the former EU Ecolabel product groups "Printed Paper products" and "Converted Paper products" have been merged to form a single product group: "*Printed paper, stationery paper, and paper carrier bag products*".
- The change to the name of the product group clarifies the type of products that are included in the scope. The revised product group addresses differences between conversion and printing processes and allows the licensing of products that are for example printed but converted.
- The scope of the product group is extended and now includes wrapping paper not in contact with food. Accordingly, food contact materials have been specifically excluded from the scope of the product group.
- The threshold for metal content in stationery paper products has been changed from 50 g to 75 g for suspension files, folders with metal fasteners, ring binders and lever arch files with a filing capacity of up to 225 sheets. This enables the inclusion of mechanisms with three or four rings.
- The specific threshold for plastic content has been revised for different types of products covered by the scope. This aims at maximising the reduction of the non-paper material used in a final product as well as stimulating product recyclability.
- The use of PVC is specifically excluded from the scope of the product group.
- Packaging material is specifically excluded from the scope, along with cardboard which is commonly used in packaging material.

2. General assessment and verification

- The product line approach has been introduced with the aim of establishing ongoing communication between a licence holder and the CB. Certifying the product line is intended to stimulate the uptake of the EU Ecolabel certification by the product group due to the reduction of administrative burdens as well as of the time required for the certification of a single product.

3. Criterion 1: Substrate

- The former EU Ecolabel criteria for printed matter required printing only on graphic paper bearing the EU Ecolabel for Graphic paper as established in Commission Decision 2011/333/EU2[31], and printing newsprint only on paper bearing the EU Ecolabel for Newsprints as established in Commission Decision 2012/448/EU[32]. The former EU Ecolabel criteria for converted paper products required substrate that is in conformity with Criteria 1, 2, 4 and 5 of the EU Ecolabel as established in Commission Decision 2011/333/EU for Copying and graphic paper or in Commission Decision 2012/448/EU (3) for Newsprint paper.
- Requiring the use of the EU Ecolabel substrate (Annex I to Commission Decision (EU) 2019/70) is consistent with the current criterion for printed paper and targets simplification of the verification process. The harmonisation with graphic paper requirements benefits from the consensus built and also knowledge gained during the revision of the EU Ecolabel criteria for graphic paper, and leads to compatibility across the scheme. The proposed criterion aims at minimising the environmental impact of paper production during its life cycle.
- The ambition level for paper substrate used in a product has increased significantly. It is not possible to evaluate the cumulative effect of all changes due to the complexity of applying a number of pass-fail conditions to an entire pulp and paper industry, which consists of over 900 mills in CEPI countries alone. Changes in the ambition level for each criterion that applies to paper substrate are specified in Chapter 14 of Final Technical Report: Graphic Paper, Tissue Paper and Tissue Products (JRC, 2019).
- The revised requirement for sustainable forest management is now harmonised across paper product groups. The single approach sets an ambition level of 70% for any particular combination of sustainable certified virgin fibre and recycled

[31] OJ L 149, 8.6.2011, p. 12
[32] OJ L 202, 28.7.2012, p. 26

fibre. The input of all materials to the process must be covered by suitable Chain of Custody certificates although inputs of Paper for Recycling may alternatively be covered only by EN 643-compliant delivery notes.

— The former Criterion 1 for Converted Paper products (Parts A and B) determined individual requirements for paper and board substrate. This distinction was built on the former scope of the EU Ecolabel criteria for copying and graphic paper that incorporated grammage restrictions (upper limit of 400 g/m^2). The revised EU Ecolabel criteria for graphic paper (Annex I to Commission Decision (EU) 2019/70) does not distinguish paper grammage, therefore it also applies to graphic paperboard. An increase in EU Ecolabel certification for substrate across board manufacturers is expected.

4. Criterion 2: Hazardous substance restrictions

— The revised structure of the horizontal hazardous substance criteria, (a) SVHC restriction and b) CLP restriction, follows the general recommendations of the EU Ecolabel Chemicals Task Force and focuses on the final product instead of consumables. Other specific criteria have now been inserted that relate purely to consumables, taking inspiration from industry best practice.

— SVHCs are restricted to 0.10% at the level of input materials and substances, and not at the level of the final product. This more stringent approach is possible without any major increase in assessment and verification efforts thanks to the communication requirements set out by REACH.

— The criterion promotes the choice of more environmentally friendly inks and other consumables (with benefits for workers and the broader environment) while placing a restriction on the potential presence of hazardous substances in the final product (with benefits for users and downstream recyclers). The previous criteria focused only on heavy metals in printing inks, toners, varnishes, foils and laminates. The new criteria do not apply to foils and laminates since the new criteria are strongly influenced by the EUPIA policy. Consequently, the restrictions on printing inks are now much broader and include CLP hazard code restrictions at the level of ingredients added to printing inks, toners and varnishes.

— Only in-can preservatives approved under the BPR (i.e. biocidal product type 6: preservatives for products during storage) present in printing inks, varnishes, lacquers and any other formulations used during the production processes and preservatives used for liquid cooling and processing systems (i.e. biocidal product type 11) may be permitted. Specific reference is now made to the non-use of biocidal products for preservation of the final product and the general terminology has been adjusted to align with that of the BPR.

— The restrictions on printing inks are much broader now and include CLP hazard code restrictions at the level of ingredients added to printing inks, toners and varnishes. A restriction on cobalt-based additives and pigments is added. For clarity, there is a note specifically stating that the restrictions equate to the non-presence of the hazardous substance or mixture in concentrations exceeding 0.10% (by weight) in the ink, toner or varnish formulation.

— The stand-alone criterion on toluene was considered necessary when changing the focus of Criterion 2.2 from a consumable-based approach to a final-product-based approach. The specific criterion that addresses toluene recovery and fugitive emissions addresses the residual toluene remaining in printed paper at levels around 0.04% w/w immediately after printing and decreasing rapidly with time after printing due to evaporation of toluene traces. Instead of a derogation for the use of toluene in the horizontal criteria (simply not applicable due to the 0.10% rule), the required recovery rate has been increased from 92% to 97%.

— The criterion on metal components has been withdrawn. The possible environmental benefit seemed disproportionately small in comparison to the additional assessment and verification effort required.

5. Criterion 3: Recyclability

— The aim of the criterion is to stimulate paper product recyclability. The structure of the criterion was modified and now it is divided into four parts that address: (a) separation of the non-paper components from paper components, (b) product repulpability, (c) adhesives removability, and (d) deinkability;

— The removability of non-paper parts depends on how these are incorporated into the final product. Therefore, a declaration of compliance issued by a manufacturer or product designer is introduced as an additional form of verification.

— Because of technical differences in recyclability, lamination and varnishing are addressed under different requirements: Lamination falls under the repulpability criterion, whereas varnishes are included under the deinkability criterion. The ATICELCA 501 evaluation system is added as an accepted proof of compliance with the repulpability criterion. Double lamination is not permitted.

— The ambition level of the deinkability requirement has increased considerably. A minimum of 51 points on the EPRC Deinkability Scorecard based on INGEDE Method 11 is requested. This guarantees that the printed paper product is suitable for deinking. The former requirement focused on proving deinkability without a minimum score. Envelopes are now included

in the scope of the deinkability requirements. Interior printing of envelopes is permitted under specified conditions and only when it is necessary due to privacy reasons.

— The ambition level of the adhesives removability criterion has increased by requesting a score of at least 71 on the EPRC Adhesive Removal Scorecard according to INGEDE Method 12. The former requirement focused on proving adhesives' removability without a minimum score. Adhesive labels are included in the scope of the adhesives removability criterion.

6. Criterion 4: Emissions

— The threshold for Cr and Cu emissions to water has been reduced by approximately half, compared to the former requirement.

— The requirement for silver emission has been withdrawn. The photographic processes are mostly obsolete and no longer used on an industrial scale.

— The structure of the "emission into air" criterion has been changed and adapted to the industry best practice in order to maximise the reduction of VOC emissions. For Criteria 4.2 and 4.3, in order to ensure that non-European sites are treated equally and can apply for the certification, the criteria addresses installations that (1) are covered by Annexes I and VII to Directive 2010/75/EU and (2) equivalent non-EU installations that meet the specifications of Annexes I and VII.

— A specific threshold is allocated to each existing printing technology. The emission thresholds for IED activities are based on 80% of the upper end of the BAT-AEL range. Monitoring of the air emission criteria is harmonised with the IED (solvent mass balance) and best available techniques, i.e. BAT 10 and 11 (EC 2020a).

— The revised criterion for non-IED activities is largely harmonised with the Blue Angel criteria for printed matter, RAL-UZ 195. It regulates the VOC emissions to which specific national or local regulations might apply (mostly SMEs).

7. Criterion 5: Waste

— The term "paper waste" has been replaced by "paper for recycling", in line with the standardised terminology.

— The thresholds for paper for recycling generated during the production process for stationery paper products and carrier bags have been revised and adapted to the type of product. The revised thresholds accommodate products with a small production volume that can generate a higher quantity of paper for recycling.

— A requirement for assessment and verification of the system for handling waste by means of EMAS and ISO 14001 has been added.

8. Criterion 6: Energy use

— Verification of energy consumption by requiring key aspects of the Energy Management System (EMS) is included. It defines the energy policy, objectives, energy targets, action plans and processes. The EMS supports the achievement of a company's overall goals, providing an organisational basis for improved energy and carbon efficiency through the measurement, monitoring, control, and improvement activities.

— A requirement for assessment and verification of the energy management system by means of ISO 50001, EN 16247, ISO14001 or EMAS has been added. The minimum required procedures for an energy management plan are specified.

9. Criterion 7: Fitness for use

— The criterion requires verification of fitness for use based on the clients' feedback or related standards. The accepted verification options have been amplified with a view to addressing the broad range of products and the differences between the printing industry and the converting industry.

Table 25. Comparison of EU Ecolabel criteria for printed paper products (2012/481/EU) and converted paper products (2014/256/EU) with the revised EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products ((EU) 2020/1803)

EU Ecolabel for converted paper products (2014/256/EU)	**EU Ecolabel for printed paper products (2012/481/EU)**	**Revised EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products** (EU) 2020/1803)
Criterion 1 — Substrate In conformity with criteria 1, 2, 4 and 5 of the EU Ecolabel as established in Commission Decision 2011/333/EU (2) for Copying and graphic paper or in Commission Decision 2012/448/EU (3) for Newsprint paper and shall demonstrate the conformity with Criterion 2. Part A — Paper Substrate Part B — Board Substrate Criterion B1 — Emissions to water and to air Criterion B2 — Energy use Criterion B3 — Excluded or limited substances and mixtures Criterion B4 — Waste management Criterion 2 — Fibres: sustainable forest management	Criterion 1 — Substrate The printed paper product shall be printed only on paper bearing the EU Ecolabel as established in Commission Decision 2011/333/EU. For newsprint paper, the printed paper product shall be printed only on paper bearing the EU Ecolabel as established in Commission Decision 2012/448/EU. 1.Emissions to water and to air 2.Energy use 3.Excluded or limited substances and mixtures 4.Waste management 5.Fibres: sustainable forest management	Criterion 1 — Substrate Paper and board requirements that address paper and board manufacturing processes are proposed to be harmonised with the EU Ecolabel for copying and graphic paper according to Annex I to Commission Decision (EU) 2019/70: 1.Emissions to water and air; 2.Energy use; 3.Fibres: conserving resources, sustainable forest management; 4.Restricted hazardous substances and mixtures; 5.Waste management; 6.Fitness for use; 7.Information on the packaging; 8. Information appearing on the EU Ecolabel.
Criterion 3 — Excluded or limited substances and mixtures (applicable to converting process) 3(a) Excluded or limited substances and mixtures 3(b) Hazardous substances and mixtures 3(c) Substances listed in accordance with Article 59(1) of Regulation (EC) No 1907/2006 3(d) Biocides 3(e) Washing agents 3(f) Alkylphenolethoxylates — Halogenated solvents — Phthalates 3(g) Printing inks, toners, inks, varnishes, foils and laminates 3(h) Metal components	Criterion 2 — Excluded or limited substances and mixtures (applicable to printing process) 2(a) Excluded or limited substances and mixtures 2(b) Hazardous substances and mixtures 2(c) Substances listed in accordance with Article 59(1) of Regulation (EC) No 1907/2006 2(d) Biocides 2(e) Washing agents 2(f) Alkyl phenolethoxylates — Halogenated solvents — Phthalates 2(g) Printing inks, toners, inks, varnishes, foils and laminates	Criterion 2 — Hazardous substance restriction 2.1. Restriction on Substances of Very High Concern (SVHCs) 2.2. Restrictions on substances classified under Regulation (EC) No 1272/2008 of the European Parliament and of the Council 2.3. Biocidal Products and biocidal active substances 2.4. Cleaning agents 2.5. Alkyl phenol ethoxylates, halogenated solvents and phthalates 2.6. Further restrictions applying to printing inks, toners and varnishes. 2.7. Toluene recovery from rotogravure printing
Criterion 4 — Recyclability (a) Wet strength agents (b) Non-soluble adhesives (c) Coating varnishes and lamination	Criterion 3 — Recyclability (a) Wet strength agents (b) Non-soluble adhesives (c) Coating varnishes and lamination (d) Deinkability	Criterion 3 — Recyclability 3.1. Removability of non-paper parts 3.2. Repulpability 3.3. Adhesives removability 3.4. Deinkability
Criterion 5 — Emissions (a) Emissions to water (b) Emissions to air	Criterion 4 — Emissions (a) Emissions to water (b) Emissions to air (c) Emissions from publication rotogravure printing (d) Printing processes to which no legislative measures apply	Criterion 4 — Emissions 4.1. Emissions to water from rotogravure printing 4.2. VOC emissions from installations covered by Directive 2010/75/EU of the European Parliament and of the Council[33] or equivalent installations 4.3. VOC emissions from printing processes not covered by Directive 2010/75/EU of the European Parliament and of the Council;
Criterion 6 — Waste 6a). Waste management	Criterion 5 — Waste 5a). Waste management	Criterion 5 — Waste 5.1. – Waste management system

[33] Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control) (OJ L 334, 17.12.2010, p. 17).

EU Ecolabel for converted paper products (2014/256/EU)	EU Ecolabel for printed paper products (2012/481/EU)	Revised EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products (EU) 2020/1803)
6b). Waste paper	5b). Waste paper	5.2 – Paper for recycling from printing facilities 5.3 – Paper for recycling from stationery paper products and paper carrier bags production sites
Criterion 7 — Energy use (apply to the printing/converting house)	Criterion 6 — Energy use (printing house)	Criterion 6 — Energy use
Criterion 8 — Training	Criterion 7 — Training	Criterion 7 — Training
Criterion 9 — Fitness for use	Criterion 8 — Fitness for use	Criterion 8 — Fitness for use
Criterion 10 — Information on the paper carrier bags	Criterion 9 — Information on the product	Criterion 9 — Information on the product
Criterion 11 — Information appearing on the EU Ecolabel	Criterion 10 — Information appearing on the EU Ecolabel	Criterion 10 — Information appearing on the EU Ecolabel

References

Aminal et al. 2002. Evaluatie van het reductiepotentieel voor VOS emissies naar het compartiment lucht en de problematiek van de implementatie van de Europese richtlijn 99/13/EG in de grafische sector in Vlaanderen; deel 3", Ministerie van de Vlaamse Gemeenschap, Afdeling Algemeen Milieu- en Natuurbeleid, 2002.

Ates, S.A., Durakbasa, N.M. 2012. Evaluation of corporate energy management practices of energy intensive industries in Turkey, Energy (45), 81–91. doi: 10.1016/j.energy.2012.03.032.

ATICELCA, 2019. Sistema di valutazione 501:2019. Valutazione del livello di riciclabilità di materiali e prodotti a prevalenza cellulosica sulla base della norma UNI 11743:2019. Associazione Tecnica Italiana per la Cellulosa e la Carta. Available at: https://aticelca.it/1/wp-content/uploads/2019/08/sistema_di_valutazione_501_2019.pdf

Bajpai, P. 2014. Process Steps in Recycled Fibre Processing Editor(s): Pratima Bajpai, Recycling and Deinking of Recovered Paper, Elsevier. 2014.

Bajpai, P. 2015. Chapter 3 - Pulp and Paper Chemicals. Emerging Technologies in Sizing. PIRA Technology Report, Smithers PIRA, the worldwide authority on the Packaging, Print and Paper supply chains., Editor(s): Pratima Bajpai, Pulp and Paper Industry, Elsevier, 2015.

Bajpai, P. 2018. Chapter 4 - additives for papermaking P. Bajpai (Ed.), Biermann's Handbook of Pulp and Paper (3rd ed.), Elsevier 2018, 77-94.

Bernd Schwegmann. Washing and cleaning solutions for offset printing. Available at: https://www.schwegmannnet.de/PDF/Broschueren/Druck/EN/WashingAndCleaningSolutions_Broschuere_EN.pdf

BG ETEM, 1995. Berufsgenossenschaft Energie Textil Elektro Medienerzeugnisse. Industry initiative for approved washing and cleaning agents for offset printing. Available at: http://praevention-dp-bgetem.bg-kooperation.de/approved-washing-and-cleaning-agents-for-offset-printing/the-industry-initiative2019s-criteria

Bhattacharyya, N., Hou, N.G., Mittelstadt, L.S., N., Hanson, E.G. 2012 Deinking of Digital Prints: Effect of Near-Neutral Deinking Chemistry on Deinkability. Journal of Imaging Science and Technology 56(6). doi: 10.2352/J.ImagingSci.Technol.12.56.6.060503.

Blue Angel, 2014. Recycled Cardboard. Basic Award Criteria. DE-UZ 56. July 2014. Version 3. Available at: https://produktinfo.blauer-engel.de/uploads/criteriafile/en/DE-UZ%20056-201407-en%20Criteria-2020-04-24.pdf

Blue Angel, 2015. Printed Matter. Basic Award Criteria. DE-UZ 195. January 2015. Available at: https://produktinfo.blauer-engel.de/uploads/criteriafile/en/DE-UZ%20195-201501-en%20Criteria-V6.pdf

Blue Angel, 2018a. Finished products made from recycled paper for office and school supplies. Basic Award Criteria. DE-UZ 14b. Edition January 2018. Version 2. Available at: https://produktinfo.blauer-engel.de/uploads/criteriafile/en/DE-UZ%2014b-201801-en%20Criteria-2020-04-24.pdf

Blue Angel 2018b, Recycled paper. Basic Award Criteria. DE-UZ 14a. Edition January 2018. Version 1. Available at: https://produktinfo.blauer-engel.de/uploads/criteriafile/en/DE-UZ%2014a-1801-en%20criteria2020-10-05.pdf

Böttcher, Ch. and Müller, M. 2014. . Insights on the impact of energy management systems on carbon and corporate performance. An empirical analysis with data from German automotive suppliers. Journal of Cleaner Production 137, 1449-1457. doi:10.1016/J.JCLEPRO.2014.06.013.

Campbell, P. 2002. Alternatives to nonylphenol ethoxylates, Review of toxicity, biodegradation & technical-economic aspects. ToxEcology environmental consulting, Report for Environment Canada, Vancouver 48, 170–177.

Carré, B., Magnin, L., and Ayala, C. 2005. "Digital prints: a survey of the various deinkability behaviors." Conference Proceeding, Available at: https://www.ingede.com/digital/digideink-publications.html

CEPI, 2012. Guide to an Optimum Recyclability of Printed Graphic Paper. Available at: https://www.cepi.org/guide-to-an-optimum-recyclability-of-printed-graphic-paper/

CEPI, 2013. European List of Standard Grades of Paper and Board for Recycling: Guidance on the revised EN 643. Available at: http://www.cepi.org/system/files/public/documents/publications/recycling/2013/CEPI_EN%20643_brochure_FINAL.pdf

ClimateCalc, Available at: https://www.climatecalc.eu

EMSPI, 2018. Energy Management Standardization in the Printing Industry. Auteur: Frank den Hartog, Co-auteurs: Michael ten Donkelaar, Joachim Hafkesbrink, Per Kaae Hansen, Iker Larrea Ereño, Peter Tegel. © copyright 2017 Dienstencentrum, Schiphol-Rijk, the Netherlands. Available at: https://www.emspi.eu/images/deliverables/pdf/publishable_report_09-05-2017_def.pdf

EC, 2009. European Commission. 2009. Guidance on VOC Substitution and Reduction for Activities Covered by VOC Solvents Emissions Directive (Directive 1999/13/EC).

EC, 2010a. Regulation (EC) No 66/2010 of the European Parliament and of the Council of 25 November 2009 on the EU Ecolabel (Text with EEA relevance). OJ L 27, 30.1.2010, p. 1–19.

EC, 2010b. Directive 2010/75/EU of the European Parliament and of the Council of 24 November 2010 on industrial emissions (integrated pollution prevention and control). OJ L 334, 17.12.2010, p. 17.

EC, 2012a. Regulation (EU) No 528/2012 of the European Parliament and of the Council of 22 May 2012 concerning the making available on the market and use of biocidal products. OJ L 167, 27.6.2012, p. 1-123.

EC, 2012b. The costs and benefits the reduction of volatile organic compounds from paints. Prepared by Directorate General for the Environment, Air and Noise Unit, 2 May 2002. Downloadable at: http://ec.europa.eu/environment/air/pollutants/stationary/paints/paints_legis.htm

EC, 2012c. 2012/481/EU: Commission Decision of 16 August 2012 establishing the ecological criteria for the award of the EU Ecolabel for printed paper (notified under document. OJ L 223, 21.8.2012, p. 55–65.

EC, 2014. 2014/256/EU: Commission Decision of 2 May 2014 establishing the ecological criteria for the award of the EU Ecolabel for converted paper products. OJ L 135, 8.5.2014, p. 24–48.

EC, 2017a. Report from the Commission to the European Parliament and the Council on the review of implementation of Regulation (EC) No 122/2009 of the European Parliament and of the Council on 25 November 2009 on the voluntary participation by organisations in a Community eco-management and audit scheme (EMAS) and Regulation (EC) No 66/2010 of the Parliament and of the Council of 25 November 2009 on the EU Ecolabel. COM(2017) 355 final.

EC, 2017b. Regulation (EU) 2017/1369 of the European Parliament and of the Council of 4 July 2017 setting a framework for energy labelling and repealing Directive 2010/30/EU. OJ L 198, 28.7.2017, p. 1–23.

EC, 2018. Commission Decision (EU) 2018/1702 of 8 November 2018 establishing the EU Ecolabel criteria for lubricants, OJ L 285, 13.11.2018, p. 82–96.

EC, 2019. Commission Decision (EU) 2019/70 of 11 January 2019 establishing the EU Ecolabel criteria for graphic paper and the EU Ecolabel criteria for tissue paper and tissue products. OJ L15, 17.1.2019, p.27.

EC, 2020a. Commission Implementing Decision (EU) 2020/2009 of 22 June 2020 establishing the best available techniques (BAT) conclusions, under Directive 2010/75/EU of the European Parliament and of the Council on industrial emissions, for

surface treatment using organic solvents including preservation of wood and wood products with chemicals (notified under document C(2020) 4050). OJ L 414, 9.12.2020, 19–78.

EC, 2020b. Commission Decision (EU) 2020/1803 of 27 November 2020 establishing the EU Ecolabel criteria for printed paper, stationery paper, and paper carrier bag products OJ L 402, 1.12.2020, 53–72. doi: 10.2760/71692 (online)

ECSPI, 2008. The Environmental Council of the Swedish Printing Industries. Recycling of printed products. What can the printing industry do to make it easier., Revised by INTERGRAF, 2008.

Environmental Council of the Swedish Printing Industries, 2008. Recycling of printed products What can the printing industry do to make it easier? The Environmental Council of the Swedish Printing Industries, INTERGRAF, MILGRAF AB TNO, The Dutch Institute of Industrial Technology with support from the European Commission revised by INTERGRAF in 2008.

EPRC, European Paper Recycling Council, 2010. Assessment of Printed Product Recyclability. available online: https://www.paperforrecycling.eu/publications/

EuPIA, 2016. Exclusion policy for printing inks and related products. 3rd Edition (Corrigendum Dec. 2018). Available at: https://www.eupia.org/fileadmin/Documents/Our_commitment/2016-11-17_Exclusion_Policy_for_Printing_Inks_and_Related_Products_3rd_ed_corrig_Dec2018.pdf

Faul, A.M. 2010. Quality requirements in graphic paper recycling, Cellulose Chemistry and Technology 44 (10), 451-460.

Henry, P. 2010. Paper characteristics (I). Foundations in Graphic Communication. New York City College of Advertising Design. Available at: http://websupport1.citytech.cuny.edu/faculty/phenry/paperchari.html

HSE, 2002. Health and Safety Executive. The printer's guide to health and safety. ISBN 978 0 7176 2267 2.

ICEX, 2016. España Exportación e Inversiones. The printing market in Germany. Market study. 2016, https://www.icex.es/icex/es/index.html

INGEDE. INGEDE Methods. http://pub.ingede.com/en/methods/

INTERGRAF recommendations, 2013. Emissions of Green House Gases in the life cycle of printed material excluding emissions related to capital assets, customer distribution and end of life of printed material. Available at http://be-nl.climatecalc.eu/archive/file?file=0c97b9cf-bf8c-465c-adfd-b4e4443c7611.pdf

Jaffe, A.B., Stavins, R.N., 1994. The energy-efficiency gap what does it mean? Energy Policy 22, 804-810. doi.org/10.1016/0301-4215(94)90138-4.

Javied T., Rackow T., Franke J. 2015. Implementing energy management system to increase energy efficiency in manufacturing companies. 12th Global Conference on Sustainable Manufacturing. Procedia CIRP. 2015. doi: 10.1016/j.procir.2014.07.057.

JRC, 2019. Kowalska, M., Donatello, S., Wolf, O. 2019. EU Ecolabel criteria for Graphic Paper. Tissue Paper and Tissue Products. Publications Office of the European Union 2019. doi:10.2760/71692.

JRC, 2020. Chronopoulos, G., Cakmak, E.G., Tempany, P., Klein, G., Brinkmann, T., Zerger, B. and Roudier, S., Best available techniques (BAT) reference document on surface treatment using organic solvents including preservation of wood and wood products with chemicals. Publications Office of the European Union doi:10.2760/857.

Jurič, I., Karlović, I., Tomić, I., and Novaković, D.2013. Optical paper properties and their influence on colour reproduction and perceived print quality. Nordic Pulp and Paper Research Journal 28(2), 264-273.

Lee, H.J., Chattopadhyay, S., Gong, E.Y., Ahn, R.S., Lee, K. 2003. Antiandrogenic effects of bisphenol A and nonylphenol on the function of androgen receptor. Toxicological sciences 75(1), 40–46. Society of Toxicology (US). doi: 10.1093/toxsci/kfg150.

Lee, P.C. and Lee, W. 1996. In vivo estrogenic action of nonylphenol in immature female rats. Bulletin of environmental contamination and toxicology 57, 341–348. New York: Springer Verlag. doi: 10.1007/s00128990019.

Nordic Ecolabelling. 2019. Nordic Ecolabelling for printing companies, printed matter, envelopes and other converted paper products. Version 5.15. 16 December 2019. Available at: https://www.nordic-ecolabel.org/product-groups/group/?productGroupCode=041&productGroupCode=041

Onur, A., Ng, A., Garnier, G., Batchelor, W. 2019. The use of cellulose nanofibres to reduce the wet strength polymer quantity for development of cleaner filters. Journal of Cleaner Production. 215, 226-231. doi: 10.1016/j.jclepro.2019.01.017.

Pschigoda, L.E. (2019) Deinkability of Inkjet- Printed Commercial Papers as Determined by Benchtop and Pilot Scale Methods.

PTS, 2019. PTS method PTS-RH:021/97 Identification of the recyclability of paper and board packages and of graphic print products, Papiertechnische Stiftung Heidenau. 2019. https://www.ptspaper.com

Putz, H.J. 2000. Stickies in recycled fiber pulp. In: Göttsching, L & Pakarinen, H (eds.) Papermaking Science and Technology, Book 7, Recycled Fiber and Deinking. Fapet Oy, Jyväskylä, Finland, 441-498. 2000.

Runte, S. and Putz H.J. 2018. Influence of digital prints products on the deinking behaviour of paper for recycling mixture in a 2-stage deinking process. INGEDE Symposium, 2018 Munich.

Sarja, T. 2007. Measurement, nature and removal of stickies in deinked pulp. Faculty of Technology, Department of Process and Environmental Engineering, Acta Universitatis Ouluensis C Technica 275, University of Oulu, 2007. http://herkules.oulu.fi/isbn9789514284649

Soares, A., Guieysse, B Jefferson, B., Cartmell, E., Lester, J.N. 2008. Nonylphenol in the environment: a critical review on occurrence, fate, toxicity and treatment in wastewaters. Environment international 34(7), 1033-1049. Amsterdam : Elsevier Science. doi: 10.1016/j.envint.2008.01.004.

Soares, A., Vijayram, I.A., Guieysse, B., Murto, M., Guieysse, B., Mattiasson, B. 2005. Degradation of non-ionic surfactants under anaerobic conditions. In: Rittmann B.E., van Loosdrecht M.C.M., editors. Third IWAleading-edge conference on water and wastewater treatment technologies. Sapporo, Japan: IWA Publishing; 2005.

Soto, A.M., Justicia, H., Wray, J.W., Sonnenschein, C. 1991. p-Nonyl-phenol: an estrogenic xenobiotic released from "modified" polystyrene. Environmental Health Perspectives 92, 167-173. National Institute of Environmental Health Sciences. doi: 10.1289/ehp.9192167.

UNEP, 2001. United Nations Environmental Programme (UNEP). Protecting the ozone layer. Technical Brochure updates.

Venditti, R., Jameel, H., Lucas, B.E. 2007. The effects of adhesive properties on the removal of pressure sensitive adhesive contaminants by pressure screen. Progress in Recycling Paper 16(3).

Vukoje, M.,Jamnicki, S. ,Rožić, M. 2016. Deinkability of thermochromic offset inks. Nordic Pulp and Paper Research Journal 31, 692-699.doi: 10.3183/NPPRJ-2016-31-04.

White, R., Jobling, S., Hoare, S. A., Sumpter, J. P., and Parker, M. G. 1994. Environmentally persistent alkylphenolic compounds are estrogenic. Endocrinology 135, 175–182. doi: 10.1210/endo.135.1.8013351.

Zakaria, S. 2004. Development of wet-strength paper with dianhydride and diacid. Mater. Chem. Phys., 88 (2), 239-243.

List of abbreviations and definitions

AHWG	Ad-hoc Working Group Meeting
ATICELCA	Associazione Tecnica Italiana per la Cellulosa e la Carta (The Italian Technical Association of the Pulp and Paper Industry)
APEOs	Alkylphenol ethoxylates
BAT	Best Available Techniques
BAT-AELs	BAT-associated emission levels
BREF	Best Available Techniques Reference Document
CEPI	The Confederation of European Paper Industries
CLP	Classification, Labelling and Packaging
CO_2	Carbon dioxide
CP	Converted paper products
DIBP	Diisobutyl phthalate
ECAT	The EU Ecolabel Product Catalogue
EMAS	Eco Management and Audit Scheme
EPRC	The European Paper Recycling Counci
EN	European Norm
EU	The European Union
EUEB	The European Union Eco-labelling Board
EuPIA	The European Ink Industry's Association
FEICA	The Association of the European Adhesive & Sealant Industry
FEPE	The European Federation of Envelope Manufacturers
FSC	Forest Stewardship Council
GHG	Greenhouse gas
GWP	Global Warming Potential
IED	Industrial Emission Directive 2010/75/EU
INGEDE	Internationale Forschungsgemeiscchaft Deinking-Technik (International Association of the De-inking Industry)
INTERGRAF	European Federation for Print and Digital Communication
IPA	Isopropyl alcohol: propan-2-ol (also called isopropanol)
ISO	International Standardisation Organisation
LCA	Life Cycle Assessment
NGO	Non-governmental organisation
PEFC	Programme for the Endorsement of Forest Certification
PAH	Polycyclic aromatic hydrocarbons
PBT	Persistent Bioaccumulative Toxic
PP	Printed paper products
PVC	Polyvinyl chloride
REACH	Registration, Evaluation, Authorisation and Restriction of Chemicals
SO_2	Sulphur dioxide
STS BREF	BREF on Surface Treatment Using Organic Solvents
TOC	Total organic carbon, expressed as C (in water or in gases)
TVOC	Total volatile organic carbon, expressed as C (in air)
VOCs	Volatile Organic Compounds
vPvB	Very persistent, very bioaccumulative

List of figures

List of tables

Annexes

Annex 1. Aromatic amines referred to in Appendix 8 of entry 43 of Annex XVII to REACH.

The substances listed here are for ease of reference for applicants, chemical suppliers and competent bodies.

Aryl amine	CAS Number	Arylamine	CAS Number
biphenyl-4-ylamine (4-aminodiphenyl)	92-67-1	3,3'-dimethylbenzidine	119-93-7
benzidine	92-87-5	4,4'-methylenedi-o-toluidine (3,3'-dimethyl-4,4'-diaminodiphenylmethane)	838-88-0
4-chloro-o-toluidine	95-69-2	6-methoxy-m-toluidine (p-cresidine)	120-71-8
2-naphthylamine	91-59-8	4,4'-methylene-bis-(2-chloro-aniline)	101-14-4
o-aminoazotoluene	97-56-3	4,4'-oxydianiline	101-80-4
5-nitro-o-toluidine (2-methyl-5-nitroaniline)	99-55-8	4,4'-thiodianiline	139-65-1
4-chloroaniline	106-47-8	o-toluidine	95-53-4
4-methoxy-m-phenylenediamine (2,4-diaminoanisol)	615-05-4	4-methyl-m-phenylenediamine (2,4-diaminotoluene)	95-80-7
4,4'-diaminodiphenylmethane	101-77-9	2,4,5-trimethylaniline	137-17-7
3,3'-dichlorobenzidine	91-94-1	o-anisidine	90-04-0
3,3'-dimethoxybenzidine	119-90-4	4-amino azobenzene	60-09-3

The dyes listed below are known to cleave during processing to form some of the prohibited substances listed above and should not be used in printing inks or related products for the production of EU Ecolabel printed paper, stationery paper or paper carrier bag products.

Indicative list of dyes that may cleave to form carcinogenic arylamines

Disperse dyes		Basic dyes	
Disperse Orange 60	Disperse Yellow 7	Basic Brown 4	Basic Red 114
Disperse Orange 149	Disperse Yellow 23	Basic Red 42	Basic Yellow 82
Disperse Red 151	Disperse Yellow 56	Basic Red 76	Basic Yellow 103
Disperse Red 221	Disperse Yellow 218	Basic Red 111	
Acid dyes			
CI Acid Black 29	CI Acid Red 4	CI Acid Red 85	CI Acid Red 148
CI Acid Black 94	CI Acid Red 5	CI Acid Red 104	CI Acid Red 150
CI Acid Black 131	CI Acid Red 8	CI Acid Red 114	CI Acid Red 158
CI Acid Black 132	CI Acid Red 24	CI Acid Red 115	CI Acid Red 167
CI Acid Black 209	CI Acid Red 26	CI Acid Red 116	CI Acid Red 170
CI Acid Black 232	CI Acid Red 26:1	CI Acid Red 119:1	CI Acid Red 264
CI Acid Brown 415	CI Acid Red 26:2	CI Acid Red 128	CI Acid Red 265
CI Acid Orange 17	CI Acid Red 35	CI Acid Red 115	CI Acid Red 420
CI Acid Orange 24	CI Acid Red 48	CI Acid Red 128	CI Acid Violet 12
CI Acid Orange 45	CI Acid Red 73	CI Acid Red 135	
Direct dyes			
Direct Black 4	Direct Blue 192	Direct Brown 223	Direct Red 28
Direct Black 29	Direct Blue 201	Direct Green 1	Direct Red 37
Direct Black 38	Direct Blue 215	Direct Green 6	Direct Red 39
Direct Black 154	Direct Blue 295	Direct Green 8	Direct Red 44
Direct Blue 1	Direct Blue 306	Direct Green 8.1	Direct Red 46
Direct Blue 2	Direct Brown 1	Direct Green 85	Direct Red 62
Direct Blue 3	Direct Brown 1:2	Direct Orange 1	Direct Red 67
Direct Blue 6	Direct Brown 2	Direct Orange 6	Direct Red 72
Direct Blue 8	Basic Brown 4	Direct Orange 7	Direct Red 126
Direct Blue 9	Direct Brown 6	Direct Orange 8	Direct Red 168
Direct Blue 10	Direct Brown 25	Direct Orange 10	Direct Red 216
Direct Blue 14	Direct Brown 27	Direct Orange 108	Direct Red 264
Direct Blue 15	Direct Brown 31	Direct Red 1	Direct Violet 1
Direct Blue 21	Direct Brown 33	Direct Red 2	Direct Violet 4
Direct Blue 22	Direct Brown 51	Direct Red 7	Direct Violet 12
Direct Blue 25	Direct Brown 59	Direct Red 10	Direct Violet 13
Direct Blue 35	Direct Brown 74	Direct Red 13	Direct Violet 14
Direct Blue 76	Direct Brown 79	Direct Red 17	Direct Violet 21
Direct Blue 116	Direct Brown 95	Direct Red 21	Direct Violet 22
Direct Blue 151	Direct Brown 101	Direct Red 24	Direct Yellow 1
Direct Blue 160	Direct Brown 154	Direct Red 26	Direct Yellow 24
Direct Blue 173	Direct Brown 222	Direct Red 22	Direct Yellow 48

Annex 2. Grades for paper and board usually intended for deinking according to EN 643 (CEPI, 2013)

Code	Name	Description
1.06.00	Magazines	Magazines, with or without glue.
1.06.01	Magazines without glue	Magazines without glue
1.06.02	Magazines with product samples	Magazines, with or without glue, may contain non-paper components as attached product samples.
1.07.00	Telephone books	New and used telephone books, with unlimited content of pages coloured in the mass, with and without glue. Shavings allowed.
1.09.00	Newspapers and magazines	Mixture of newspapers and magazines (predominantly unsold) each of them with a minimum of 30%.
1.11.00	sorted graphic paper for deinking	Sorted graphic paper, consisting of a minimum of 80% newspapers and magazines. It has to contain at least 30% newspapers and 40% magazines. Print products which are not suitable for deinking are limited to 1.5%.
2.01.00	Newspaper	Newspapers, containing a maximum of 5% of newspapers or advertisement coloured in the mass
2.02.01	Unsold newspaper	Unsold newspapers, which may contain inserts originally circulated with the publication. No additional inserts allowed.
2.03.00	Lightly printed white shavings	Lightly printed white shaving, coated or uncoated, mainly mechanical pulp-based paper with no restriction for glue
2.03.01	Lightly printed white shavings without glue	Lightly printed white shaving, coated or uncoated, mainly mechanical pulp-based paper without glue
2.04.00	Heavily printed white shavings	Heavily printed white shavings, coated or uncoated, mainly mechanical pulp-based paper with no restriction for glue
2.04.01	Heavily printed white shavings without glue	Heavily printed white shavings, coated or uncoated, mainly mechanical pulp-based paper without glue
2.05.00	Ordinary sorted office paper	Paper, as typically generated by offices, shredded or unshredded, printed, may contain coloured papers, with a minimum 60% woodfree paper, free of carbon and principally free from carbonless copy paper (ccp)/no carbon required (NCR), less than 10% unbleached fibres including manila envelopes and fil covers, less than 5% newspapers and packaging
2.05.01	Sorted office paper	Paper, as typically generated by offices, shredded or unshredded, printed, may contain coloured papers, with a minimum 80% woodfree paper, free of carbon and principally free from carbonless copy paper (ccp)/no carbon required (NCR), less than 5% unbleached fibres including manila envelopes and file covers.
2.06.00	Ordinary sorted coloured letters	Paper, as typically generated by offices, shredded or unshredded, lightly printed, mass coloured paper allowed, but no deep coloured papers, with a minimum of 70% woodfree paper, free of carbon and principally free of carbonless copy paper (ccp)/no carbon required (NCR), free of manila envelopes, file covers, newspapers and cardboard.
2.06.01	Sorted coloured letters	Paper, as typically generated by offices, shredded or unshredded, lightly printed, mass coloured paper allowed, but no deep coloured papers, with a minimum of 90% woodfree paper, free of carbon and principally free of carbonless copy paper (ccp)/no carbon required (NCR), free of manila envelopes, file covers, newspapers and cardboard.
2.07.00	White woodfree bookquire	Books or their shavings, without hard covers, mainly of white woodfree paper, mainly black printed, containing a maximum of 10% coated paper.
2.07.01	White mechanical pulp-based bookquire	Books or their shavings mainly of white mechanical pulp-based paper, without hard covers, mainly black printed, containing a maximum of 10% of coated paper

Code	Name	Description
2.08.00	Coloured wood free magazines	Coated or uncoated magazines, white or coloured in the mass, free from hard covers, bindings and poster papers. May include heavily printed circulars and coloured in the mass shavings. Contain a maximum of 10% mechanical pulp-based papers.
2.12.00	Mechanical pulp-based computer print-out	Mechanical pulp-based continuous computer print-out may include recycled fibre
2.13.00	Multigrade	A blend of coloured and white letters, coloured woodfree magazines and other woodfree papers and shavings. Free from newsprint but 10% of other wood containing papers are permitted. May contain 2% paper with plastic layer.
3.01.00	Mixed lightly coloured printer shavings	Mixed shavings of printing and writing papers, lightly coloured in the mass, containing a minimum of 50% of wood free paper
3.02.00	Mixed lightly coloured wood free printer shavings	Mixed shavings of printing and writing papers, lightly coloured in the mass, containing a minimum of 90% of wood free paper
3.03.00	Wood free binders	White wood free lightly printed shavings with glue, free from paper coloured in the mass. May contain 2% paper with plastic layer and a maximum of 10% of mechanical pulp-based paper.
3.03.01	Special wood free binders	White wood free lightly printed shavings with glue, free from paper coloured in the mass. Plastic layered and mechanical pulp-based papers not permitted.
3.04.00	Tear white shavings	White woof free lightly printed shavings without glue, free from wet-strength paper and paper coloured in the mass
3.05.00	White wood free letters	Sorted uncoated white woodfree printing and writing papers, printed, free from cash books, carbon paper and non-water soluble adhesives. May contain 5% mechanical pulp-based paper.
3.06.00	White business forms	White wood free business forms free from carbonless paper (NCR) and glue
3.08.00	Printed bleached sulphate board	Heavily printed sheets of bleached sulphate board, without glue, polycoated, or wax materials
3.09.00	Lightly printed bleached sulphate board	Lightly printed sheets of bleached sulphate board, without glue, plastic layers, waxed materials
3.10.00	Multi printing	Lightly printed wood free coated papers in sheets or trim, free from wet-strength paper and from paper coloured in the mass.
3.10.01	Medium printed multi printing	Medium and heavily printed wood free coated papers in sheets or trim, free from wet-strength paper and from paper coloured in the mass.
3.11.00	White heavily printed multiply board	New cuttings of heavily printed white multiply board, containing wood free or wood containing plies, but without grey and brown plies.
3.11.01	Mixed white heavily printed multiply board	New cuttings of heavily printed white multiply board, containing wood free or wood containing plies, with a maximum of 20% grey and brown plies
3.12.00	White lightly printed multiply board	New cuttings or lightly printed white multiply board, containing wood free or mechanical pulp –based plies , but without grey or brown plies
5.05.00	Wet labels	Used wet labels from wet strength papers, containing a maximum of 1% glass content, and a maximum of 50% moisture, without other unusable materials.
5.05.01	Dry labels	Labels made from wet-strength papers.
5.09.00	Carbonless copy paper (NCR)	Sheets or shavings of new carbonless copy paper (NCR)
5.10.00	Printed white envelope	White envelopes, printed on the inside with or without water soluble or latex glue and windows (plastic or glassine)

Code	Name	Description
5.10.01	Mixed envelopes	Mixed white or coloured in mass envelopes with or without water soluble or latex glue and windows (plastic or glassine)

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