# A Comparative Assessment of Standards and Certification Schemes for Verifying Recycled Content in Plastic Products

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***The full version of this report is only available in English.**

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# Glossary

The following are some of the key terms that are used throughout this report.

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| **Additive** | Substances intentionally added to a base polymer to improve processability, prolong the life span, and/or achieve the desired physical or chemical properties in the final plastic/ product. |
| **Chain of custody** | Process by which material inputs and outputs and associated information are transferred, monitored and controlled as they move through each step of the relevant supply chain.[1] |
| **Chemical recycling** | The conversion of plastic waste whereby the chemical structure of the polymer is converted into monomers, separating out the additives and contaminants and creating chemical building blocks that can be used as raw materials in chemical processes. |
| **Compostable plastic** | Plastic that biodegrades in industrial composting and is compliant with ASTM D6400, CAN/BNQ 0017-088, or an equivalent national standard. |
| **Free Allocation** | In mass balance models, at both batch level and site level there may be several co-products that result from a process. The recycled input may therefore be allocated to one single product (despite it being evenly distributed throughout all of the co-products). This is a form of accounting know as free allocation/attribution. |
| **High-density polyethylene (HDPE)** | A strong, durable, lightweight, and chemically resistant plastic material popular for a variety of applications, including rigid plastics. Coded as plastic resin #2. |
| **Identity Preservation** | A chain of custody model in which certified product from a certified site is kept separate from other sources. If used through the whole supply chain, it allows certified products to be uniquely traced through the production process from a production site and batch (sustainability certificate holder) to the last point of transformation or labelling of a product. In this model, the certified material cannot be physically mixed with other certified or non-certified material of the same commodity or ingredient. |
| **Low-density polyethylene (LDPE)** | A soft, flexible, lightweight plastic material. It is often used for sandwich bags and cling wrap. Coded as plastic resin #4. |
| **Mechanical recycling** | The processing of (plastic) waste into secondary raw materials or products via mechanical processes (e.g. grinding, washing, separating, drying, re-granulating and compounding) without changing the chemical structure of the material. |
| **Non-mechanical recycling** | Any recycling process that does not fit the definition of mechanical recycling; this can include dissolution, solvent purification, thermal depolymerization, or chemical depolymerization. These technologies are also referred to as chemical or advanced recycling. |
| **Mass Balance** | Mass balance is an overarching term for various slightly different types of chain of custody which involve balancing volume reconciliation. In the |

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| | mass balance model, the volume of certified product entering the operation is controlled and an equivalent volume of product leaving the operations can be sold as certified. The physical mixing of certified and non-certified product is allowed, but not required at any stage in the production process provided that the quantities are controlled in documentation. The subsets of mass balance are: batch-level, site-level, and group-level.[2] |
| **Monomer** | A molecule that can react with other molecules to form larger molecules (chains). |
| **Plastics converter** | A plastic manufacturer that transforms raw material into semi-finished and finished plastic products using a range of manufacturing processes including injection moulding, extrusion, blow moulding, rotational moulding and vacuum forming, etc. |
| **Polyethylene terephthalate (PET)** | A clear, strong, and lightweight plastic that is widely used for packaging food and beverages, especially convenience-sized soft drinks, juices, and water. Coded as plastic resin #1. |
| **Polylactic Acid (PLA)** | A stiff polymer that may be partially or wholly made from corn starch, tapioca root or sugarcane. May be compostable in industrial composting facilities under certain conditions. Coded as plastic resin #7. |
| **Polymer** | Material consisting of large molecules composed of many repeating sub-units. |
| **Polyolefins** | Large molecules (polymers) formed by the polymerization of olefin monomer units (e.g., polyethylene and polypropylene). |
| **Polypropylene (PP)** | A thermoplastic used in a variety of applications, including packaging for consumer products like yogurt pots, margarine containers, and many plastic bottle caps. Coded as plastic resin #5. |
| **Polystyrene (PS)** | A transparent thermoplastic that is found as both a typical solid plastic as well as in the form of a rigid foam material. Often used for producing disposable cutlery and dinnerware and coded as plastic resin #6. |
| **Polyvinyl Chloride (PVC)** | A common thermoplastic used in construction and generally known for its hardness. Coded as plastic resin #3. |
| **Recyclate** | Material resulting from the processing of plastic waste (pellets, granules, flakes, etc.) |
| **Reprocessor/Recycler** | A business that, in the ordinary course of conduct of trade, carries out a recovery operation whereby waste materials are reprocessed into products, materials or substances whether for their original or other purposes. This includes the reprocessing of organic material but does not include energy recovery and the reprocessing into materials that are to be used as fuels or for backfilling operations. |
| **rPET** | Recycled PET (polyethylene terephthalate). |
| **Segregation** | A chain of custody model in which certified product is kept separate from non-certified sources through each stage of the supply chain, allowing assurance that the ingredients within a particular product originate from |

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| | certified sources, though it may not be possible to identify which molecule came from which certified source.[3] |
| **Thermoform (thermoplastic)** | A family of plastics that can be melted when heated and hardened when cooled. These characteristics, which lend the material its name, are reversible. That is, it can be reheated, reshaped and frozen repeatedly. |
| **Thermoset** | A family of plastics that undergo a chemical change when heated, creating a three-dimensional network. After they are heated and formed, these plastics cannot be re-melted and re-formed. |

# Summary of Standards and Certification Schemes Reviewed

| Name | Jurisdiction | Description |
|---|---|---|
| **EN 15343:2007 Plastics Recycling Traceability and Assessment of Conformity and Recycled Content**[4] | Europe | Published by the European Committee for Standardization (CEN), the purpose of the standard is to describe the necessary procedures for mechanical recycling that are needed for products that have been manufactured completely or in part from recycled plastics and need proof of traceability. It allows producers to use the recycled materials in confidence. |
| **ISO 22095 Chain of Custody – General Terminology and Models**[5] | Global | Provides unambiguous definitions of the different CoC models and the corresponding requirements, which are independent of sectors, materials, products, and issues addressed. Can be used by any organization operating at any step in a supply chain, as well as by standard setting organizations as a reference point for specific CoC standards. |
| **International Sustainability and Carbon Certification (ISCC) Plus**[6] | Global | A global voluntary certification system that certifies sustainable, deforestation-free, and traceable supply chains for materials from agriculture, forestry as well as waste and residue raw materials, non-bio renewables and recycled carbon materials and fuels. The standard can be applied to all markets including chemical and energy markets, as well as food and animal feed.[7] |
| **UL 2809 Environmental Claim Validation Procedure (ECVP) for Recycled Content**[8] | Global | Authenticates the post-consumer, pre-consumer (post-industrial), closed-loop or total recycled content of products, providing third-party validation. Also includes Ocean Bound Plastic and Ocean Plastic in the source materials. In addition, the program can certify any material or industry and has completed projects in glass, gold, copper, tantalum and cobalt at all stages in the supply chain. Industries served include electronics, jewelry, and batteries. Any material or industry is eligible for certification. |
| **SCS Recycled Content Standard**[9] | Global | Voluntary standard that evaluates products made from pre-consumer or post-consumer material diverted from the waste stream. Certification measures the percentage of recycled content for the purpose of making an accurate claim in the marketplace. |
| **Association of Plastic Recyclers (APR) Postconsumer Resin (PCR) Certification**[10] | USA | Provides converters and brand owners certainty that the material they are buying and incorporating into their packaging is PCR. |
| **GreenBlue Recycled Material Standard (RMS)**[11] | North America | Voluntary, market-based framework that enables consistent labelling of products and packaging that contain or support verified recycled |

| Name | Jurisdiction | Description |
|---|---|---|
| | | material, either through a certified CoC or via the Attributes of Recycled Content (ARC) certificate trading system. |
| **EuCertPlast**[12] | Europe | Voluntary European-wide certification for recyclers of pre- and post-consumer plastic waste. The aim is to recognize recyclers of pre- and post-consumer plastic waste operating according to high standards. |
| **RecyClass**[13] | Europe | Voluntary third-party audit scheme that verifies the traceability of recycled material within all steps of the value chain while ensuring the origin of the material pre- and post-consumer in product claims. |
| **Recycled Claim Standard (RCS)**[14] | Global | Voluntary standard that sets requirements for third-party certification of recycled input and CoC. The goal of the standard is to increase the use of recycled materials. The affiliated standard, Content Claim Standard (CCS), ensures the accuracy of content claims. The CCS accomplishes this goal by verifying the presence and amount of a given raw material in a final product. |
| **RSB Standard for Advanced Products**[15] | Global | The scheme aims to certify all sectors. Certification applies to non-energy products such as plastics, textiles, pharmaceuticals, packaging, tableware, cosmetics, nutritional supplements, food, feed, pulp, paper, etc. One uniform standard for bio-based, recycled content, and attributed systems. |
| **RAL Quality Mark for Recycled PET**[16] | Germany | Certifies PET beverage bottles produced with post-consumer waste. Awarded to fillers, bottle and preform manufacturers and recycling companies that comply with the quality and testing regulations. |
| **QA-CER Recycled Content Certification System**[17] | Global | Voluntary independent, third-party system certification based on ISO 9001 principles including CoC. |
| **Istituto per la Promozione delle Plastiche da Riciclo (IPPR) Plastica Seconda Vita (PSV)**[18] | Italy | Voluntary product certification scheme that certifies mechanically recycled plastic. Developed in Italy and designed to make recycled plastic products more visible and identifiable to public administrations and companies with predominantly public capital. |
| **Cradle to Cradle Certified**[19] | USA | Assigns an A, B, C, X, or GREY material assessment rating to recycled content materials subject to review in a finished product that is applying for Cradle to Cradle certification. |

# Executive Summary

The Government of Canada has committed to a target of at least 50% recycled content in plastic products by 2030, where applicable, with an aim to increase the amount of plastic waste re-circulated in the economy, and to consequently reduce the amount being landfilled or littered. This target is included in the Ocean Plastics Charter[20] and the Canadian Council of Ministers of the Environment (CCME) Phase 1 Action Plan on Zero Plastic Waste.[21] As the Federal Government considers actions to support the achievement of Canada's target, a critical element will be how to measure and verify recycled content in products to demonstrate attainment of the target. Eunomia Research and Consulting (Eunomia) was commissioned by the Standards Council of Canada (SCC), in cooperation with Environment and Climate Change Canada, to conduct a comparative assessment of existing and in-development standards and certification protocols for verifying recycled content in plastic products. The specific objectives of the study are to:

- Assess the global landscape of standards and certifications for the verification of recycled content claims in plastic products.
- Compare standards and certifications to determine key differences.
- Gain insight into stakeholder use and choice of existing standards and certifications.
- Identify future needs related to the verification of recycled content in plastic products.

## E.1.0 Approach

A desktop review of standards and certifications for recycled content in plastics was undertaken to identify those currently active or in development in both North America and globally. Following the desktop review, interviews were held with representatives from the schemes. The schemes identified, and for which secondary research was carried out, are detailed in Appendix A.1.0. The primary purpose of all schemes reviewed was to trace and verify recycled content through a supply chain or within a facility through document review and in some instances site audits, and for that process to be transparent and credible to enable product claims to be made.

To enable comparison and to identify gaps and needs for the future, the research was aimed at gathering information on key elements of each standard including:

- Calculation of recycled content, including details on inclusion of pre and/or post-consumer material, allowance for non-mechanical processes, allowed chain of custody models and allocation of recycled content under mass balance.
- Verification process including use of third-party accreditation.
- Recycled content reporting and claim requirements.
- Industry uptake.
- Cost of purchasing the standard or attaining/maintaining certification in respect to licensing, audits, and label use.

## E.2.0 Recycled Content Standard Key Elements – Scheme Similarities and Differences

No two schemes reviewed were identical, however there were key elements within schemes and identified through the research and in discussions with stakeholders that were identified as being key within a recycled content standard and these are detailed in Table 1. Table 1 provides an explanation as to why these elements are considered important and summarizes where schemes are or are not aligned against these elements.

### Table 1: Key Elements - Scheme Similarities and Differences

| Key Elements | Why this is Important? | Detail |
|---|---|---|
| **Alignment with ISO 22095 and ISO 14021** | Alignment with international standards provides a level of consistency across schemes. | **Pre- and post-consumer plastic definitions are aligned to ISO 14021 (**Environmental Labels and Declarations) **in the large majority of schemes. Just over half of the schemes also reference chain of custody models and definitions sets out in the 2020 published ISO 22095 (**Chain of Custody — General terminology and models). |
| **Accreditation** | Linked to the credibility, accountability and transparency of the scheme | **Annual accreditation** through third party auditors is common. |
| **Focus of scheme** | Considers the extent to which a scheme can cover the entire supply chain or if multiple schemes are required for supply chain verification. | The **majority of schemes cover the whole supply chain**, while APR and EuCertPlast schemes focus on certifying the recycling facility and its outputs. |
| **Pre- and post-consumer material** | Impacts how recycled content targets can be demonstrated to be met. | **Pre-and post-consumer material in the supply chain is covered by all schemes except APR,** EuCertPlast, and RAL. |
| **Mechanical and non-mechanical recycling** | Impacts how recycled content goals can be demonstrated to be met. | Just under **half of the schemes reviewed cover non-mechanical recycling** (i.e. ISCC Plus, UL, RMS, RCS, RSB and QA-CER). |

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| **CoC model** | Linked to the physical traceability of recycled content in a final product and important when considering the role of the non-mechanical recycling technologies in the supply of recycled content to meet targets. Impacts how recycled content goals can be demonstrated to be met. | **Chain of custody models include identity preserved, segregated, controlled blending, mass balance and book and claim. All programs except one allow for identity preserved, segregated, controlled blending and mass balance accounting.** Only one scheme allows for book and claim and that is RMS. |
| **Mass balance system boundary and geographical scope** | Covers the accounting boundary for mass balance--effectively the extent to which recycled content can be transferred within companies in the same or different countries, and as such where recycled content is deemed to be available to meet country-specific goals. | **Three of the schemes** (i.e. ISCC Plus, UL and RMS) **allow for mass balance accounting at a group level, with geographic restrictions** confined to countries sharing a boundary (i.e. ISCC Plus, UL) or North America only (i.e. RMS). |
| **Free allocation** | Most important to recycled material generated through chemical recycling processes; linked to how recycled content input can be attributed to outputs when there is no physical traceability and where there are many different outputs, the minority of which might be feedstock to plastics production. | **No commonality** between schemes **regarding how recycled input is allocated in the final output under non-mechanical recycling processes**. Fuels excluded in RMS but not in ISCC Plus. |
| **Mass balance accounting period** | The accounting period sets the timeframe by which recycling input must equate to output and to ensure that more output cannot be sold than what has been processed. | **Three- or twelve-month balancing period** common, **no negative balance** or material deficits **at end of period**.<br>The ability to carry over positive credits from one accounting period to the next varies across schemes. |
| **Claims and labelling** | Within a standard or certification, the purpose of labelling is to provide transparency and clarity as to what the claim is attesting to. In the case of recycled content claims and labelling, it relate to the amount of recycled content within a specific product or packaging, or recycled content across several products determined through mass balance accounting for example. In either of these scenarios, labelling and claims must be clear on the method of calculation. | **RecyClass and RCS require recycled content in each individual product to make a product claim. RMS allows for claims to be made across products**—although the claim must state it is based on mass balance accounting—and the same is true for ISCC Plus and UL. Under each of these schemes the labelling states for example that assessment and claim is based on a mass balance method of account. |

## E.3.0 Use and Choice of Standards and Certifications

Use and choice of standard varied by stakeholder group. Certifications and standards are most commonly used by the chemical industry, with ISCC Plus being the preferred standard, likely in part because it allows for free allocation of recycled content across products at a group level. Mechanical recyclers are increasingly looking to be certified under APR as it is viewed as a credible industry association and focuses on certifying post-consumer recycling processes. Brands and producers are predominately requiring, through purchasing agreements, suppliers to attest to the amount of recycled content in products supplied, and have no requirement for the supply chain to be audited through a third-party scheme. Public Services and Procurement Canada has yet to consult with suppliers on recycled content in plastic products, but is due to consult on sustainable packaging in 2022.[22]

The key factors that appear to be influencing the use of standards and certification schemes as identified through stakeholder interviews include:

- *Legislation:* **Minimum recycled content mandates**, such as Senate Bill (SB) 270 and Assembly Bill (AB) 793[23] in California,[24] are **driving the demand for certification** in this area, just as the EU's Single Use Plastics Directive is driving research on calculation rules to ensure consistency in reporting recycled content in plastic bottles across European member states.
- *Customer requirements*: **Business-to-business (B2B) companies are more likely to be certified than business-to-consumer (B2C) companies** who rely on supplier attestations.
- *Corporate values*: Use of **recycled content** in products, and therefore **certification**, is being **driven by demonstrating achievement of publicly stated corporate environmental, social and governance commitments**.

The main factors impacting choice of standard include:

- *Wider sustainability reporting*: The ability to use **one standard to verify against a range of social, environmental, and health metrics is seen as convenient**.
- *CoC model*: **Level of transparency and traceability provided by different chain of custody models and allowed by different standards is very important**. For some companies, physical traceability through the supply chain (e.g., the identity preserved model CoC and the segregation CoC model, explained in section 3.2.1) is critical. Other companies require mass balance accounting and in some cases want to ensure the scheme allows for accounting across multiple sites that might be connected (e.g. UL) or at a group level.
- *Allocation method*: **Chemical companies consulted chose schemes that had the most relaxed approach (i.e. free allocation) to how recycled content input was allocated to products.**
- *Post-consumer resin*: Some stakeholders believe that since there is an established market for many pre-consumer plastics, the focus should be on post-consumer accreditation.
- *Sector:* Some schemes are sector-specific. Cradle to Cradle is predominantly used by the textiles sector, while RMS appears to be focused on the packaging sector. The chemical sector prefers ISCC Plus because it allows for the complete free allocation of recycling input to polymer output regardless of the percentage of output that flows into plastic polymer production.

Cost is a major consideration by organizations when choosing a scheme. The costs of a scheme mainly relate to the cost of auditing, which in turn is primarily driven by the number of sites and/or product supply chains to be covered.

## E.4.0 Market Realities of Using Recycled Content

Information was also sought to gain insight into some of the challenges and barriers stakeholders face with respect to using greater levels of recycled content in products. Common challenges include:

- Regulatory health and safety requirements: The need to achieve US Food and Drug Administration approval for food grade packaging specifications narrows the types and quality of feedstock that producers of food contact packaging can accept. Legacy chemicals and the need to comply with strict product safety requirements were also key concerns for manufacturers working in the ICT and consumer goods (toy) product sector.
- Design specifications: The need to achieve manufacturer design specifications (e.g. packaging colour or shade) was cited as a key barrier to using recycled resins.
- Low virgin resin prices: Value of recycled material needs to be decoupled from the supply and demand dynamics of virgin plastics. Producers noted that they are likely to use virgin raw materials if prices are lower.
- Sourcing issues: Lack of supply, quality of post-consumer feedstocks and security/consistency of supply were stated as key barriers to increased use of recycled content.
- Consumers' perceived quality of recycled products: Some market segments (e.g. retail) identified consumer perceptions of recycled materials as lower quality as being a key issue.

## E.5.0 Limitations, Gaps and Needs for the Future

Some of the limitations, gaps and needs for the future are listed below:

- Inconsistency across standards: There are several inconsistencies across standards and certification schemes, including balancing periods and geographical boundaries under mass balance. Ideally, there should be alignment so that different players in a supply chain could choose a specific scheme knowing that it would be compatible with other schemes that might be chosen by other actors in the supply chain.
- Material testing: One stakeholder noted that while third-party audits consisting of desktop documentation reviews and some site auditing are needed, these should work in tandem with material tests.
- Labelling: Of the schemes that provide a label, what is included on the label and how information is presented is not consistent; this is something that needs to be addressed to ensure transparency with consumers.
- Terms: Alignment of definitions for key terms will be required, e.g. recycled material.
- Standardized reporting process: There is a lack of consistency between schemes when it comes to processes for calculating, tracking, or verifying recycled content.

- Supply chain verification: There is a need for all actors along the value chain to be certified using a consistent approach.
- Global consistency: Many of the stakeholders that were interviewed are international organizations and as such stated that consistency across countries and jurisdictions would be preferable.
- Internal verification equivalently valid as third-party certification: Some stakeholders were of the view that their internal supplier attestations, combined with self-auditing, were as valid as having a third-party certification, but at a lower cost. It was, however, acknowledged that consistent criteria for audits/verification is critical to ensure a level playing field among organizations.

## E.6.0 Future Needs and Considerations

Despite the first standard for recycled plastics being published in 1993, the verification of recycled content and claims about its use in products is still in its infancy. Setting minimum requirements around what counts as recycled content (for example) and addressing some of the existing gaps or ambiguities in definitions and measurement methods highlighted above will be required to ensure consistent measurement and reporting. Based on the research carried out for this project specifically, as well as Eunomia's previous work on standards, Eunomia has identified the following future needs related to the verification of recycled content:

- Verification and reporting requirements/rules: Due to the differences across existing schemes, establishing a set of minimum requirements that must be complied with to verify and report recycled content may be a preferred course of action in Canada. Once the minimum requirements have been set, schemes would ideally be required to demonstrate that they comply with those requirements before being able to audit and verify recycled content. The points below outline what should be covered in these minimum requirements.
- Definitions: There is a need for clear, unambiguous definitions for key terms such as recycled plastic and pre- and post-consumer plastics. Clarity is also needed with regards to whether pre-consumer plastics can be included in the calculation of recycled content; this should be considered in parallel with the market realities of achieving 50% recycled content for different products and polymers.
- Acceptable CoC models: Most of the schemes reviewed as part of this research are aligned to ISO 22095 (Chain of custody — General terminology and models). Consideration is needed as to the appropriateness of the book and claim model, which is currently only used in RMS. Supporters of this CoC model claim that it encourages investment in recycling infrastructure and systems, while those opposed state that it prevents producers from making the necessary product design changes that would enable recycled content to be included, and that there is no guarantee that using this model will spur investment where it is needed. The biggest concern raised by stakeholders was that book and claims lacks physical and chemical traceability seen by many as important with respect to the credibility and accountability of claims. While mass balance is a common accounting method, there can be inconsistencies around the balancing period, the ability to have a negative balance during an accounting period, and whether positive balances can be carried forward (and if so, under what circumstances).

- Allocation method: Whether or not recycled credits can be freely allocated across co-products from a process or transferred from site to site within an organization or within a set geographical region will need to be made clear; this is currently one of the key areas of difference between schemes, and is particularly relevant for chemical recyclers.
- Auditing and compliance: To ensure that audits are transparent and robust, third-party independent auditing of supply chain actors is critical. Consistency with respect to frequency and methodology of sampling is also important. Currently, most of the certification schemes do not require all players in the supply chain to be audited. Technological developments related to blockchain as well as the testing of materials to identify the presence of recycled content are being investigated and may play a critical role in the verification process in the future.
- Recycled content calculation and point of measurement: The method by which recycled content is calculated must be clarified, as well as the point at which material is considered recycled. This requires clarity on the point of measurement in the denominator and numerator.
- Sources of recycled content: It will be important to consider how the outputs from non-mechanical recycling will contribute to recycled content goals, considering necessary chain of custody accounting.

As all the existing standards and certification schemes reviewed are different, a key consideration for the federal government might be how it develops a set of rules that address the current gaps, inconsistencies, and differences which would allow existing standards and certification schemes to align around a common set of defined elements. This will encourage consistency in verification of goals while also allowing companies to choose their preferred scheme, which may fulfill other operational needs. As part of this course of action the federal government will need to determine what specific requirements will be needed and what its role might be in approving or accrediting certification schemes to ensure that the rules are met. Many of the existing schemes reviewed operate internationally and are used by multinational companies; as such they are likely to want to continue to use existing certification organizations to verify recycled content across their business.

With emerging developments in respect to recycled content across the globe, including in the form of international standards, the federal government might also wish to consider how it engages with these processes including for example participating in ISO's development of a new standard for mass balance accounting.

# Contents

# List of Tables, Figures and Boxes

# 1.0 Introduction

The Government of Canada has committed to a target of at least 50% recycled content in plastic products by 2030, with an aim to increase the amount of plastic waste re-circulated in the economy, and to consequently reduce the amount being landfilled or littered. This target is included in the Ocean Plastics Charter[25] and the Canadian Council of Ministers of the Environment (CCME) Phase 1 Action Plan on Zero Plastic Waste.[26]

The act of recycling is a complex process that starts with the disposal of waste items and ends with the re-use of a value-added material to deliver a set of benefits. The plastic recycling process, from the point of waste-creation to eventual re-use as part of a new material or product, can involve numerous collection, sorting and separation stages. Often, several complex processing and conversion operations take place and the recovered plastic passes through several changes of ownership before returning to a consumer as a new product.

Understanding the origin of product components, input and output materials, and the conditions under which they are produced is becoming increasingly important. A standard and certification process for Canada will need to consider this complicated supply chain for plastic products. Any standard and certification process will need to ensure clear definitions as to what constitutes a recycled material as well as effective verification of the supply chain to prevent fraudulent claims or double counting of materials. Now more than ever, demand for recycled content is increasing, and with increasing legislation globally this demand is set to grow even further, calling into consideration where material could be sourced to meet recycled content requirements in a jurisdiction. From a consumer's perspective, we want to be able to trust the claims made regarding the percentage of recycled material included in the products we buy.

To demonstrate progress toward the Government of Canada's commitment of 50% recycled content in plastics products by 2030, a standardized approach to verifying and demonstrating the quantity of recycled content in goods will be key to ensuring transparency and traceability, and that all parties are playing by the same rules.

To inform discussions on verification and quantification of recycled content in plastics products, Eunomia Research and Consulting (Eunomia) was commissioned by the Standards Council of Canada (SCC) and Environment and Climate Change Canada (ECCC) to conduct a comparative assessment of existing and in-development standards and certification protocols for verifying recycled content in plastic products. The specific objectives of the study are to:

- Assess the global landscape of standards and certifications for the verification of recycled content claims in plastic products.
- Compare standards and certifications to determine key differences.
- Gain insight into stakeholder use and choice of existing standards and certifications.
- Identify future needs related to the verification of recycled content in plastic products.

With these overarching objectives in mind, this report synthesizes the key findings of our research in the following structure:

- **Section 2.0 – Methodology:** This section provides a description of the activities undertaken that form the basis of the analysis.
- **Section 3.0 – Standards and Certifications for the Verification of Recycled Content:** In this section, some of the key components of standards and certification schemes for verifying recycled content are explained. The section also includes an overview of each of the standards against a common set of factors before highlighting some of the key differences and similarities. Finally, some of the gaps and inconsistencies are highlighted.
- **Section 4.0 – Overview of Existing and Proposed Recycled Content Standards and Certifications:** This section provides an overview and comparison of existing standards and facility and supply chain certifications for verifying recycled content. More detailed information for each standard and certification is provided in Appendix A.1.0. The different rules for verification and calculation are detailed, and gaps and inconsistencies across schemes are highlighted.
- **Section 5.0 – Uptake of Recycled Content Standards and Certifications:** In this section, we look at how the standards are currently used by stakeholders across the recycled plastics supply chain (from mechanical and chemical recyclers to product producers and brand owners).
- **Section 6.0 – Market Insights into Use of Recycled Content:** This section summarizes some of the insights gained (as part of the stakeholder engagement process) regarding some of the barriers to incorporating greater levels of recycled content in plastic products. Although not directly related to the use of standards, these insights will prove valuable for discussions on how to phase in recycled content mandates.
- **Section 7.0 – Future Needs:** This section examines what additional guidance may be needed in Canada for developing recycled content standards and certification schemes.

In-depth summaries of the standards reviewed are provided in the appendix, along with a summary of the stakeholders who were interviewed and the questions that were asked of them.

# 2.0 Methodology

**This section provides an overview of the methodology used to evaluate current recycled content verification schemes as well as the schemes reviewed.**

## Literature Review

A review of the available literature was carried out to collect key information on existing and known (in-development) standards and certification schemes for the verification of recycled content relevant to plastic products. A long list of standards and certifications was developed using data gathered in a similar review that Eunomia recently completed for the European Commission. The review was limited to information that was readily accessible/available in the public domain, and included technical and academic papers as well as public and private sector institutional guidelines, methodologies, policies, and position papers. We also reviewed standards and certifications used to verify recycled content in other materials or products, as some elements of those could be transferable to the verification of recycled content in plastic products. As per the Statement of Work, each standard and/or certification scheme was reviewed to identify the following aspects:

- Title
- Status (e.g., active, withdrawn, in development, under review)
- Publication date (for a standard) or launch date (for a certification)
- Publishing / certifying organization.
- Scope.
- Definitions of recycled content (including whether the standard makes any distinctions between pre-consumer and post-consumer resins, whether the recycling technology is relevant (e.g., chemical recycling methods; resins derived from fuels), and any other relevant distinctions).
- Compliance mechanisms (e.g., how is compliance measured, verified, and communicated).
- Method of measuring recycled content (e.g., mass balance accounting, chain of custody).
- Requirements for claims and labelling.
- Transparency requirements (e.g., public reporting, third-party auditing requirements).
- Flexibility mechanisms (e.g., ability for a company to allocate recycled content over time and across different product lines).
- Traceability.
- Cost of purchasing the standard or attaining certification.
- Uptake by industry (e.g., producers, recyclers).
- Reference in government policies and/or regulations (e.g., public procurement requirements).
- Reference in other organizations' purchasing policies.

### Interviews

The literature review was supplemented with primary research in the form of interviews with representatives from the standard or certification organizations as well as a small number of interviews with operators and users of the identified standards.

The certification schemes and standards that were part of the review (as agreed within the Work Plan) are shown in Table 2. In addition to those identified in Table 1, we also looked at the PolyCert Europe compliance scheme, which is complementary to and aims at aligning the existing certification schemes for converters of polymeric materials in Europe (e.g. Plastica Seconda Vita, RAL, AENOR, etc.), three of which are included in the table below. As PolyCert Europe is effectively a harmonization of existing standards, it was not included in the review. All of the schemes are active, with RMS only going live in June 2021 and as such still in early implementation phase.

### Table 2: Summary Table of Certification Schemes and Standards

| Name | Jurisdiction | Description |
|---|---|---|
| **EN 15343:2007 Plastics Recycling Traceability and Assessment of** | Europe | Published by the European Committee for Standardization (CEN), the purpose of the standard is to describe the necessary procedures for mechanical recycling that are needed for products that have been manufactured completely or in part from recycled plastics and need proof |

| Name | Jurisdiction | Description |
|---|---|---|
| **Conformity and Recycled Content**[27] | | of traceability. It allows producers to use the recycled materials in confidence. |
| **ISO 22095 Chain of Custody – General Terminology and Models**[28] | Global | Provides unambiguous definitions of the different CoC models and the corresponding requirements, which are independent of sectors, materials, products, and issues addressed. Can be used by any organization operating at any step in a supply chain, as well as by standard setting organizations as a reference point for specific CoC standards. |
| **International Sustainability and Carbon Certification (ISCC) Plus**[29] | Global | A global voluntary certification system that certifies sustainable, deforestation-free, and traceable supply chains for materials from agriculture, forestry as well as waste and residue raw materials, non-bio renewables and recycled carbon materials and fuels. The standard can be applied to all markets including chemical and energy markets, as well as food and animal feed.[30] |
| **UL 2809 Environmental Claim Validation Procedure (ECVP) for Recycled Content**[31] | Global | Authenticates the post-consumer, pre-consumer (post-industrial), closed-loop or total recycled content of products, providing third-party validation. Also includes Ocean Bound Plastic and Ocean Plastic in the source materials. In addition the program can certify any material or industry and has completed projects in glass, gold, copper, tantalum and cobalt at all stages in the supply chain. Industries served include electronics, jewelry, and batteries. Any material or industry is eligible for certification. |
| **SCS Recycled Content Standard**[32] | Global | Voluntary standard that evaluates products made from pre-consumer or post-consumer material diverted from the waste stream. Certification measures the percentage of recycled content for the purpose of making an accurate claim in the marketplace. |
| **Association of Plastic Recyclers (APR) Postconsumer Resin (PCR) Certification**[33] | USA | Provides converters and brand owners certainty that the material they are buying and incorporating into their packaging is PCR. |
| **GreenBlue Recycled Material Standard (RMS)**[34] | North America | Voluntary, market-based framework that enables consistent labelling of products and packaging that contain or support verified recycled material, either through a certified CoC or via the Attributes of Recycled Content (ARC) certificate trading system. |
| **EuCertPlast**[35] | Europe | Voluntary European-wide certification for recyclers of pre- and post-consumer plastic waste. The aim is to recognize recyclers of pre- and post-consumer plastic waste operating according to high standards. |
| **RecyClass**[36] | Europe | Voluntary third-party audit scheme that verifies the traceability of recycled material within all steps of the value chain while ensuring the origin of the material pre- and post-consumer in product claims. |

| Name | Jurisdiction | Description |
|---|---|---|
| **Recycled Claim Standard (RCS)[37]** | Global | Voluntary standard that sets requirements for third-party certification of recycled input and CoC. The goal of the standard is to increase the use of recycled materials. The affiliated standard, Content Claim Standard (CCS), ensures the accuracy of content claims. The CCS accomplishes this goal by verifying the presence and amount of a given raw material in a final product. |
| **RSB Standard for Advanced Products[38]** | Global | The scheme aims to certify all sectors. Certification applies to non-energy products such as plastics, textiles, pharmaceuticals, packaging, tableware, cosmetics, nutritional supplements, food, feed, pulp, paper, etc. One uniform standard for bio-based, recycled content, and attributed systems. |
| **RAL Quality Mark for Recycled PET[39]** | Germany | Certifies PET beverage bottles produced with post-consumer waste. Awarded to fillers, bottle and preform manufacturers and recycling companies that comply with the quality and testing regulations. |
| **QA-CER Recycled Content Certification System[40]** | Global | Voluntary independent, third-party system certification based on ISO 9001 principles including CoC. |
| **Istituto per la Promozione delle Plastiche da Riciclo (IPPR) Plastica Seconda Vita (PSV)[41]** | Italy | Voluntary product certification scheme that certifies mechanically recycled plastic. Developed in Italy and designed to make recycled plastic products more visible and identifiable to public administrations and companies with predominantly public capital. |
| **Cradle to Cradle Certified[42]** | USA | Assigns an A, B, C, X, or GREY material assessment rating to recycled content materials subject to review in a finished product that is applying for Cradle to Cradle certification. |

## One-to-one Stakeholder Consultations

Although the initial intention was to issue questionnaires to stakeholders, it was decided that one-on-one stakeholder interviews would provide more valuable information given the relative complexity of the standards and certifications and the infancy of recycled content verification schemes. In total, the Eunomia team conducted 21 one-on-one stakeholder interviews lasting between forty-five minutes and an hour each. The list of stakeholders contacted are included in Appendix A.1.0 and details regarding the types of questions that were asked are included in Appendix A.2.0. Table 3 summarizes the number of interviews, by stakeholder category, that were carried out. While conversations started with questions aimed at gathering insight into the use and choice of standards, information was also gathered on recycled content commitments and market conditions which will be important for SCC and ECCC to consider as measures such as legislation and standards are developed.

## Table 3: Stakeholder Interviews

| Stakeholder Group | Interviewed |
|---|---|

| | |
|---|---|
| **Producers – Durable goods** | 5 |
| **Producers – Non-durable goods** | 4 |
| **Conformity assessment bodies** | 2 |
| **Government organizations** | 2 |
| **Chemical companies** | 4 |
| **National organizations and associations** | 2 |
| **Plastic recyclers and converters** | 4 |

### Analysis and Synthesis of Findings

The findings of the above research tasks were then collated, analyzed and screened to identify key differences between the various standards and certification schemes, as well as to identify the usefulness, and limitations for different user groups. The findings were also analyzed to identify gaps in the current landscape of recycled content standards and to identify future needs related to the verification of recycled content in plastic products that could be suitable for Canada moving forward.

# 3.0 Key Components of Standards and Certifications for the Verification of Recycled Content

**This section sets out the key components withing recycled content schemes which should be understood before schemes can be reviewed. An explanation of the different chain of custody models referred to in schemes is provided as well as some of the rules as to how they can be applied to recycled content verification. Insight is provided as to how the schemes differ against the key components. Points of discussion include: allowance for pre- and/or post-consumer material in recycled content calculations, the point at which the amount of recycled content should be calculated, how process losses, moisture, additives and fillers are treated, and the allocation of recycled content in mass balancing accounting models within schemes.**

## 3.1 Introduction

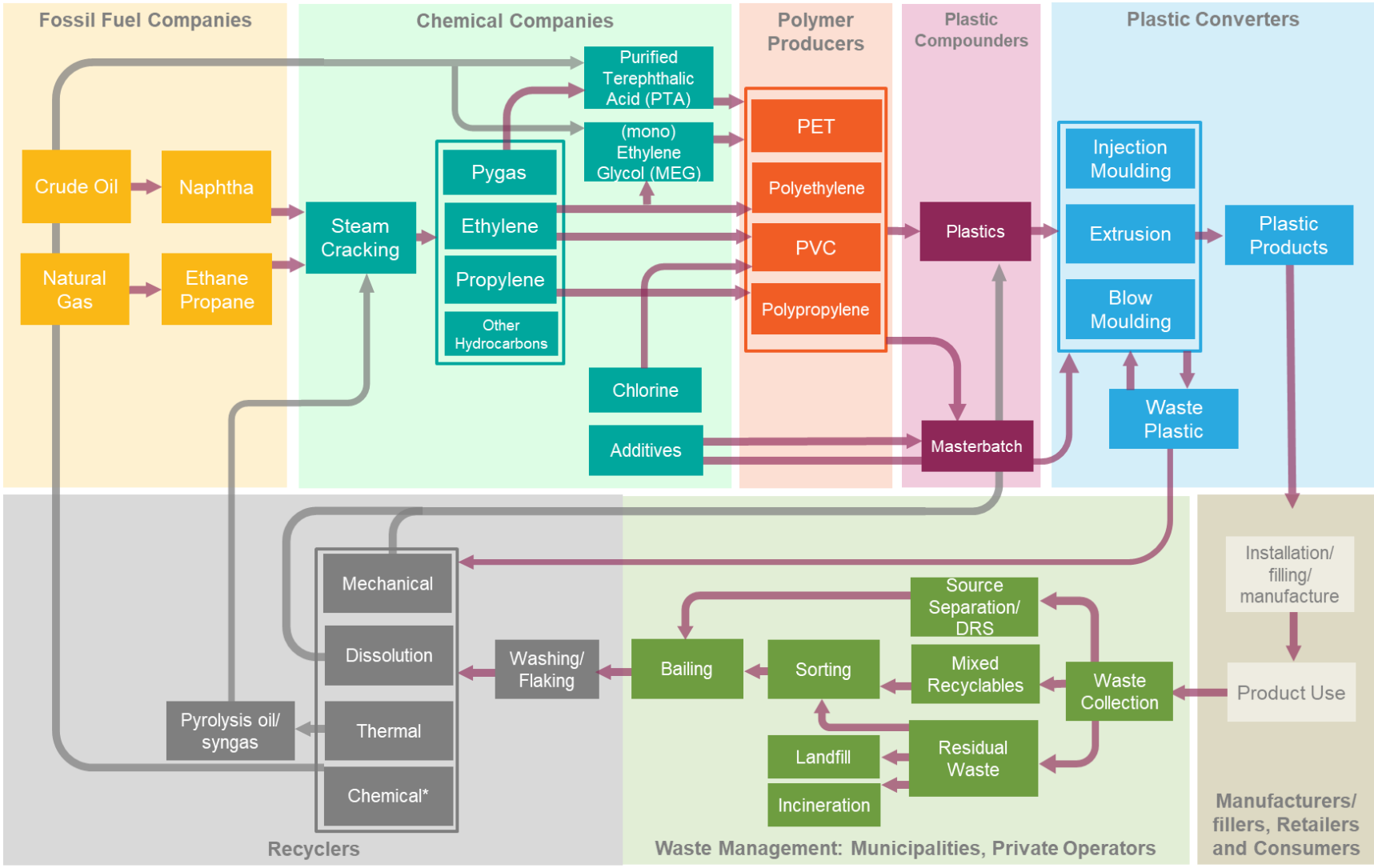
One of the main objectives of standardization is to have everyone adhere to the same procedures, processes or product specifications. This can help to ease logistical procedures, facilitate trade, prevent consumer deception, improve quality, or demonstrate compliance.

ISO defines standards as "... documented agreements containing technical specifications or other precise criteria to be used consistently as rules, guidelines or definitions, to ensure that materials, products, processes and services are fit for their purpose[43]." From this definition it becomes clear

that standards are not only used for standardization, but also as "guidelines", i.e. for capacity building. Figure 1 shows the complexity of the plastics value chain, and an overview of each player in the chain is provided in Table 4. Today, most post[1]- and pre-consumer plastic waste is mechanically recycled and fed back to the plastic compounders where it may be mixed with virgin plastics from chemical processes. In theory, material recycled via a mechanical process is easier to trace and verify compared to material recycled through a chemical recycling process (where plastic waste is converted by chemical reactions into monomers), since physical tracing of recycled plastics in the latter is not possible. To ensure consistency, traceability, transparency, and accurate accounting, a recycled content standard needs to stipulate the chain of custody requirements and allowances from the point that the plastic becomes a waste to the point that it is fed back into the production of a new product. While commitments to increase recycled content are currently being met through mechanical recycling processes, stricter requirements to include high percentages of recycled content in different goods in the future is likely to increase the need to consider the supply of recycled material through chemical recycling processes. For this reason, future standards must be developed in a way that enables both players to contribute to the attainment of targets in different polymer types and products.

[1] *ISO 14021:2016 – Environmental Labels and Declarations, defines pre- and post-consumer material as: Pre-Consumer Material: Material diverted from the waste stream during the manufacturing process. Excluded is the reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it. Post-Consumer Material: Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain.*

## Figure 1: The Plastics Value Chain




*Several variations of chemical depolymerisation exist which produce monomers – this example represents hydrolysis with outputs of PTA and MEG

## Table 4: Plastics Value Chain: Players and Roles

| Player in the Plastics Value Chain | Role |
|---|---|
| **Fossil Fuel Companies** | In the linear economy, the key role of these companies is to ensure uninterrupted supply of raw materials for other actors across the value chain.<br>Oil and gas companies operate refineries where crude oil is transformed into various useful chemicals. In the refining process, crude oil is normally heated in a furnace and later distilled into lighter components called fractions. |
| **Chemical Companies** | Refined petrochemicals from the oil and gas industry are sold directly to chemical companies who specialize in extracting high value chemical products. Naphtha is one of the hydrocarbon fractions than can be refined from oil, which can be processed in a steam cracker to produce a variety of other hydrocarbons including ethylene and propylene. Steam crackers can process upwards of 1 million tonnes annually and therefore are owned and operated by a relatively small number of big players. Natural gas can also be processed into natural gas liquids (NGLs) (e.g., ethane and propane) that can also be processed in a stream cracker to produce the same monomers (albeit in different proportions). |
| **Polymer Producers** | Many chemical companies are also key actors in the conversion of monomers into polymers. In the polymerisation process, light olefin gases such as ethylene and propylene (i.e. monomers) are chemically bonded into chains to produce polymers.<br>Five primary polymer types (PET, HDPE, PVC, LDPE, PP) account for around three-quarters of plastic demand[44]. Notably, four of the ten largest global plastic producers are based in Europe[45]. In 2019, European companies produced a total of 57.9 million tonnes of polymers, equivalent to 16% of the global production[46]. In 2019, plastic resin (CA$10 billion in sales) and plastic product (CA$25 billion in sales) manufacturing accounted for 5% of sales in the Canadian manufacturing sector and introduced 4.7 million tonnes of plastics to the domestic market.[47] |
| **Plastic Compounders** | Most companies that make polymers tend to sell relatively few polymer types, containing only basic additives needed to keep the polymer from degrading during processing. However, when used in combination with different additives or barrier properties, polymers can form thousands of material types. Additives can provide for a range of desired polymer features. They can serve as flame retardants, UV stabilizers, processing aids, colorants and more. Essentially, polymer compounding companies possess the know-how and the equipment to alter the features of polymers so as to meet the requirements of plastic product manufacturers. However, many of the compounds used in additives are also produced by the chemicals industry. |

| | |
|---|---|
| **Plastic Converters** | Converters produce polymer-based semi-finished and finished products for the full range of industrial and consumer markets. Converters primarily make use of several tried-and-tested plastics manufacturing processes, including injection moulding, extrusion, blow moulding, rotational moulding and vacuum forming. |
| **Waste Management Industry** | Municipalities, extended producer responsibility organizations, and private sector waste management companies set up infrastructure to separately collect and sort plastics. The pathways for post-consumer plastic waste differ depending on if the product is generated from the commercial, industrial, or residential sectors, and may differ again from pre-consumer or post- industrial waste. Post-consumer plastic packaging may go through material recycling facilities (MRFs) to be separated into different polymers, unlike plastics that are part of electronics goods, which may be separated by griding the whole item, for example. Post-industrial plastic waste may be process off-cuts that do not meet quality control and cannot be fed back into the manufacturing process. |
| **Plastic Recyclers** | Plastic recyclers are responsible for recycling sorted waste plastic products to produce a polymer pellet or a finished product depending upon the type of process. |

## 3.2 Key Components

This section provides an overview of some of the key components of recycled content standards and certification schemes, which are important to understand prior to comparing the various standards and certifications that are currently operational or in development.

### 3.2.1 Chain of Custody (CoC) Models

In 2020, ISO published ISO 2206:20 Chain of Custody – General Terminology and Models, the aim of which is to provide: (1) unambiguous definitions of the different chain of custody models, and (2) the corresponding requirements, which are independent of sectors, materials, products, and issues addressed. These requirements are applicable to any organization operating at any step in the supply chain.

ISO 2206:20 defines CoC as a:

> *Process by which inputs and outputs and associated information are transferred, monitored and controlled as they move through each step of the relevant supply chain.*

Figure 2 shows simplified schematics of the five key CoC models that are used to support claims related to the recycled content of the end product. Most of these models were originally developed for food crops or other bio-based materials to differentiate the origin of the product and are now being applied in other industries. Each model is described in more detail below. In addition to the overview of each CoC model, information is given as to the supply chain requirements for the model and the ultimate claim that could be made.

The physical presence of recycled content in a product reduces as you move from the identity preserved model (see definition below), where there is physical traceability of the recycled input in the output, to the mass balance model, where the recycled plastics input could be spread across many or few outputs but what goes in is equal to what comes out (accounting for system losses).

#### Identity preserved model

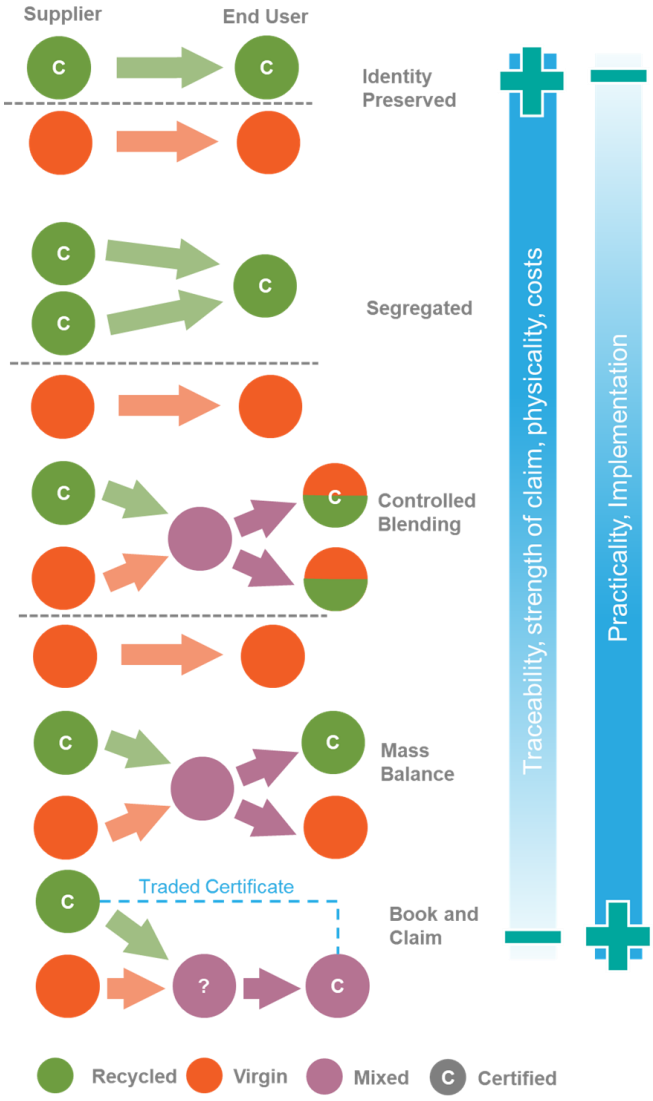
The identity preserved model is defined in ISO 22095:20 as "*a chain of custody model in which the materials or products originate from a single source and their specified characteristics are maintained throughout the supply chain*."

This model provides the highest level of traceability and strength of claim related to the content. This is because the supply chain is kept entirely separate and isolated. **For plastics recycling, this level of strictness is unlikely to be possible due to the variety of sources that the waste can come from—a possible exception being single source pre-consumer waste.**

*Supply chain requirements:* To fulfil the requirements, the organization must ensure:

- Physical separation of inputs and outputs with specified characteristics during, production, transport and storage;

## Figure 2: Chain of Custody Models




- Clear identification of the materials or products during the process;
- The output quantities corresponding to the input quantities are in line with an appropriate factor.

*Claim:* The organization producing the product may claim that the product contains 100% recycled content from a specific single source.

### Segregated model

The segregated model shares similarities with the identity preserved model, and is defined in ISO 22095 as "*a chain of custody model in which specified characteristics of a material or product are maintained from the initial input to the final output.*"

This model allows aggregation from multiple certified sources or sources that have met the requirements of the standard and would therefore be possible for some plastics recyclers.

*Supply chain requirements:* To fulfil the requirements, the organization must ensure that:

- 100% recycled material from different sources is kept separate, that each source has similar levels of traceability, and that the end products are kept separate from virgin materials across the supply chain so that it can be clearly identified in the production process
- The output quantities of recycled material are aligned with the input quantities accounting for losses or any conversion factor(s).

*Claim:* The organization can claim 100% recycled content if each supplier has conformed to the supply chain requirements.

### Controlled blending model

The controlled blending model is defined in ISO 22095 as "a chain of custody model in which materials or products with a set of specific characteristics are mixed according to certain criteria with materials or products without that set of characteristics resulting in a known proportion of the specified characteristics in the final output."

This model allows for the mixing of known quantities of virgin plastics with recycled plastics to produce a product with a known proportion of recycled content.

*Supply chain requirements:* To fulfil the requirements, the organization must ensure that:

- Recycled material is kept physically separated from virgin material from the point of production, transport and storage until the point of mixing;
- Each material is clearly identified until the point of mixing;
- The inputs are mixed during the production process to ensure that the final output contains the actual split of recycled vs material;
- All organizations active in the CoC deliver the required percentage of each output with specified characteristics in accordance with the requirements of the CoC system;
- Materials or products are processed over a specified timeframe. During the inventory balancing period the incoming percentage of controlled blended input shall be known before in order to determine the percentage of conforming output. The ratio determines the delivered percentage of controlled blending output per contained volume (e.g. batch, shipment, storage facility).

*Claim:* The organization can claim that the product contains X% recycled content.

### Mass balance model

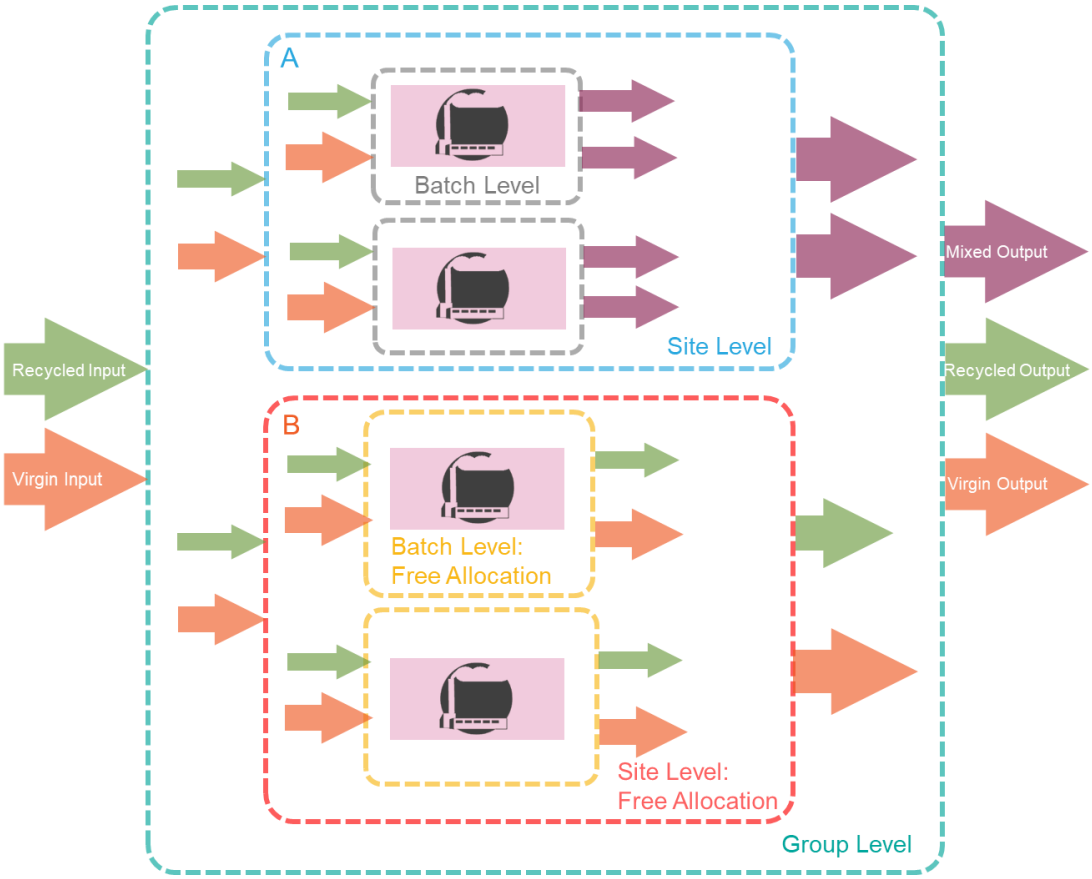
Mass balance is where the material supply begins to be decoupled from the actual content of a particular product. Recycled and non-recycled material are mixed together at any point in the supply chain. This means that all end products may contain a proportion of recycled material. ISO 22095 defines the mass balance model as "*a chain of custody model in which materials or products with a set of specified characteristics are mixed according to defined criteria with materials or products without that set of characteristics*."

The proportion of the input with specified characteristics might only match the initial proportions on average and will typically vary across different outputs.

This model can be used in both mechanical and chemical recycling supply chains and can be used at a batch, site or group level. The mass balance approach at a group level prevents the need to physically transport material from one place to another for which there are cost and environmental impacts. How the recycled content input is allocated to the products can differ for example all of the recycling input could be assigned to one product – this is known as free allocation/attribution, or assumed to be shared across the outputs. The allocation of recycled inputs to products can be carried out at different levels, at batch, site or group level. Figure 3 shows a simplified diagram of the three most prominent system boundaries that could be used in a mass balance approach: batch level, site level and group level. Batch level mass balance (grey dotted line) is the strictest and most transparent approach, and ensures that the end-product contains at least a proportion of certified product, which allows specific end-use claims to be made. In site level mass balances (blue dotted line), the proportion of certified content entering and leaving the site is known, although the proportion in each final product may not be known.[48] Finally, at the widest level, group level mass balances are described as a balance for a "group", which may refer to a group of companies or to a company with sites at different locations (multi-site).

In each of these approaches, there are also variations in the ways in which the outputs are allocated. At both batch level and site level, there may be several co-products that result from a process. The recycled input may therefore be allocated evenly across the products (the batch and site level allocations in box A) or to a single product (box B), despite it being evenly distributed throughout all the co-products. The second form of accounting is known as free allocation/attribution. Free allocation/attribution is most applicable to chemical recycling due to some processes typically producing fuel co-products alongside monomers destined for polymer production as well as monomers that flow into non-polymer products.

## Figure 3: Mass Balance System Boundary Examples




Two implementation methods are specified for the mass balance model:[49]

- Rolling average percentage method: This method is based on the use of a fluctuating proportion of input bearing specified characteristics entering the organization process over a defined claim period, allowing a claim of an average percentage to be made for the output over the claim period. The organization shall calculate the average percentage of the inputs and outputs of a defined category for each material or product.
- Credit method: This method is applicable when two or more types of input are used in a material or product. The recorded output amount of each type shall be equivalent to the physical input, taking into account the conversion factor. The conversion factor shall be defined within each material or product at each site and it shall be applied to define the

amount of credit to enter the credit account, when using the output as the basis for calculation, or to withdraw the credit when using the input as the basis for calculation. An organization using the credit method shall deduct from the credit account the respective credit of the output, up to the limit in, but not exceeding, the credit account. Credits shall expire after a defined period of time (usually determined by the requirements setter).

*Supply chain requirements:*

- The organization active in the CoC should determine the geographic area and the timeframe within which the materials or products are mixed.
- For each material or product, the organization shall define the claim period, which shall reflect the input in relation to the output; these should be limited to the determined timeframe.
- The inputs and outputs shall be balanced within the specified timeframe. The organization shall ensure a zero or positive balance at all times.

*Claim:* An individual product cannot claim to contain a certain percentage of recycled content, as this cannot be guaranteed. A claim could potentially be made across a product range or across an organization's entire product line, for example, company A's PET packaging containers in North America contain X% recycled content. However, it is more likely that the claim would refer to the specific allocation model that has been used in the product range or a company's product that has resulted in a level of recycled content. The claim would provide transparency in the CoC model used to assign recycled content to the product.

#### *Book and claim model*

The book and claim model is defined under ISO 22095 as "*a chain of custody model in which the administrative record flow is not necessarily connected to the physical flow of material or product throughout the supply chain*."

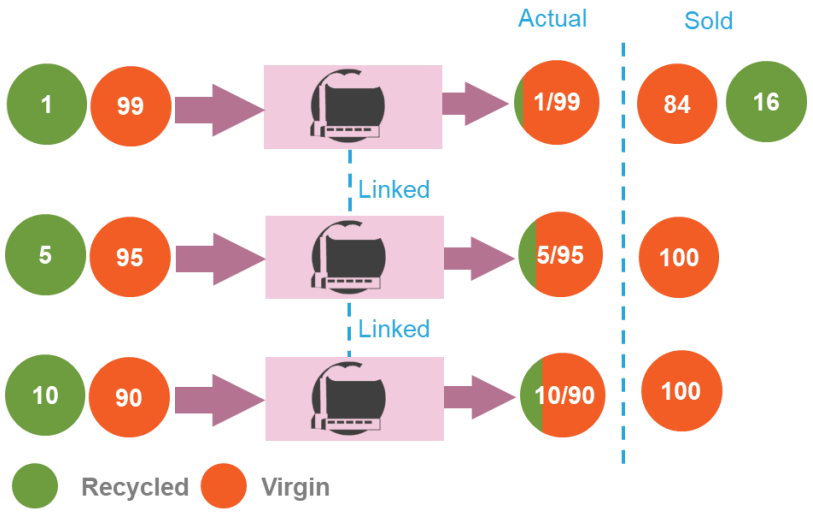
This model is also referred to as "certificate trading model" or "credit trading" and provides the lowest level of transparency as it involves tradable certificates that entirely decouple the production from the end user. Book and claim aims to encourage the use of recycled material by allowing recycled content credits to be transferred and as such providing investment in the recycling industry. Claims need to be strictly controlled to prevent the end user from stating the product contains certified product or more recycled content than what it does. In the context of recycled plastic consideration would need to be given as to the extent that credits could be traded across between different polymer types. Interchanging certificates between polymers could result in underinvestment in the market where it is most needed. For example if polymer A has a higher recycling rate than polymer B and as such results in more recycled polymer A in the market, credits from this polymer could be traded and applied to a product using polymer B. Under this scenario there would be in incentive to invest in the necessary infrastructure to enable polymer B to be effectively collected and recycled to enable recycled material to be incorporated into future products using polymer B.

### 3.2.2 Group Level Mass Balance and Restricted Credit Transfers

Existing large chemical companies, which may in the future be players in the supply of recycled material, will have multiple sites with feedstocks from recycled and virgin sources and produce

outputs that are allocated through a mass balance process. For example, under current thermal depolymerisation processes, the input pyrolysis oil/syngas or refined syngas is produced in small quantities and is diluted with high concentrations of virgin material. This means that over the next several years (perhaps at least the next decade) the outputs from each plant might include fractions of a percent of recycled content. The benefits of aggregation at a group level through internal company credit transfers is demonstrated in Figure 5. The simplified diagram shows credits being transferred to one site for sale. It is argued by chemical companies that this approach is required to make the process viable, at least in the short to medium term (~5-10 years). The figure shows that each site is taking in an amount of recycling content and that the product from each facility therefore contains a proportional amount of recycling content, however under a group level free allocation of the recycled content all recycled content can be attributed to one output from one facility. At a later time, when more recycled feedstock is available, a tighter set of requirements may be considered more acceptable to this industry sector. Restricting the transfer to the same company or group of companies should be a prerequisite which, if not adhered to can begin to stray towards a book and claim approach. Transfers should also only apply to identical product.

**Figure 4: Multi Site Group Mass Balance and Credit Transfer**




### 3.2.3 Geographical Boundary

Geographical boundaries can vary from unrestricted, to neighboring countries only, or specific regions (e.g., North America). In any case, they should reflect the aims of a particular recycled content target. For instance, specific, local geographical restrictions may be necessary to drive circularity in a particular market. Geographical boundaries should also be realistic to the flow of goods within a region as well as the potential supply of recycled material. At the recent National Institute of Standards and Technology's virtual conference on the assessment of mass balance accounting methods for polymers,[50] geographical boundaries were discussed in the context of traceability and accountability and credibility of mass balance accounting and claims. Discussion included the need to allow the system boundary to cover an integrated chemical production process, with either physical connectivity (i.e. facilities at the same location, or different plants interconnected by transportation systems, e.g. pipe lines, ships, trains or trucks), or by chemical

connectivity (i.e. facilities at different locations where both facilities produce the same outputs). The latter is specifically relevant to allocation, which is discussed further below.

### 3.2.4 Allocation/Attribution

The mass balance approach establishes a set of rules for how to allocate the recycled content to different products to be able to claim and market the content as "recycled." There are several methods for allocation, each of which impacts the end recycled content claim and is therefore an important consideration. For chemical recycling pathways, the input recycled material has to be allocated to the outputs as there is no directly traceable physical link; this can be achieved by allocating according to a technical balance of co-product yields (by mass, lower heating value (LHV) or carbon counting).

Figure 6 outlines four different allocation options under a mass balance approach. Most of these are included in certification schemes that allow for mass balance, with the exception of option 'd', which Eunomia is currently discussing with the European Commission as part of this work. Under this option, recycling input that is used as a fuel in the process cannot be allocated as recycled content in an output nor can recycled input that is not used in the manufacture of plastics products (e.g. if two outputs are subsequently used in the manufacture of plastics, the recycled content of one can be allocated to the other (and vice versa)). It should be noted that allocation can take place more than once for subsequent processes. For example, recycled content allocated to ethylene can be subsequently mass balanced in the production of mono ethylene glycol (MEG) to produce PET.

**Figure 5: Methods for Allocation in Mass Balance**

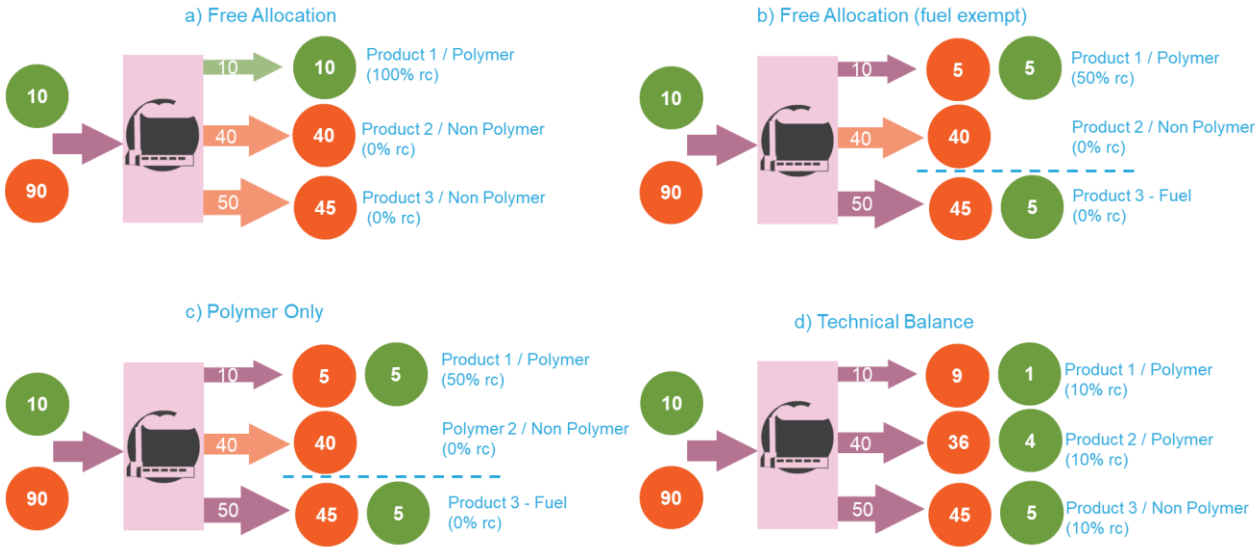
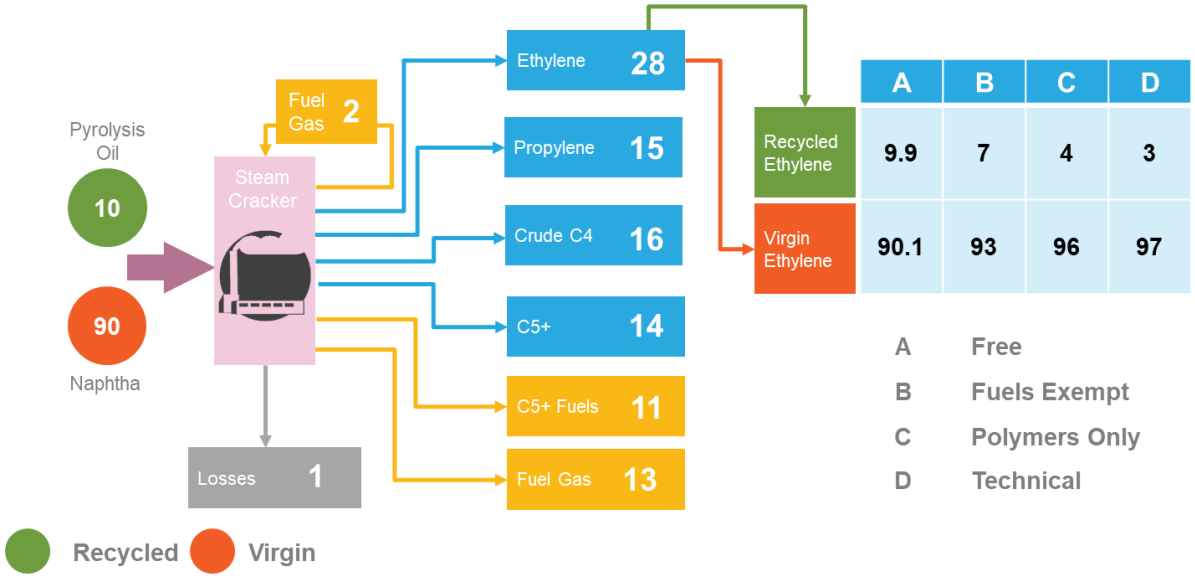



Figure 6 uses the example of inputting pyrolysis oil from a chemical recycling process alongside naphtha into an ethylene steam cracker to highlight the difference in the number of credits of recycled content that could be claimed under each of the allocation approaches set out in Figure 5. In this example, 26% of the output is used in fuel applications (including 2% to run the cracking process). The example shows the mass balance process from least strict (A) where there is free allocation minus process losses to most strict (D) where allocation takes place equally across all

products and process losses are taken into account. Between these two extremes, the recycled content that can be claimed differs by 70%. Two other possible allocations are to exempt fuels (B), which results in a 30% reduction compared to (A), and accepting only outputs destined for polymer production, which results in a 60% reduction (C).

It is also important to recognize that this particular process (steam cracking) does not produce single batches in these proportions, but is a continuous process of feedstock input and product output with down-time only for routine and unscheduled maintenance. The exact outputs may also be varied according to demand. This means that the allocation and balancing are usually calculated as rolling averages with maximum timeframes (usually 3 months) required for balancing.

### Figure 6: Example of Allocation in Mass Balance Approach – Naphtha, Ethylene Steam Cracker




*Source: Steam cracker outputs are derived from Ullmann's Encyclopedia of Industrial Chemistry*[51]

Currently, it is the position of the European chemicals industry (as articulated by the Cefic working group on chemical recycling) that free allocation should be adopted for all recycled content targets. Several companies are already using this approach with associated certification from ISCC (see Section 4.0).

# 4.0 Overview of Existing and Proposed Standards and Certifications

**This section provides an overview and comparison of existing standards and facility and supply chain certifications for verifying recycled content. More detailed information for each standard and certification is provided in Appendix A.1.0. The different rules for verification and calculation**

**are detailed in the context of the key components explained in Section 4.0. Gaps and inconsistencies across schemes are highlighted.**

Many of the standards and certifications make reference to EN 15343 – 2007 Plastics Recycling Traceability and Assessment of Conformity and Recycled Content, and ISO 22095 Chain of Custody – General Terminology and Models, and as such these are outlined below before a summary of each schemes is provide and the differences and similarities detailed.

### EN 15343

EN 15343 is the European standard that specifies the procedures needed for the traceability and assessment of the conformity of mechanically recycled plastics. The standard is not specific for a certain product, but it refers to the traceability and conformity of the recycled plastic. This provides the basis for the calculation procedure for the recycled content of a product. The procedures are needed to formulate or describe the traceability, while the traceability can be used as a basis for calculating the recycled content. Its goal is to enable producers to use the recycled materials with confidence and provide end users with a basis for their acceptance.[52]

The recycled content of a product is calculated using the following formula:

$$\%\ \text{of recycled content} = \frac{\text{mass of recycled material in the product}}{\text{total mass of the product}}\ x\ 100$$

For the purposes of this calculation:

- A recyclate or material containing recyclate is considered a product.
- Only pre-consumer and post-consumer materials shall count towards recycled content.
- Material that is recovered within the same manufacturing process that generated it, shall not count towards recycled content.

To ensure traceability of recycled plastics, the supplier of the recyclate must provide data for each of the following stages:

- Control of input material (e.g. proper design of collection and sorting schemes, batch identification)
- Control of the recyclate production process (e.g. recording the process variables, quality control testing of the products delivered by the process, batch identification of the output)
- Plastics recyclate characterization (information regarding characteristics of the batch of recyclate following the relevant standard, e.g. EN 15342)

The standard is used for a number of certifications that focus on mechanical recycling.

### ISO 22095

The international standard ISO 22095 as referenced earlier in the report defines a framework for CoC by providing:

- a consistent generic approach to the design, implementation and management of CoC;
- harmonized terminology;
- general requirements for different CoC models;

- general guidance on the application of the defined CoC models, including initial guidance on the circumstances under which each model might be appropriate.

The standard is applicable to all materials and products and does not apply to services as final outputs.

During the research, we also became aware that ISO (under its PS308 working group) is currently working on the development of a new standard for mass balance accounting that is likely to take three years to develop and publish.

The measures within ISO 22095 aim to provide transparency and consistency in terms of accounting CoC that can be used across different product and material supply chains.

The principles and requirements for all CoC models are that the organization shall:

- Establish and implement one or more CoC models for all materials or products with specified characteristics and shall be transparent about that model;
- Use the same CoC model as its supplier, or a model with lower physical presence of the specified characteristics in the output.

All standards and certification programs reviewed are voluntary. A summary of the schemes against a set of 28 factors is provided in Appendix A.3.0.

## 4.1 Review and Comparison of Existing or Known In-Development Standards and Certification Schemes

The key components of a recycled content standard or certification scheme, as identified through the research, are discussed in more detail in this section.

The first recycled content standard was published by Scientific Certification Systems (SCS) in 1993.

### Formula and Rules

How recycled content is calculated and verified differs across the standards and certifications. This section summarizes the different factors or rules that influence the calculation.

**Scope of Material and Point of Verification**

With regards to scope, the majority of the schemes reviewed cover all plastic types, with only one (the RAL Gützeichen certification scheme) confined to a specific product (PET bottles). The schemes differ in respect to what they verify. Some schemes (i.e. APR's PCR Certification and EUCertPlast) verify the recycling facility and effectively the resin that is produced, while others (i.e. SCS, UL, RMS, ISCC Plus) verify the manufactured product and the preceding supply chain, which includes the recycler.

**Mechanical and Non-Mechanical Processes**

Six out of the 13 certifications and standards reviewed certify mechanical and non-mechanical processes. It is worth noting that at time of writing SCS plans to update their standard to include non-mechanical processes in version 8.

**Pre- and Post-Consumer Material**

With the exception of APR and RAL, all standards and certifications reviewed include both post- and pre-consumer material in their calculation methods. APR is specifically focused on supporting the development of post-consumer plastics markets and RAL is focused on recycled content in PET bottles.

Some believe that industrial waste should be certified as recycled, even if it creates a risk of overinflation by manufacturers. In such cases, it is important that recycled content labels or claims clearly state the use of pre- or post-consumer material. Still, the general public's understanding of the difference between pre- and post-consumer sources is likely to be limited. It is also commonly argued that pre-consumer waste, in many cases, is already being incorporated into products and therefore the focus should be on driving systems that create the demand for post-consumer material, as opposed to highlighting what is already taking place. One of the biggest difficulties lies in defining pre-consumer waste and distinguishing it from by-products or co-products. Most schemes rely on the definitions of pre- and post-consumer waste in ISO 14021:2016 – Environmental Labels and Declarations, which are as follows:

> *Pre-Consumer Material: Material diverted from the waste stream during the manufacturing process. Excluded is the reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it.*
>
> *Post-Consumer Material: Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain.*

The term post-industrial and pre-consumer is used interchangeably across schemes. GreenBlue's RMS standard uses the term post-industrial but its definition is the same as the above definition of post-consumer used by SCS and UL. One standard, QA-CER, also includes regrind as recycled content, as well as post-production and post-consumer, but they are accounted for separately.

Adherence to these definitions is applied on a case-by-case basis during the auditing process. Some schemes require supporting evidence, or historical data on average waste yields, to determine whether particular material can count as pre-consumer recycled content, although in many cases, the experience and opinion of the conformity assessment bodies can play a role in the final decision. The relative infancy of such definitions and associated auditing highlights the need for more guidelines to reduce the need for individual interpretation.

For this reason, some schemes have explored different definitional options. GreenBlue's RMS, for example, has introduced an additional requirement that the plastic must undergo a 'phase change,' which essentially requires material to be remelted.[53] QA-CER takes a different approach by distinguishing 'pre-consumer', 'post-consumer' and 'internal recycled' materials separately.[54] In this way, companies are incentivized to use internal process waste even though it cannot be claimed as pre-consumer. Alternatively, the RSB Global Advanced Products Certification allows 'production residue', defined strictly and on the basis of economic value rather than a physical property or at a specific point in the value chain:

*"Material that is a secondary product of a process which is inelastic in supply and that has an economic value ratio of ≤ 5% with respect to the sum of primary product(s), co-products and other by-products generated from the same production process."*[55]

**Moisture Additives and Fillers**

All of the standards and certification schemes reviewed agree that moisture content and impurities are insignificant (relative to the burden of measuring them) and do not warrant deductions from the numerator in the calculation. However, additives and fillers are dealt with differently depending on the scheme. For example, whereas Plastica Seconda Vita (PSV) considers outputs that include less than 5% pigments and additives as recycled content[56], conformity assessment bodies working under the Recyclass scheme check product content for additives to deduct from the recycled content total.[57]

Additives are added to polymers to aid processing and give the finished product specific functional properties such as antimicrobial, antioxidant, biodegradability, lubrication, fragrance, heat, and light stabilization properties. In general, additives form part of the polymer matrix during the plastic product life and, in the case of mechanical recycling, remain in the recyclate (albeit to varying degrees) and therefore to some extent in any recycled content used to create a new product.

There are four main categories of additives:

1) **Functional** additives (e.g. plasticizers; flame retardants; stabilizers (antioxidants, UV, heat); slip agents; lubricants (internal, external, combined); anti-statics; curing-agents; blowing agents; and biocides);
1) **Colourants** (e.g. soluble (e.g. azo-colourants); organic pigments; inorganic pigments; special effect);
2) **Fillers** (e.g. mica; talc; kaolin; clay; calcium carbonate; barium sulphate); and
3) **Reinforcements** (e.g. glass fibres; carbon fibres).

Of particular interest in the context of this study is the role of fillers, which are used primarily to provide bulk (often at lower cost than the main polymer(s)) in a plastic product, whilst retaining or enhancing the engineering properties of the plastic. In many plastic products, particularly within the packaging sector, the proportion of non-filler additives is relatively low (estimated by stakeholders to be within the range of 500 – 2500 ppm, with considerable variation by polymer[58]). In PET packaging applications, the proportion is noted to be particularly low. Similarly, the use of fillers in packaging applications was not thought to be particularly significant (within the 1-2% range), although this is considerably higher in other sectors using plastic products (automotive, construction, leisure products).[59] In PVC plastic products used in the construction sector, for example, the additives and filler proportion can be over 60%.[60]

It is difficult to find detailed information on the use of different additives in specific polymers and applications, as this information is usually commercially sensitive and not publicly available. Because different products have different design specifications, even products made from the same polymer for the same application can make use of very different additives. This makes it difficult for recyclers, reprocessors, and converters to know the exact mix of additives that were used in plastic that has been received for recycling and subsequent production.

**Process Losses**

Both the Recycled Claim Standard (RCS)[61] and the RMS[62] indicate that virgin material processing losses are differentiated from recycled material losses. RMS plans to guide its auditors on the kinds of losses to verify, including different losses for recycled and virgin material.[63] Overall, the schemes reviewed for this research do not consider the fact that virgin and recycled material could have disparate processing loss rates due to quality or that it could significantly affect the recycled content claim. The Roundtable on Sustainable Biomaterials (RSB), for example, states that materials gain the same quality through chemical recycling and therefore have the same loss rates.[64]

### Chain of Custody

**Model**

All but one certification scheme allows for a mass balance CoC. True book and claim is only present in the draft RMS and is referred to as the *Attributes of Recycled Content (ARC) Certificate System.*

Most schemes that take a supply chain approach require the same CoC model to be used throughout the supply chain. For example, they state that an entity shall not use the identity preservation or segregation model for any internal processing steps if a mass balance model has been used elsewhere in the preceding steps of the supply chain.

**System Boundary, Balancing/Credit Transfer and Balance Period**

The system boundary for the mass balance is one area where the schemes and standards differ. All of the standards that focus on certifying recycled content from mechanical recycling supply chains use either batch or site boundary models, whereas those that certify content from non-mechanical processes are more likely to define the system boundary at a group level. ICSS Plus, UL and RMS, for example, all allow for group mass balance accounting. UL's standard states:

> *"The system can be defined by a physical boundary or group of physical boundaries which are connected through shipment of materials between the boundaries. Key to the concept of the system is that feedstock entering the system could be present in any of the product streams leaving the system… Some example system boundaries are:*
>
> *• A single facility where all processing is taking place.*
>
> *• A site which has multiple buildings connected by pipelines which interchange feedstock between the buildings.*
>
> *• A group of sites which are geographically distanced and exchange feedstock through either, rail car or truck"*

ISCC Plus allows group level mass balancing, and allows certified material to be transferred within a group of companies where there is not a direct physical link, but where the same equivalent non-certified material is made in another part of the business (sometimes referred to as Qualified Credit Transfers). RSB Advanced Products states the boundary of the assessment to be:

- one site, or
- several sites at the same geographic location which are connected with pipelines or other means of transport, or
- sites at different geographic locations if the operator can ensure and demonstrate for all sites that double-booking does not occur, for example, by limiting the boundary to one legal entity or by having specific contractual relationships in place.

In addition to the system boundary for the mass balance, there is a geographical boundary. Geographical boundaries are particularly important if the standard allows for recycled credits to be transferred within a company. Under the UL standard, credits can be transferred between sites in a group where there is a physical connection that provides some form of physical link and, as such, this connection sets the boundary of the mass balance. Under the ISCC Plus scheme, sites must be located within the same country or within a neighbouring country sharing a land border; this would mean that transfers could take place between the US and Canada but not Canada and Mexico, for example.[65] The draft RMS sets the geographical boundary as North America.

According to feedback obtained from chemical industry stakeholders at the NIST workshop *"Assessment of Mass Balance Accounting Methods for Polymers"* held May 3-5 2021[66]:

- There should be no restriction on physical connection, because if a recycled input is identically the same as virgin input it would not be beneficial from an environmental and cost perspective to transport the output derived from a recycled input from one facility to another where the credit and claim is required.
- While the book and claim model is useful in certain circumstances, there is a need for it to provide greater transparency, traceability, and accountability.

The accounting period over which schemes are required to "balance the books" ranges from three months to 12 months. This means that material deficits may occur as long as a balance is achieved over the fixed accounting term.

Some schemes also allow for credit carryover at the end of accounting periods. ISCC Plus, for example, allows for excess in one period to be carried over to the next. Others allow for only the physical inventory to be carried over.

**Free Allocation**

The free allocation method is specifically relevant to supply chains that include non-mechanical recycling processes where the physical input cannot be traced through the process and could flow into a number of co-products, which may include different polymers as well as fuels and other chemicals. Complete free allocation as detailed in Section 3.2.4 allows for all recycled content claims to be allocated to any one of the outputs that could *in theory* be produced from an input. Table 5 identifies the schemes where free allocation is permitted and notes which ones include restrictions.

## Table 5: Allocation for Co-Products and Fuels Excluded by Standard/Certification Scheme

| Standard/Certification Scheme | Allocation Allowed for Co-Products? | Restrictions? |
|---|---|---|
| **ISCC Plus** | Yes | Chemical link required |
| **UL** | Yes | Fuels excluded |
| **RMS** | Yes | Fuels excluded |
| **RSB** | Yes | Fuels excluded |

As shown earlier in Figure 5, there could be many co-products. While the majority of the schemes clearly exclude fuels, details around the allocation for co-products are not so clear. ISCC Plus, for example, states[67] that:

> *the attribution / determination is limited to: > process outputs that can potentially contain parts (molecules/atoms) of the sustainable input after its processing/chemical reaction.*

This means that free allocation cannot be applied between two processes where the output could not be produced from the input (i.e. there is no chemical link).[68]

In an ethylene cracker, there is the potential for pyrolysis oil (produced through chemically recycling a plastic feedstock) to flow to any one of the co-products and as such could all flow into a polymer for plastic production, equally it could all flow into any one of the co-products including fuel. The chemical industry maintains that complete free allocation should be allowed, at least in the initial stages, on the basis that significant investment is required for example to enable an existing facility to be able to accommodate pyrolysis oil for example.[69] A stricter allocation method, which only allows recycled content credit to be attributed based on the percentage of output that is sold into the plastics supply chain, is at the opposite end of the spectrum.

## Verification

### Audits and Self-Declarations

All but one of the schemes reviewed for this report require annual auditing to maintain the standard or certification. Most of the schemes require audits to be carried out by third parties, with some requiring on-site audits but most involving a review of documentation. Self-declarations are investigated as part of the audit process. UL audits sites and customers in the first year and SCS reserves the right to audit the site. ISCC Plus also trains its third-party conformity assessment bodies to ensure consistency. This is also something that the RMS is considering.

In all the schemes that requiring annual auditing, the purpose of the audit and document review is to ensure that recycled content can be traced either into or out of a recycling facility or along a supply chain. Under a mass balance system, the recycled content characteristics remain assigned to material on a bookkeeping basis.

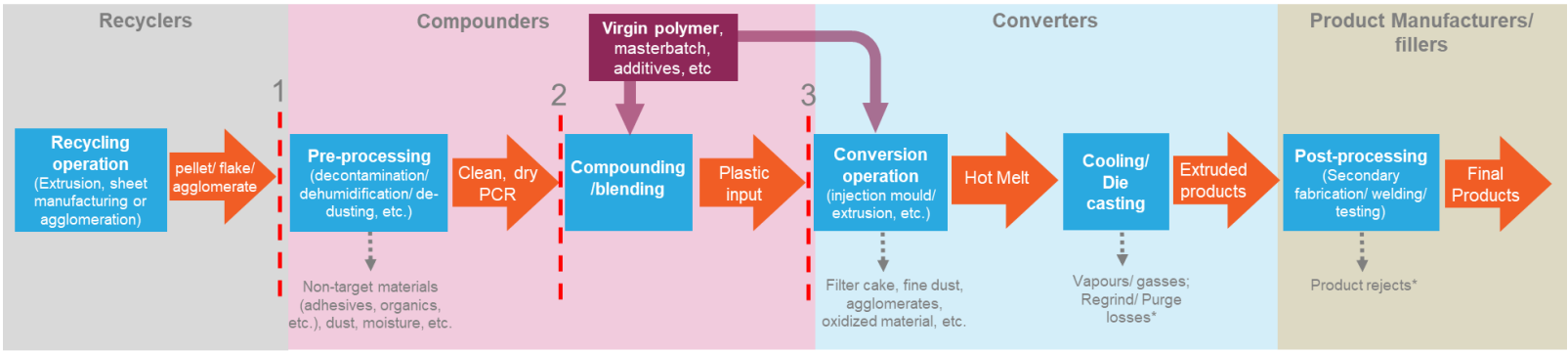
## Mechanism for Determining Recycled Content

To measure recycled content, a number of the schemes use a calculation method that is based on EN 15343. While the basis of a recycled content calculation may appear simple and straightforward at first glance, it is important to consider where the point of measurement is for both the numerator and denominator.

Figure 7 presents the potential options for *measurement points* for the numerator in the recycled content calculation, while Figure 8 presents those for the denominator. It should be noted that the flows and analysis do not represent a particular product or process (i.e. some processes will not require all steps), but cover generic plastic production processes to aid and inform the initial thinking on a general calculation methodology for recycled plastic content. As detailed above the recycled content of a product is calculated using the following formula:

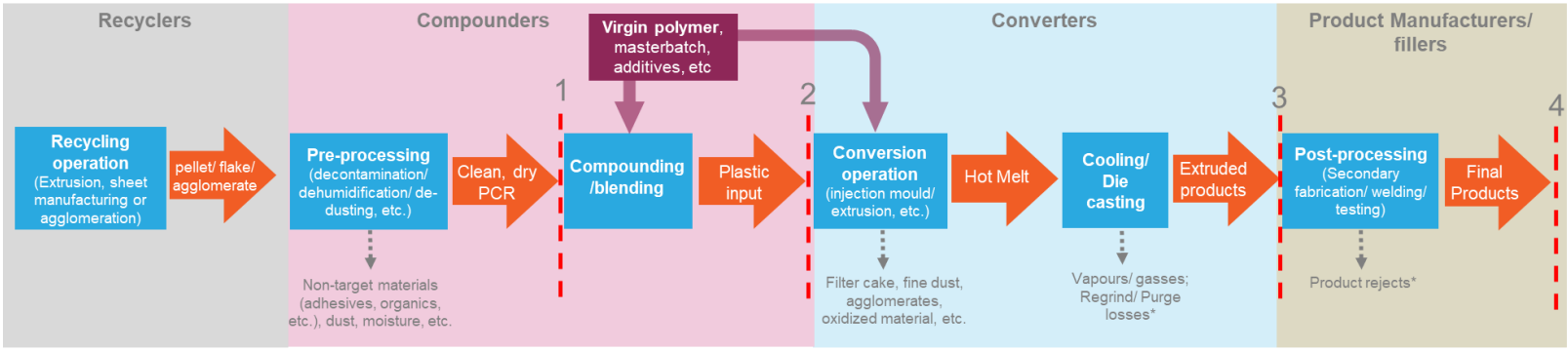
$$\%\ \text{of recycled content} = \frac{\text{mass of recycled material in the product (numerator)}}{\text{total mass of the product (denominator)}}\ x\ 100$$

## Figure 7: Numerator Measurement Points




*Some of this material may be reintroduced into the process

## Figure 8: Denominator Measurement Points




*Some of this material may be reintroduced into the process

Key considerations when deciding on measuring points to use for the numerator and denominator are as follows:

**Numerator**: Losses need to be accounted for, including losses during preliminary washing, drying and decontamination steps (moisture, non-target materials, etc.), losses during the extrusion/moulding process itself (filter cake, purge losses, etc.), as well as losses that occur in the post-processing stages (product rejects, etc.). These are the points at which recycled plastic material:

1) enters a production site;
2) is inputted into a compounding/blending process; and,
3) is inputted into the final conversion process.

Given that it is technically not feasible after this point to identify and measure recycled material inputs, no other measurement points further down the supply chain (e.g. once the material has been incorporated into a finished product) have been suggested for analysis.

In the case of material entering a production site (point 1), this may be the point at which it is easiest to measure inputs of recycled material, as material is usually delivered to a standard weight specification (usually 'dry weight'), with additional information, such as a maximum moisture content, specified. It is also noted that in some cases, the output of recycling operations may also be used as a proxy for measurement at this point, particularly at sites where recycling and conversion processes are integrated.

However, a key challenge arises if the recyclate received at the site is then subjected to further processing (and therefore potential losses) prior to being inputted into the final conversion process (e.g., additional washing, drying, decontamination, crystallization and/or homogenization). This would require further delineation of when the secondary materials are of sufficient quality to undergo conversion comparable to the processing of primary materials (point 2).

Whether point 2 or point 3 is used depends on the point at which virgin polymers and other additives are introduced to the process. After this point, it is not possible to accurately measure the mass of recycled plastic.

Finally, regardless of which measurement point is ultimately used (measurement point 2 or 3, or both), further deductions from the numerator may be necessary to ensure that losses from the conversion process (that are not considered inherent to the process or reused within the process) are accounted for in the final estimates of recycled content.

**Denominator**: Careful consideration is required when potentially defining what constitutes the denominator in the recycled content calculation. For example, the denominator could represent recycled plastic as a proportion of the mass of all material inputs into a given production process, or a proportion of the mass of the final product, or a proportion of the mass of product placed on the market, further details on each of these is provided below. Figure 8 identifies four potential measurement points, many of which overlap with those identified for the estimation of the numerator. These are the points at which:

1) all materials are inputted into a compounding/blending process;
2) all materials are inputted into the final conversion process;
3) outputs of the conversion process are generated; and,
4) products are placed on the market.

The first two measurement points listed above mirror measurement points 2 and 3 discussed for the numerator, in which the inputs to a compounding/blending process may need to be used as a proxy for some or all of the inputs into the final conversion process. In this case, the denominator would constitute the total mass of all inputs into the conversion process (including recycled plastic materials, recycled non-plastic materials, virgin plastic materials, and any additives or other substances). However, estimates derived at this point would need to be adjusted for material losses during the conversion process (that do not make their way into the final outputs).

In reality, measurement point 3 or 4 is likely to be more suitable, since losses in the pre-processing and conversion stages will have already been accounted for. It would also be sensible to choose the measurement point that is the furthest along the chain and only use earlier points if this is problematic. In the case of measurement at point 3, it is noted that the outputs of a conversion process do not always represent a finished product as it is intended to be used. Instead, it may be only one component of a final product (e.g., components housing in a car dashboard), or may need secondary processing in order to be useful (e.g., a bottle preform). In such cases, the calculation of recycled plastic content would relate only to the specific plastic components in question, which may be desirable for some products/sectors.

Alternatively, requiring that the mass of material in the denominator is measured at the point at which products are placed on the market (point 4 in Figure 8) may be more appropriate. However, once again, this must be clearly defined.

### Claims and Labelling

Five of the schemes only allow claims to be made if the product contains a set percentage of recycled content; this ranged from 5% for the RMS to 30% under the PSV certification.

A number of the schemes require the full supply chain to be certified using the same certification (e.g. ISCC Plus, EuCertPlast) while others (e.g. SCS) require affidavit forms from suppliers of recycled material.

The draft RMS has the most expansive list of claims and labelling, including a claim stating that the producer of the product has supported investments in recycling.

There are three types of claims:

- Average Content
  - The classic “percentage-based” claim
  - Manufacturers track and trace production on each batch of materials
  - Allows for separate tracking of post-consumer and post- industrial sources
- Mass Balance
  - Materials are accounted for at the facility level
  - Claims are allocated to designated product groups
  - Inputs balance with outputs to assure no double counting
  - A critical enabler for facilities with complex material handling processes (e.g. chemical recycling)

- Attributes of Recycled Content (ARC) which is the RMS-equivalent tradable credits under a book and claim accounting system.

As per the draft RMS, the label shall contain the following elements:

- Material type of the certified content
- The certified percent content (average content claims only)
- Recycled status
- Certified product component(s):

Under the RSB Standard, all operators in the supply chain must be certified for final products to carry recycled content claims. RSB certification requirements vary depending on the type of operator, of which three are identified:

- Traders: Operators carrying out buying and selling of materials or product, including raw materials, intermediates and final products. Traders do not carry out any processing activities.
- Industrial operators: Feedstock processors, intermediary producers, advanced product producers.
- Mechanical operators: Subgroup of industrial operators only conducting mechanical processes, i.e. mixing, assembling, sorting, molding, cutting[70].

Whilst different operators may have different requirements to meet for certification, they are all required to have a CoC procedure in place and to respect specific standards on balancing material.

Where the mass balance approach is used, schemes do not allow claims to be made on the physical presence in a product, as there may not be any physical presence. ISCC Plus is currently working with large multinationals to determine what logos and claims can go on and off-pack (e.g. websites) to ensure companies do not overclaim or mislead the consumer.[71]

**Figure 9: Examples of RMS Product Claims**


**Figure 10: Example of a RSB Product Claim**


### Industry Uptake and Reference in Regulations and Purchasing Policies

In North America, APR's mechanical recycling certification is being used by 14 recycling companies including Canada-based Merlin Plastics and EFS-Plastics Inc. ISCC Plus, UL 2809 and SCS's Recycled Content standards also appear to have traction with North American operators. Dell's 10% post-consumer closed loop recycled content claim is verified through UL 2809, for example. Eastman and a number of other chemical companies are accredited under ISCC Plus; this is likely to be because of its inclusion of mass balance and the allowance for free allocation of recycled content. Some companies gain accreditation under a number of programs at the request of their clients. Aside from

their ability to audit and verify recycled content claims, companies choose certification schemes for other environmental and social metrics that are important to their clients.

Very few schemes are stipulated in regulation or in organizations' internal policies.

California Senate Bill (SB) 270 stipulates that reusable bags distributed or sold in California must meet certain standards, including recycled content. Any plastic reclaimer's post-consumer recycled (PCR) content that has been certified under the requirements of SB 270 would be considered certified by APR.[72]

EuCertPlast Certification is recognized by a number of European organizations including:

- The Italian National Consortium for the Collection and Recycling of Plastic Packaging (COREPLA) as an official auditing process to guarantee the quality procedures of plastics recyclers.
- Plastics recyclers in Germany (since 2013, the sources and composition of the recycled plastic used in products that have been awarded the German ecolabel "The Blue Angel" must be shown and certified according to EuCertPlast)
- Citeo, the company in charge of Extended Producer Responsibility for household packaging and graphic papers in France, notes on page 56 of its 2019 Declaration Guide Packaging that "a EuCertPlast certificate of compliance from the recycled PE supplier may be required" by suppliers in order to provide proof that they use at least 50% exclusively post-consumer waste for the production of their recycled PE resin.[73]

Flemish Regulation on the sustainable management of material cycles and waste (VLAREMA) (7th package of amendments)[74] states that "when using recycled plastics, the declared proportion of recycled plastics shall be demonstrated by means of a certified management system (e.g. QA-CER or equivalent) issued by an accredited body, which guarantees the origin and recycled plastics content of the bags."

### Costs

While there is a cost for purchasing ISO 22095 and EN 15343, there is no cost for a copy of the other standards and certification schemes reviewed except RAL.

The cost of obtaining certification under a scheme is likely to consist of the following:

- Application fee (paid to the scheme), which ranges from around CAD $300 to CAD $2,000;
- Auditor fees (paid to certification body); and
- License fees (paid to scheme certifying organization) for being certified and using the scheme label.

Audit costs are dependent on a number of factors, including:

- The number, location and size of site(s) to be audited;
- Number of products being audited;
- Whether it is the first time a product or site has been audited and certified.

Initial audits of a site or product will be more expensive than annual reviews. Information received from schemes and companies obtaining certification suggests that costs range between ~$2,500 and $7,000 per facility or product. None of the companies that we interviewed said that cost was a prohibiting factor; however, most of the companies we spoke with were large multi-nationals.

## 4.2 Gaps, Inconsistencies and Considerations

The preceding comparison identifies some key differences and similarities between the most commonly used certification schemes and standards for recycled content in plastics.

Whilst all aspects of the comparison should be considered, the key areas for further consideration as the Canadian government moves forward with considering measures to support the 50% recycled content in plastics goal are as follows:

- **Pre- and post-consumer waste –** All schemes except for APR, EuCertPlast and RAL Quality Mark allow pre-consumer waste to be included in the calculation for recycled content. The actual feasibility of meeting 50% recycled content by 2030 either by product type, resin type or across all products in aggregate needs to be investigated. A baseline assessment of how much pre-and post-consumer recycled content is currently in products manufactured in and imported to Canada should also be carried out. While higher levels of post-consumer content may be possible for some products and resins, for others there are specific market as well as product design challenges which can inhibit greater incorporation of recycled content (see Section 6.0 for more detail).
- **Chain of custody –** All schemes accept mass balance and some also allow stricter forms of CoC. The key differences are in the application of mass balance; schemes that certify material from mechanical recycling processes only use a batch-based system boundary, whereas schemes that also allow for non-mechanical recycling allow multi-site/group level balancing to take place. The geographical boundary also varies across schemes that allow for group mass balance accounting. Accounting periods and the conditions for transfer credits also different across these schemes.
- **Mass balance –** It is likely that for most recycling processes, stricter forms of CoC such as the segregation or identity preservation model are not always possible due to the mixing of recycled with virgin material at some point in the value chain.
    - **Allocation:** free allocation between co-products is generally permitted and is the commonly accepted approach for most certification schemes. However, this should not necessarily be the guiding principle given the priority of the schemes is to encourage and promote uptake rather than determine a boundary for target setting. A stricter approach may be required for target setting, particularly if any co-products are used in fuel applications.
    - **Timeframes:** Typically, the minimum time requirement to balance is 3 months, with the provision to carry credits forward, but not to maintain a long-term deficit.
- **Auditing and verification –** Third-party verification and direct auditing of self-declarations is seen by most schemes as an important aspect to maintain credibility. This is likely to become a more important aspect when such reporting is directly fed into conformance with national targets.
- **Claims and labelling –** Although it is recognized that recycled content claims and labelling made according to a mass balance approach should not indicate that the product itself contains recycled content, the types of claims and the associated labelling under each of the schemes reviewed vary significantly and is clearly one area where greater consistency is required.

- **Recycled content measurement method:** Further guidance is likely required to ensure that there is consistency in the way recycled content is measured (i.e. at what point in the process the numerator and denominator is calculated).

# 5.0 Use and Choice of Recycled Content Standards and Certifications

**This section pulls together information gathered from stakeholder interviews and the literature review, along with Eunomia's broader understanding based on previous work in both North America and Europe, to provide some perspective on current use and choice of standard or certification.**

## 5.1 Factors Impacting Uptake of Recycled Content Verification Standards and Certification Schemes

While the research confirms that recycled content in products and processes is being verified (see Table 5), the use of standards and certifications by stakeholders is mixed. Most of the stakeholders interviewed in Canada were not seeking formal certification; however, some had internal standards that required their supply chain to supply attestations of recycled content use.

### Table 6: Products/Industries Certified as Published by Select Schemes

| | ISCC Plus | UL | SCS | APR | CCS | Cradle to Cradle |
|---|---|---|---|---|---|---|
| **Geographical Area** | Global | Global | Global | North America | Global | Global |
| **Number of Organizations or Products Certified** | 314 organizations[2] | 1000+ | 1000+ products | 14 recycling companies | Unclear | Unclear |

Table 7 summarizes the types of organizations that were interviewed as part of the research and how many of them are certified under a standard or scheme. The table also indicates if the company is focused on pre- and/or post-consumer recycled content.

[2] Includes plastics producers and product manufactures

## Table 7: Use of Standards by Interviewed Companies

| Stakeholder Group | Sectors Covered and Number of Organizations | Certification Used | Pre- and/or Post-Consumer? |
|---|---|---|---|
| **Producers - Durable** | Information and Communications Technology (1) | UL 2809 - Environmental Claim Validation Procedure (ECVP) for Recycled Content | Pre- and post-consumer |
| | Flooring (1) | Leverages UL, FCS, and other third-party certifiers that specifically look at how much PCR is used, based on mass balance. Has Cradle to Cradle certification. | Post- and pre-consumer |
| | Consumer goods (5) | No standard used. Some parts of the supply chain may be certified but certification or proof is not often requested. Monitored through supplier attestation. | Pre- and post consumer |
| **Producer – Non-Durable** | Retailer (1) | No standard requested. Some parts of the supply chain may be certified but certification or proof is not requested. Voluntary guides through a supplier 'playbook'. Monitored through supplier attestation. | Post-consumer |
| | Paint containers (1) | Not confirmed | Predominantly pre-consumer, although some post-consumer |
| | Beauty and personal care (1) | No standard requested. Some parts of the supply chain may be certified but certification or proof is not requested. Monitored through supplier attestation. | Commitment related to post-consumer |
| **Chemical Companies** | Chemical producers (4) | ISCC Plus, UL | Post-consumer and pre-consumer |

| Stakeholder Group | Sectors Covered and Number of Organizations | Certification Used | Pre- and/or Post-Consumer? |
|---|---|---|---|
| **Recyclers and Converters** | Recyclers (4) | None, or APR with some using UL | Pre- and post-consumer |
| | Converters (2) | None, or ISCC Plus | Post-consumer |

Based on the research, the key factors that appear to be influencing the use or uptake of various standards and certification schemes include:

- Legislation: In the US, it is likely that California's recycled content requirements for reusable plastic bags (SB 270)[75] and plastic bottles (Assembly Bill 793)[76] played a role in APR and RMS developing schemes to enable producers to demonstrate compliance. Washington is the latest state to pass a minimum recycled content bill and other states are likely to follow. This is likely to drive more recyclers, resin producers, converters and producers to utilize or become certified. This trend is also being observed in Europe, where discussions on recycled content, including how to verify it and what standards are needed, are being driven by the Single Use Plastics Directive, which requires that all plastic bottles contain 25% recycled content by 2025 (increasing to 30% by 2030).
- Customer requirements: Business-to-business (B2B) companies (those that create products and services geared towards other businesses) are more likely to be certified than business-to-consumer (B2C) companies (those supplying products and services directly to consumers or the end-users). In the interviews, one large multinational company that is producing a durable good in the flooring sector stated that for over ten years its customers have been asking for products with recycled content as part of a suite of other environmental and health and safety criteria. While customer demand was a driver for some interviewees, the lack of demand was also provided as a reason for not being certified.
- Corporate values: A number of interviewees stated that use of recycled content in their products, and therefore the need to verify it, was being driven by publicly stated, corporate environmental, social and governance commitments. The organizations were internally verifying compliance with these commitments via supplier attestations.
- Validity: The ability to verify recycled content through mass balance accounting is necessary to validate the process, particularly when it comes to chemical recycling processes.
- Wider business benefits: In the construction sector, receiving recycled claim verification provides points under LEED®.[3] This means that companies supplying goods into the construction sector

[3] LEED (Leadership in Energy and Environmental Design) is the most widely used green building rating system in the world. Available for virtually all building types, LEED provides a framework for healthy, highly

that incorporate recycled content may be at an advantage over competitors that don't. Equally, this allowance under LEED® has likely created the environment for suppliers to consider recycled content where they might not have previously.

We expected product claims and labelling to be a major driver of standard and certification uptake, but our interviews with stakeholders revealed that this was not the case. Brand holders and manufacturers explained that due to the inconsistent availability of quality feedstocks and price fluctuations, use of recycled content is not consistent and therefore there is a general hesitancy to make a claim. In addition, many of the companies that have made recycled content commitments have done so across a suite of packaging and/or products, which prevents them from making a claim specific to any package or product.

## 5.2 Factors Impacting Choice of Which Recycled Content Verification Standards and Certifications to Use

Summarized below are some of the key factors identified as influencing a company's choice of which standard or certification scheme to use:

- Wider sustainability reporting: For some companies, the choice of which scheme to use was influenced by whether it also provided verification against other social, environmental, and health metrics. The ability to use one standard to verify different metrics was seen as convenient.
- CoC model: For some companies, it is of utmost important to have a scheme that allows for physical traceability through the supply chain (e.g., the identity preserved and segregation CoC models). Other companies require mass balance accounting and in some cases want to ensure the scheme allows for accounting across multiple sites that might be connected (e.g. UL) or at a group level.
- Allocation method: All of the chemical companies that were consulted chose schemes that had the most relaxed approach (i.e. free allocation) to how recycled content input was allocated to products.
- Post-consumer resin: Some stakeholders believe that there is an established market for many pre-consumer plastics and as such the focus should be on post-consumer accreditation.
- Auditing organizations: While SCS and UL have their own recycled content standard, they are also auditors for a number of other environmental and social standards. Some organizations choose these companies because they can audit against a number of different requirements.
- Sector: Some schemes are more sector-specific than others. For example, Cradle to Cradle is predominantly used by the textiles sector, while RMS appears to be focused on the packaging sector. The chemical sector prefers ISCC Plus because it allows for the complete free allocation of recycling input to be claimed (subject to losses and conversion factors) to recycled output regardless of the percentage of output that flows into plastic polymer production.

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efficient, and cost-saving green buildings. LEED certification is a globally recognized symbol of sustainability achievement and leadership.

For some of the stakeholders interviewed, the choice of what standard or certification scheme to use was dictated by their client. One of the main challenges highlighted by these organizations was that different customers from different sectors were asking for verification through different standards or were sending auditors from different schemes. These inconsistencies added administrative processes, time and costs but did not necessarily add value.

## 5.3 Characteristics of Recycled Content Standards and Certification Schemes Considered Most Important

Of the relatively small number of organizations that were interviewed and that were verified under a scheme, the main characteristics deemed to be important within a standard were as follows (in some cases, these are linked to the factors that influence choice of scheme):

- Choice of CoC model: The ability to choose different CoC models, including mass balance.
- Free allocation: For the chemical industry, the ability to allocate recycled content across co-products was considered necessary to support the development of the industry; others did not agree with this, noting that the need to maintain traceability and credibility is critical and is not possible through free allocation. Plastics to fuel is not accepted under RMS and there are discussions in Europe on requiring allocation only based on the proportion of product flows into the plastics supply chain.
- Third-party auditing: There are inconsistencies across schemes in terms of what is audited, when audits are conducted, and whether site audits are carried out. Third-party audits are seen as necessary to provide transparency and credibility.
- Distinction between pre-and post-consumer content: Mechanical recyclers, as well as some producers, want to ensure that there is a focus on post-consumer content as this is where the collection and recycling investment needs are, they would argue that pre-consumer waste in many cases has a market as it is generally cleaner.
- Labelling claims: Stakeholders identified a need for improved clarity and consistency around recycled content claims (i.e. what types of claims can be made to accurately reflect the amount (if any) of recycled content in the product and where the recycled content was sourced (e.g. pre- or post-consumer)).
- Definitions: Consistency in key terms such as pre- and post-consumer material and recycled material were highlighted as being critical.

## 5.4 Characteristics of Recycled Content Standards and Certifications Considered Most Concerning

In some cases, the characteristics considered to be most concerning by some stakeholders were the characteristics that other stakeholders deemed most important, namely:

- Allowance for pre-consumer content;
- Free allocation;
- Mass balance accounting across sites within the same company;
- How a company is defined (as some allow for joint ventures, for example).

As most of the organizations interviewed were large multi-nationals, the benefits they gained in respect to supply chain transparency outweighed the costs associated with having sites and products audited and certified. Only one of the interviewees stated that the cost could not be justified based on the lack of customer demand; this, of course, would change if recycled content was mandated by legislation.

## 5.5 Limitations, Gaps and Needs for the Future

Some of the limitations, gaps and needs for the future are listed below:

- Inconsistency across standards: There are several inconsistencies across standards and certification schemes, including balancing periods and geographical boundaries under mass balance. Ideally, there should be alignment so that different players in a supply chain could choose a specific scheme knowing that it would be compatible with other schemes that might be chosen by other actors in the supply chain.
- Material testing: One stakeholder noted that while third-party audits consisting of desktop documentation reviews and some site auditing are needed, these should work in tandem with material tests.
- Labelling: Of the schemes that provide a label, what is included on the label and how information is presented is not consistent; this is something that needs to be addressed to ensure transparency with consumers.
- Terms: Alignment of definitions for key terms will be required, e.g. recycled material
- Standardized reporting process: There is a lack of consistency between schemes when it comes to processes for calculating, tracking, or verifying recycled content.
- Supply chain verification: There is a need for all actors along the value chain to be certified using a consistent approach.
- Global consistency: Many of the stakeholders that were interviewed are international organizations and as such stated that consistency across countries and jurisdictions would be preferable.
- Internal verification equivalently valid as third-party certification: Some stakeholders were of the view that their internal supplier attestations, combined with self auditing, were as valid as having a third-party certification, but at a lower cost. It was, however, acknowledged that consistent criteria for audits/verification is critical to ensure a level playing field among organizations.

## 5.6 Developments in Recycled Content Verification

Our research and discussion with stakeholders revealed a number of developments in the certification and supply chain verification of recycled content, including:

- Digital markers and block chain: BASF's reciChain project is looking to the future in respect to verifying recycling content in items. A non-commercial bench scale pilot tracked recycled content containing a digital marker that had been injected into a flexible and rigid plastic packaging through the supply chain via its digital twin using blockchain technology. At each stage of the recycling process the item was scanned to identify the amount of recycled content.[77] Porsche is also working on digitalization of recycled material to enable tracing through the supply chain.[78]

# 6.0 Market Realities and Barriers in Recycled Content Uptake

**This section summarizes some of the current barriers to use of recycled content which should be considered when considered the types of measures that may be required to enable a 50% recycling content goal in plastic products to be achieved.**

In order to increase the utilization of recycled content by plastic packaging and product manufacturers, sufficient recycled feedstock must be available. It must also make economic sense for manufacturers to choose recycled content over virgin material, which is not always the case, particularly when commodity prices are volatile and when there is no legislation in place to level the playing field. Our consultation with stakeholders provided some insight into the market realities facing plastic packaging and product manufacturers which impact their ability to use recycled content, as well as the barriers they face, perceived or real.

One key finding is that uptake of recycled content varies dramatically between plastic resin types and between product sector categories. There appears to be significant demand for recycled PET (rPET) due to a combination of legislative requirements specific to beverage containers and its broad and flexible usage in many packaging and product applications. There also seems to be a high demand for recycled film plastics for the production of garbage and grocery bags, which, like rPET, is driven by legislation and its broad usage in many manufacturing applications. Conversely, uptake of recycled content is much lower for several of the other plastic resins, like PP and PE. Anecdotal evidence from stakeholder interviews suggests that there is more uptake of post-industrial plastic waste than post-consumer, because of its higher quality and consistent supply.

Common market barriers to increased uptake of recycled content that were consistently cited by most interviewees included (but were not limited to) the following:

- Regulatory health and safety requirements: This was a common issue identified by manufacturers producing plastics or packaging for the food sector, who are required to meet a number of food grade specifications including minimum amounts of legacy chemicals persisting through the recycling process. For these stakeholders, they need to produce ‘bottle to bottle’ or ‘like for like’ applications, which limits and narrows the types and quality of feedstock they can accept. Legacy chemicals and the need to comply with strict product safety requirements were also key concerns for manufacturers working in the information and communications technology and consumer goods (toy) product sector.
- Meeting design specifications: Many stakeholders throughout the supply chain identified the need to meet manufacturer design specifications around packaging colour or shade as a key barrier to using recycled resins. According to them, darker coloured products and/or packaging allow for greater flexibility in feedstock usage and therefore can maximize recycled content uptake.
- Sourcing issues: Many stakeholders pointed to a lack of supply and quality of post-consumer feedstocks as key barriers to increased uptake of recycled content, as well as concerns surrounding security of supply.
- Low virgin resin prices: To increase the use of recycled content by manufacturers and recyclers, the value of recycled material needs to be decoupled from the supply and demand

dynamics of virgin plastics. Just as price-sensitive consumers will switch to lower-cost alternatives when confronted with higher prices, interviewees noted that they are likely to use virgin raw materials if prices are lower. Put simply, whenever virgin material is the cheaper option, it will be used instead of recyclable materials.

- Consumers' perceived quality of recycled products. One retailer and recycler identified consumer concerns around lower perceived quality of recycled materials as a key issue. Although the quality of products containing recycled content may exceed that of products manufactured with only virgin material, the risk of a lack of quality or uncertain levels of quality is still present and is therefore an influencing factor.
- Visual impact on product and ability to meet design specifications: packaged products had specific colour and shine specifications that recycled content had difficulty meeting. In some cases the possible intermittent use of recycled content was seen identified as impacting the visual consistency of packaging.

Regardless of their place in the plastics value chain, stakeholders expressed that there was significant interest and motivation within their respective organizations to increase uptake of recycled content by:

- Making direct investments in product/packaging design changes: Bottle container manufacturers indicated that they are exploring options to increase use of HDPE resins in closure designs, for example.
- Making direct to scale up mechanical and non-mechanical recycling infrastructure and working with partners along the value chain to enable circularity.
- Sourcing increased quantities of recycled resin to supplement virgin use: Consumer goods companies are adopting a phased-in approach to incorporate increasing amounts of recycled content over time.
- Working with supply chain partners on new application opportunities across resin types: ICT and toy manufacturers are exploring a partnership to share/utilize ABS recycled resins from their product take back programs.
- Testing and trialing of new resin chemistries that can better replicate virgin inputs.

## 6.1 Recycled Content Use by Market Segment and Application Type

### Durable Products

The following categories of stakeholders were interviewed in the durable products sector:

- carpeting;
- consumer electronics and appliances;
- toys;
- agriculture; and
- consumer packaged goods.

Given the immense scope and size of the durable plastics product category, almost every type of plastic resin chemistry and application is utilized. The diversity of design and consumer use of durable plastic products means that some are subject to a variety of regulatory or mandatory product standards that affect design and specifications that *could* limit recycled content. For

example, consumer electronics, automobiles, and some textiles use chemical compounds like flame-retardants and formaldehyde in order to comply with product health and safety requirements. In other durable applications these same chemical compounds are not allowed making the challenge of sourcing recycling content even more complex and challenging. These design requirements are important considerations when integrating recycled content and, therefore, may create barriers to incorporation. Fillers also create barriers to recyclability and some companies are looking to reduce their use. Conversely, legacy chemicals used in some durable products may limit or reduce opportunities to reintegrate plastic parts back into production cycles through recycling. Highly regulated goods are often managed through consumer take-back programs so that the manufacturer can influence and control sourcing of end-of-life materials. The challenge with creating a vertical supply chain through take-back programs is that it is time intensive, costly and return volumes uncertain unless for example measure are put in place to incentivize return. This could be done by a individual organization if the scale is large enough or potentially facilitated by government. Deposits on beverage containers is an example of an incentive-based return program that could work for other products.

Durable product manufacturers interviewed for this study also cited a number of regulatory requirements that complicate increased recycled content use. One example is the toy industry where multiple plastic resin types are used to achieve desired functionality and all chemicals within the resins (recycled or virgin) must comply with rigorous national and international toy safety regulations (ASTM F9-16, EN71, CPSCIA). Additionally, interviews revealed prohibitions by some jurisdictions for any use of recycled content in the manufacturing of toys.

Overall, information obtained from the interviews indicates that the use of recycled content in durable plastics products is limited. The uptake of recycled material in this sector is generally the result of public commitments or targets made by brand holders or retailers to use more recycled content, and is more common when feedstock controls can be put in place. Although there was recycled content use in some consumer goods like construction piping, solar panels, paint containers and trays, storage and recycling bins and house siding, this was not publicly promoted.

According to interviewees, the primary motivations for using recycled content in durable plastic products are price advantages, other business interests, or the recognition that it is environmentally beneficial regardless of external claims.

In cases where recycled content is being integrated into the production of durable goods, the predominant resin types being used are LDPE, PET, and some PP. Interviewees noted there was minimal concern surrounding operational or technical challenges and product performance. Some product manufacturers expressed they were often unable to source a consistent supply of quality recycled content resin even though they were prepared to pay for the material or take it at no cost. As demand grows for recycled content in a wider range of goods especially durable goods demand for mechanically recycled good will increase, driving up costs potentially making investment in no-mechanical recycling more viable however it is important to consider the time necessary to deliver non-mechanical recycling facilities that might be necessary to meet demand against recycled content goals.

### Non-Durable

Several of the stakeholders that were interviewed indicated they were actively engaged in recycled content use, either through blending recycled content pellets with virgin resin materials or carrying out pilot projects within their supply chains to trial use in a variety of application types. This was particularly evident in the beverage industry with rPET. This application seemed most prevalent because of readily available and good quality supply of rPET, and due to its diverse and flexible use in closed- and open-loop packaging manufacturing applications (e.g., new containers, clamshells). Moreover, specifications for many food packaging applications, particularly those for fresh foods, require a minimum clarity to enable consumers to see the product, which can be satisfied by rPET.

Interviewees also noted that using recycled content often comes at a higher cost. Despite this, its use was justified as it helped these companies meet corporate commitments and delivered through supply chain procurement agreements. This was cited by one of the multinational consumer product groups interviewed. As with applications in the durable goods sector, there are a number of regulatory and product health and safety requirements to consider as well. For example, plastic packaging intended for food applications must adhere to food contact packaging requirements that require full transparency and confirmation of resin chemistries.

## 6.2 Activating Increased Recycled Content in a Global Market

Despite the barriers identified, the research shows that recycled content is used successfully and consistently across many sectors, and that motivations for incorporating recycled material in new products and packaging are often similar between organizations and product sector categories. Corporate commitments and targets were a significant motivator for large brand holders, specifically consumer packaged goods firms. Brand holders and retailers that made commitments to increase their use of recycled content are encouraging greater uptake of recycled materials by adding requirements to existing product/package specifications and working with supply chain partners to satisfy requirements. Verification of these new requirements, when applied, is generally done through supply chain (converters, manufacturers, resin producers/recyclers) representative attestations, not through certification schemes.

For large multinational organizations that manufacture plastic packaging and products for a global market, sourcing recycled material that can consistently meet quality specifications is critical. Given that significant amounts of goods are manufactured offshore, locally sourced recycled plastic inputs may need to be shipped significant distances, which complicates tracking and verification and increases costs. However, stakeholder interviews revealed that using recycled content is more common in cases where local recyclers have a role in manufacturing goods. In these rarer cases recycled content use was not publicly declared nor promoted because it was not viewed as being important to customers.

Cost was a key factor affecting recycled content use in any application across all resin types. Recycled content resin producers emphasized the low cost of virgin fossil fuel resins as a significant market impediment. Even when price points could be matched by recyclers, customers would choose virgin materials as they felt virgin supplies minimized risk to quality and availability. Recycled resin producers often set prices at or below virgin prices in order to stay competitive.

## 6.3 Future Considerations for Recycled Content Requirements

The uptake of recycled content in plastic products and packaging varies widely between durable and non-durable goods categories, as well as between resin types. These variations mean that supply chain actors (manufacturers, converters, and recyclers for each of the different product sector categories and packaging types) are at very different stages in terms of their abilities to integrate recycled content in manufacturing. Increasing recycled content use across all plastic packaging and product applications will likely need to be considered as a staged or phased approach to scale up. This will allow time for pilots and trials, and provide support for industry sectors or applications that deal with conflicting or competing regulatory dynamics. The recyclers we interviewed expressed a willingness to invest in infrastructure and technologies to meet increased demands for high quantities and quality of recycled material, however, they require minimum demand thresholds with commitments in order to compete with low virgin resin pricing.

Knowledge-sharing and consumer awareness will be key to increasing recycled content use in Canada. In particular, some of the perceived market barriers identified by manufacturers and other supply chain actors need to be confirmed through pilots and trials in order to dispel or verify risk factors. Consumer education will also be needed to ensure there is confidence in product performance and safety is not compromised. Consumer demand is also important to expand recycled content use across packaging and product categories.

# 7.0 Future Needs Related to the Verification of Recycled Content in Plastic Products

**This section provides some guidance on what is needed to be able to demonstrate compliance effectively and transparently with future recycled content requirements.**

Despite the first standard for recycled plastics being published in 1993, the verification of recycled content and claims about its use in products is still in its infancy. Setting minimum requirements around what counts as recycled content (for example) and addressing some of the existing gaps or ambiguities in definitions and measurement methods will be required to ensure consistent measurement and reporting against nationally set targets.

The importance of establishing harmonized standards and methods for calculating, verifying, and reporting recycled content is recognized by the European Commission (EC), which is currently going through this process for plastics bottles, for which there is a legislated recycled content target under the Single Use Plastics Directive. Eunomia has been commissioned by the EC to develop recommendations for recycled content measurement and verification for plastic bottles and will consider how its findings can be applied to other plastic products including other types of packaging, as well as plastics used in the automotive, electronics and construction sectors. This work, which commenced in September 2020, will not be completed until June 2022.

Based on the research carried out for this project specifically, as well as Eunomia's previous work on standards, we have identified the following future needs related to the verification of recycled content:

- Minimum requirements/set of rules: Due to the differences across existing schemes establishing a set of minimum requirements that must be complied with to verify and report recycled content may be a preferred course of action in Canada. Once the minimum requirements have been set schemes should be require demonstrating that they comply with those requirements before being able to audit and verify recycling content. The points below outline what should be covered in these minimum requirements.
- Definitions: There is a need for clear, unambiguous definitions for key terms such as recycled plastic and pre- and post-consumer plastics.
- Source of recycled content: Clarity is needed with regards to whether pre-consumer plastics can be included in the calculation of recycled content; this should be considered in parallel with the market realities of sourcing recycled content as well as the ability to achieve 50% recycling content for different products and polymers considering the presence of legacy chemicals, fillers and additives necessary for the functioning of the plastic product.
- Recycled content calculation and point of measurement: The method by which recycled content is calculated must be clarified, as well as the point at which material is considered recycled. This requires clarity on the point of measurement in the denominator and numerator.
- Acceptable CoC models: Most of the schemes reviewed as part of this research are aligning to ISO 22095 (Chain of custody — General terminology and models). Consideration is needed as to the appropriateness of the book and claim model, which is currently only used in RMS. Supporters of this CoC model claim that it encourages investment in recycling infrastructure and systems, while those opposed to the use of book and claim state that it prevents producers from making the necessary product design changes that would enable recycled content to be included, and that there is no guarantee that using this model will spur investment where it is needed.
  Whether or not recycled credits can be freely allocated across co-products from a process or transferred from site to site within an organization or within a set geographical region will need to be made clear; this is currently one of the key areas of difference between schemes, and is particularly relevant for chemical recyclers.
- Auditing and compliance: In order to ensure that audits are transparent and robust, third-party independent auditing of supply chain actors is critical. Consistency with respect to frequency and methodology of sampling is also important. Currently, most of the certification schemes do not require all players in the supply chain to be audited; this is likely to be something for future consideration.

Current standards and certifications are based on auditing a paper trail. Technological developments related to block chain as well as testing of materials to identify the presence of recycled content are being investigated and may play a critical role in the verification process in the future.

As all the existing standards and certification schemes reviewed are different, a key consideration for the federal government might be how it develops a set of rules that address the current gaps, inconsistencies, and differences which would allow existing standards and certification schemes to align around a common set of defined elements. This will encourage consistency in verification of goals while also allowing companies to choose their preferred scheme which may fulfill other operational needs. As part of this course of action the federal government will need to determine what elements specific requirements will be needed and what its role might be in approving or

accrediting certifications schemes to ensure the rules met and effectively allowing their standard to be used by companies that in the future will be required to meet recycled content requirements. Many of the existing schemes reviewed operate internationally and are used by multinational companies and as such are likely to want to continue to use existing certification organizations to verify recycled content across their business.

With emerging developments in respect to recycled content across the globe, including in the form of international standards, the federal government might also wish to consider how it engages with these processes, including for example ISO's development of a new standard for mass balance accounting.

# Appendix

# A.1.0 Stakeholder Outreach

Table 8 outlines the organizations that were identified for outreach and the number of those organizations that were interviewed.

### Table 8: List of Organizations Contacted and Interviewed

| Stakeholder Group | Interviewed |
|---|---|
| **Producers – Durable goods** | 5 |
| **Producers – Non-durable goods** | 4 |
| **Conformity assessment bodies** | 2 |
| **Government organizations** | 2 |
| **Chemical companies** | 4 |
| **National organizations and associations** | 2 |
| **Plastic recyclers and converters** | 4 |

# A.2.0 Stakeholder Questions

A summary of the questions that were asked of stakeholders is provided in Table 9.

### Table 9: Stakeholder Questions

| Question Category | Question |
|---|---|
| **General** | Please explain what your organizations interest in the supply of recycled content? |
| | How are you incorporating recycling content into your supply chain now - what products and materials |
| | What certification schemes are you asking your suppliers to use if at all and why? |
| | What recycled material do you or could you sell or use? |
| **Users of Recycled Content** | Has your company made commitments to use recycled content, if so what and in what polymers? |
| | If yes how are you verifying recycled content in your supply chain? What documentation do you ask for and how often and at what points of the supply chain? |
| | What are the challenges with including recycled content in your products e.g. supply, cost, quality (food grade) etc. |
| | What factor influence your choice of standard/certification or would influence if you are not using one your choice if standard? |
| | Do you think there are different needs for different plastic products or resin types? Explain |
| | Are you aware of any third party auditors that can verify your recycled material supply chain? |
| | If you are an international company and have colleagues in Europe are you aware of any standards that are being used their that may be applicable to Canada? |

| | |
|---|---|
| | Please include any further information that you feel is relevant in future recycled content standards discussions? |
| **Suppliers of Recycled Content** | What is your role in verification of your client's RC claims? Are you audited under any recycled content standard? Do you use accredited third party auditors if so who? |
| | Are you aware of standards being used in Canada or under development in Canada? |
| | What information are your clients requesting as part of their verification and/or certification process |
| | What are the common standards or certification requests you are responding to and what would be considered best practice and why? |
| | What is being asked of you in terms of verification of your product(s)? |
| | Please include any further information that you feel is relevant in future recycled content standards discussions? |
| **Auditors of Recycled Content** | What is your role in the verification of recycled content? |
| | What actors in the recycled content supply chain are you auditing? |
| | What do you audit as part of the process? |
| | What type of chain of custody models do you audit? |
| | How often do you audit? How long does your certification last? |
| | Does your audit include site inspections or is it based on a paper trail? |
| | What recycled standards are you auditing under? |
| | What do you review and verify as part of the audit process? |
| | Are you aware of and do the standards you audit comply with ISO 22095 - Chain of Custody? |

| | |
|---|---|
| | Have you been part of the RMS standard development? |
| | Do you audit under APR - what and who are you auditing? |
| | Are there any standards not directly related to the supply of recycled content that you feel has elements that could be included in a recycled content standard? |
| | Any concerns with double counting? Or other issues? Concerns? |
| | Any costs information you are able to share? |

# A.3.0 Standards and Certifications for the Verification of Recycled Content

## A.3.1 Summary Tables

Table 10 provides an overview of each of the programs against a set of criteria providing an ability to compare schemes.

## Table 10: Overview of Researched Standards and Schemes

| | | # | | Scheme Features | ISCC Plus | UL | SCS Recycled Content V7 | APR | RMS | EuCertPlast | Recyclass | CCS and RCS | RSB | RAL Gützeichen | QA-CER | Plastica Secunda Vita | Cradle to Cradle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| General | | 1 | Standard or Certification | Is it a published as standard or certification? | Certification | Standard | Standard | Endorsement of 3rd Party PCR Certification | Standard | Certification | Certification | Standard | Standard | Certification | Certification | Certification | Certification |
| | | 2 | Location | What region /country does it operate? | Global | Global | Global | North America | North America | Europe | Europe | Global | Global | Germany | Belgium | Italy | Global |
| | | 3 | Status | Is the scheme active? | Active | Active | Active | Active | In development | Active | Active | Active | Active | Active | Acitve | Active | Active |
| | | 4 | Age and Version | When was the scheme first developed and what revision is currently in place? | 2006, revised 2019 | 2012 | 1993 | 2020 | N/A | 2012 | 2020 | 2017, next revision scheduled for 2021 | 2018 | 2014, revison 2020 | January, 2013, revision 2017 | 2004 | 2017 |
| | | 5 | Material | What product/ material does it cover? | All types of agricultural and forestry raw materials, waste and residues, non-bio renewables and recycled carbon materials and fuels | Any material | Plasitc | Post consumer resin | Products and packaging | Plastics | Plastics | Any product | Plastics, textiles, pharmaceuticals, packaging, tableware, cosmetics, nutritional supplements, food, feed, pulp, paper and others. | PET Beverage containers | Plastics and textiles | Plastics | Any product |
| | | 6 | Activity | Acitvity | Applies to full supply chain | Applies to raw materials, manufactured products and components of manufactured products | Product manufacturer and its supply chain | Recycling facility | Entities who generate, reprocess, and/or purchase recycled material | Recycling facility | Applies to products or semi-finished products. | Manufacturers, brands and retailers,traders, | Product manufacturer and its supply chain | fillers, bottle and preform manufacturers and recycling companies | Sorters/ Recyclers/ Processors/ Product manfacturers | Applies to recycled plastics from mechanical recycling processes (no chemical). | Applies to most recycled content materials from post-consumer and postindustrial sources. |
| | | 7 | Acredditing Period | How often does accreditaton need to be carried out? | Annually | Annually | Annually | Annually | Annually | Annually | Annually | Annually | Unclear | Self monitoring monthly | Annually | Annually | Unclear |
| | | 8 | Publishing/ Certifying Organization | Who publishes the standard/ certificaiton? | ISCC System GmbH | UL | SCS Environmental Claims Certification Program | Association of Plastic Recyclers | GreenBlue | EUCertPlast | Plastics Recyclers Europe | Textile Exchange | RSB | RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V | BQA | Istituto per la Promozione delle Plastiche da Riciclo (IPPR) | Cradle to Cradle Products Innovation Institute |

| | | # | | Scheme Features | ISCC Plus | UL | SCS Recycled Content V7 | APR | RMS | EuCertPlast | Recyclass | CCS and RCS | RSB | RAL Gützeichen | QA-CER | Plastica Secunda Vita | Cradle to Cradle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calculat-ion | Formula Rules | 9 | EN 15343 | Does the scheme conform with EN 15343? | No | Yes | Yes | No | No | Yes | Yes | No | No | Yes | Yes | No | No |
| | | 10 | ISO 22095 | Does the scheme confirm with ISO 22095? | No | No | N - but currently being updated | No | No | No | Yes | No | No | No | No | No | No |
| | | 11 | ISO 14021:1999 | Does the definiton of post and pre consumer conform with ISO 14021? | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Yes | Unclear | No | Yes | No |
| | | 12 | Recycling process | Does the scheme exclusively certify mechanical recycling? | No | No | Mechanical but V8 soon to be released will include non-mechinical | Yes | No | Yes | Yes | No | No | Yes | No | Yes | Yes |
| | | 13 | Pre-consumer Content | Does the scheme accept pre-consumer waste as part of recycled content? | Yes | Yes | Yes | No | Yes | No | Yes | Yes | Yes | No | Yes | Yes | Yes |
| | | 15 | Calculation exclusions | In the case of plastic, are virgin additives and fillers, moisture content, impurities and contaminants excluded from the recycled content? | Not if less than 3% | Unclear | No clear | Unclear | Unclear | Additives and fillers | Additives and fillers | Unclear | No | Unclear | Unclear | No | Unclear |

| | | # | | Scheme Features | ISCC Plus | UL | SCS Recycled Content V7 | APR | RMS | EuCertPlast | Recyclass | CCS and RCS | RSB | RAL Gützeichen | QA-CER | Plastica Secunda Vita | Cradle to Cradle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Calculat -ion | Chain of Custody | 14 | CoC Model | Which chain of custody models are approved by the scheme (e.g. Identity preservation, segregation, mass balance, book and claim)? | Segregation Mass balance | Segregation Mass balance Form of Book and Claim | Segregated moving to mass balance in V8 | Mass balance | Segregation Mass balance Book and Claim | Mass balance | Mass balance | Segregation and controled blending | Segregation Mass balance Book and Claim | Mass balance | Segregation Mass balance | Mass balance | Unclear |
| | | 15 | System Boundary | boundary also varies between sschems that allow for group mass balance | Group | Site or Group | Site | Site | Group | Batch | Batch | Batch | Site | Batch | Site | Batch | Unclear |
| | | 16 | Geography | Are there geographical limitations for balancing (e.g. credit transfers between countries)? | Cross country prohibited | Group with a physical connection | N/A | N/A | North America | N/A | N/A | Unclear | N/A | N/A | N/A | N/A | Unclear |
| | | 17 | Allocation Method | Which yield accounting unit is allowable (e.g. Mass, volume, energy (LHV) or carbon)? | Mass, Energy, Trace-the-atom, Isotope | Mass Energy | Mass | Mass | Mass Energy | Mass | Mass | Mass | Mass Energy (carbon) | Mass | Mass Volume | Mass Volume | Unclear |
| | | 18 | Co-Products | Is free allocation/attribution allowed for co-products? Are fuels excluded? | Yes Chemical Link | Yes Fuels excluded | N/A | N/A | Yes Fuels excluded | N/A | N/A | N/A | Yes Fuels excluded | N/A | Yes Chemical link | N/A | Unclear |
| | | 19 | Timeframe | What maximum mass balancing timeframe is permitted? | 3 months | 12 months | Unclear | 12 months | 12 months | 3 months | N/A | N/A | 3 months | N/A | Unclear | N/A | Unclear |

| | | # | | Scheme Features | ISCC Plus | UL | SCS Recycled Content V7 | APR | RMS | EuCertPlast | Recyclass | CCS and RCS | RSB | RAL Gützeichen | QA-CER | Plastica Secunda Vita | Cradle to Cradle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Verification | | 20 | Audits | Does the scheme use accredited thrird-party organisation for its audits? | Yes | Unclear | Yes | Yes | Yes | Unclear | Yes | Yes | Unclear | No | Yes | Unclear | No |
| | | 21 | Self-declarations | Does the scheme audit what recyclers declare as recycled content (as opposed to relying on self-declarations)? | | Yes | Yes | Specific to certrifying company | Yes | Yes | Yes | Unclear | Unclear | Yes | Yes | Unclear | Unclear |
| Reporting and Communication | - | 22 | Claims | Are there minimum recycled content requirements to make final product claims? | No | No | No | No | 5% | Unclear | 10% | 5% | 25% | 25% | No | 30% | Unclear |
| | | 23 | Flexibility | Can the recycling content be allocated over time? | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear | Unclear |
| | | 24 | Flexibility | Can the recycling content be allocated across product lines? | Yes, claims can be linked to actual content or based on mass balance | Unclear | Unclear | N/A | Yes, claims can be linked to actual content or based on mass balance | Unclear | No, must be in product | No, must be in product | Unclear | Unclear | Unclear | Unclear | Unclear |
| | | 25 | Food Contact | Does the scheme include any additional requirements for final products that will be in contact with food? | No | No | Unclear | Unclear | No | No | No | Unclear | Unclear | Yes | No | Yes | Unclear |

| | | # | | Scheme Features | ISCC Plus | UL | SCS Recycled Content V7 | APR | RMS | EuCertPlast | Recyclass | CCS and RCS | RSB | RAL Gützeichen | QA-CER | Plastica Secunda Vita | Cradle to Cradle |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| Use | | 26 | Industry Uptake | How many organizations or products/product are certified under the scheme? | 314 industries and growing, post established | Unclear | 1000+ products with certified recycled content | 14 recycling companies - major NA recyclers | N/A | 214 recycling facilities | Unclear | Unclear | 15 certified | Unclear | Unclear | Unclear | Unclear |
| | | 27 | Reference in policies | Is the standard/certification referenced for use in existing policy? | Yes | Unclear | Unclear | Unclear | N/A | Yes | Unclear | Unclear | Unclear | Unclear | Yes | Unclear | Yes |
| Cost | | 28 | Standard | What is the cost of the standard? | Free | Free | Free | Free | Free | Free | Free | Free | Free | 76 euros | Free | Free | Free |
| | | 28 | Standard | What is the cost of certification under the standard? | 100-1000+ euros per certificate | $6,000-7,000+ per product | $4,000-$6,000 per product | $5,500-$9,350 per year | Unclear | Unclear | Unclear | Unclear | $500 app fee + other fees | 6,300 euros | Unclear | Unclear | Unclear |

## A.3.2 EN 15343: 2007 Plastics - Recycled Plastics – Plastics recycling traceability and assessment of conformity and recycled content

### Introduction

This standard specifies the procedures needed for the traceability of recycled plastics. This gives the basis for the calculation procedure for the recycled content of a product.

### Status

The standard is active.

### Date of Publication or Launch

The standard was approved on November 2, 2007 and published on December 1, 2007.

### Publishing/Certifying Organization

This standard was published by CEN, the European Committee for Standardization, an association that brings together the National Standardization Bodies of 34 European countries. Along with CENELEC and ETSI, CEN is one of three European Standardization Organizations that have been officially recognized by the European Union and by the European Free Trade Association (EFTA) as being responsible for developing and defining voluntary standards at the European level. The organization provides a platform for the development of European standards and other technical documents related to various kinds of products, materials, services, and processes.[79]

### Scope

EN 15343 is the standard that specifies the procedures for the traceability and assessment of the conformity of mechanically recycled plastics and provides the basis for recycled content calculation for a product. The procedures are needed to formulate or describe the traceability, while the traceability can be used as a basis for calculating the recycled content. Its goal is to enable producers to use the recycled materials with confidence and provide end users with a basis for their acceptance.[80]

The traceability requirements pertain to:

- Inspection of incoming material (selective collection system, sorting diagrams, batch identification, origin of waste, entry inspection data)
- Inspection data of recycling process(es): process parameters, product inspection results

- Identification of recyclates according to polymer-specific standards (EN 15342 for polystyrene (PS), EN 15344 for polyethylene (PE), EN 15345 for polypropylene (PP), EN 15346 for polyvinyl chloride (PVC), and EN 15348 for polyethylene terephthalate (PET)).

The standard indicates not only how recycled content needs to be calculated, but also clearly indicates that claims regarding the recyclate content of products, must be based on a transparent traceability system (materials flows and production data) and an internal quality assurance system focused on:[81]

- Monitoring the quality of inputs and outputs
- Demonstrating and ensuring the compliance of the produced goods with the applicable product standards or specifications
- The introduction of targeted process controls of the applicable recycling and production processes

### Associated Standards and Guidance

This standard is one part of series of CEN publications on Plastics Recycling which is structured as follows:

- EN 15342, Plastics — Recycled Plastics — Characterization of polystyrene (PS) recyclates
- EN 15343, Plastics — Recycled Plastics — Plastics recycling traceability and assessment of conformity and recycled content
- EN 15344, Plastics — Recycled Plastics — Characterisation of Polyethylene (PE) recyclates
- EN 15345, Plastics — Recycled Plastics — Plastics recyclate characterisation of (PP) recyclates
- EN 15346, Plastics — Recycled plastics — Characterisation of poly (vinyl chloride) (PVC) recyclates
- EN 15347, Plastics — Recycled Plastics — Characterisation of plastics wastes
- EN 15348, Plastics — Recycled plastics — Characterization of poly (ethylene terephthalate) (PET) recyclates
- CEN/TR 15353, Plastics — Recycled plastics — Guidelines for the development of standards for recycled plastics

### Definitions of Recycled Content

The standard defines recycled content as the “percentage by weight of recycled material in a product.” It does not define what constitutes recycled material.

Other relevant terms that are defined in the standard include:

- “Qualified recycling process”: Recycling process producing material which meets the requirements for the intended applications.

### Compliance Mechanisms

Information not available.

### Method of Measuring Recycled Content

The recycled content of the product is calculated using the formula:

$$\%\ \text{of recycled content of the product} = \frac{\text{mass of recycled material in the product}}{\text{total mass of the product}} \times 100$$

- For the purposes of this calculation, a recyclate or material containing recyclate is considered a product.
- Only pre-consumer and post-consumer materials shall count towards recycled content.
- Material that is recovered within the same manufacturing process that generated it shall not count towards recycled content.

### Traceability

To ensure traceability of recycled plastics, the supplier of the recyclate must provide data for each of the following stages:

- Control of input material (e.g., proper design of collection and sorting schemes, batch identification)
- Control of the recyclate production process (e.g., recording the process variables, quality control testing of the products delivered by the process, batch identification of the output)
- Plastics recyclate characterization (information regarding characteristics of the batch of recyclate following the relevant standard, e.g., EN 15342)

All procedures for the identification and the recording of data shall be appropriately documented and recorded.

Since traceability of each individual waste item is not realistic, the traceability should start from the sorting centers for household waste and end of life products. For industrial waste, traceability should start from the plastic producer or converter where the waste originates. The sorting centers and the recyclers should achieve traceability by giving each batch produced an identifier (e.g., serial number date code, batch code, transponder) unique to the source of operation. The appropriate identification should be maintained throughout the recycling process, during all stages of production and delivery. The preferred method of identification and administration depends on the size of the recycling operation and the origin of the material and therefore is not specified in the standard. Once the material is delivered to the converter for production of the end products, the standard states that the converter should handle information through their regular administrative procedures.

The table below summarizes what information collectors and sorters are required to record to ensure traceability.

### Table 11: Traceability Requirements

| | |
|---|---|
| **Origins** | • Material type/form<br>• Product type<br>• Type of waste (e.g., pre-user, post-user, demolition waste)<br>• Where it came from (supplier identification)<br>• Date<br>• History of waste (e.g., known contact with hazardous substances) |
| **Logistics** | • Collection (transporter/type of transport)<br>• Sorting<br>• Batch size, identification and marking<br>• Pre-treatment (e.g. washing, grinding)<br>• Storage (e.g. outside) |
| **Tests carried out before processing** | • EN 15347 – Plastics recyclate characterization of waste plastics<br>• Or as appropriate for the end use application |
| **Process parameters** | • Details of the process used as appropriate |
| **Tests carried out after processing** | • EN 15343<br>• EN 15344<br>• EN 15345<br>• EN 15346<br>• EN 15348 |
| **Intended (suitable) application** | Details of appropriate or inappropriate applications |
| **Other** | Other optional information as agreed between buyer and seller |

### Requirements for Claims and Labelling

Any claim concerning recycled content that implies an environmental benefit must be supported by appropriate evidence (see ISO 17422, EN ISO 14021).

Where a statement of recycled content (or the previous history of the material) is requested, documentary evidence must be provided where there is no analytical method available to supply such information. The standard states that these records should be available to the purchaser upon request.

### Transparency Requirements

Information not available.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard or Attaining Certification

The cost of this standard varies depending on where it is purchased. Below are some examples:

SAI Global: USD $155.63 (https://infostore.saiglobal.com/en-us/standards/bs-en-15343-2007-242857_saig_bsi_bsi_566336/

European Standards s.r.o: €123.20 (https://www.en-standard.eu/bs-en-15343-2007-plastics-recycled-plastics-plastics-recycling-traceability-and-assessment-of-conformity-and-recycled-content-english-pdf/)

British Standards Institution: €123 (https://shop.bsigroup.com/en/ProductDetail/?pid=000000000030097507)

### Uptake by Industry

This standard is the foundation of the EuCertPlast certification scheme, which has been widely adopted across Europe.

### Reference in Government Policies and/or Regulations

An August 2017 report by the Joint Research Centre (JRC)[82] on the revision of the EU's public procurement criteria for furniture states that "the use of batch delivery information following EN 15343" was suggested as a basis for communicating the presence or non-presence of restricted hazardous substances.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

Information not available.

## A.3.3 International Standard ISO 22095 Chain of Custody – General Terminology and Models

### Introduction

The aim of this standard is to provide: (1) unambiguous definitions of the different chain of custody models, and (2) the corresponding requirements, which are independent of sectors, materials, products, and issues addressed. These requirements are applicable to any organization operating at any step in the supply chain.

### Status

The standard is ***active***.

### Date of Publication or Launch

First edition October 2020.

### Publishing/Certifying Organization

ISO (the International Organization for Standardization) is a worldwide federation of national standards bodies (ISO member bodies).

### Scope

The standard defines a framework for chain of custody by providing:

- a consistent generic approach to the design, implementation and management of chains of custody;
- harmonized terminology;
- general requirements for different chain of custody models;
- general guidance on the application of the defined chain of custody models, including initial guidance on the circumstances under which each chain of custody model might be appropriate.

The standard is applicable to all materials and products. It does not apply to services as final outputs.

**This standard can be used by any organization operating at any step in a supply chain, as well as by standard setting organizations as a reference point for specific chain of custody standards.**

This standard can enhance the transparency of specific claims regarding materials or products and thereby support the reliability of these claims. It is not intended to be used on its own to make or verify such claims.

This standard is not, on its own, able to support claims about an organization's materials or products. This is misleading, especially to consumers and other end customers, as the existence of a chain of custody system alone does not specify the characteristics or the conditions under which materials or products are produced.

The standard does not specify or recommend a management system.  Users refer to the standard clearing which models of chain of custody described are used as the basis in their chain of custody systems.

### Associated Standards and Guidance

Information not available.

### Definitions of Recycled Content

ISO 22095 does not offer a specific recycled content definition but does define other relevant terms, listed in Table 12.

### Table 12: Definitions of Relevant Terms

| Term | Definition |
|---|---|
| **Chain of custody design** | |
| **Chain of Custody** | Process by which inputs and outputs and associated information are transferred, monitored, and controlled as they move through each step of the relevant supply chain |
| **Chain of custody system** | Set of measures designed to implement a chain of custody including documentation of these measures |
| **Chain of custody model** | Approach taken to control inputs and outputs and associated information in a particular chain of custody system |
| **Supply chain** | |
| **Supply Chain** | Series of processes or activities involved in the production and distribution of a material or product through which it passes from the source |
| **Input** | Material or product that enters an organization or part of an organization |
| **Output** | Material or product that leaves an organization or part of an organization |
| **Chain of custody model** | |
| **Identity preserved model** | A chain of custody model in which the materials or products originate from a single source and their specified characteristics are maintained throughout the supply chain |
| **Segregated model** | A chain of custody model in which specified characteristics of a material or product are maintained from the initial input to the final output |
| **Control blended model** | A chain of custody model in which materials or products with a set of specific characteristics are mixed according to certain |

| | |
|---|---|
| | criterial with material or products within that set of characteristics resulting in a known proportion of the specific characteristics in a final output |
| **Mass balance model** | A chain of custody model in which materials or products with a set of specified characteristics are mixed according to defined criteria with materials or products without a set of characteristics |
| **Book and claim model** | A chain of custody model in which the administrative record flow is not necessarily connected to the physical flow of material or product throughout the supply chain |

### Compliance Mechanisms and Types of Certification

ISO 22095 is not a compliance scheme and does not provide certification but provides a set of measures or framework to enable transparency in the custody of materials and product as ownership or control is transferred from one party to the next with a relevant supply chain.

### Traceability

The measures within the standard aim to provide transparency and a consistency in terms of accounting chain of custody that can be used across different product and material supply chains.

### Method of Measuring Recycled Content

While the standard is not specific to recycled content, the chain of custody requirements can be applied to the supply chain from the sorter through to the converter and user of the recycled material. The functions within a robust supply chain include:

- Organizing: Overseeing and managing the chain of custody so that there are no gaps in the chain.
- Requirement setting: Setting the parameters for the organized chain of custody.
- Conformity assessment: Evaluating if the requirements have been met. Conformity with the requirements can be assessed by the:
    - First part conformity assessment activity (self-assessment).
    - Second part conformity assessment activity (per assessment).
    - Third party conformity assessment activity (independent body).
- Implementing: Implementation by the supply chain members.

The standard sets out requirements for:

- Evaluating performance and adequacy of its CoC system.

- Document management and the types of documents that should be kept for what periods.
- Including measures for ensuring, assessing, and monitoring materials or products received meet specification.
- Setting accurate and justifiable conversion factors.
- Inventory balancing.
- Managing complaints.
- Internal and external communication.

### Requirements for Claims and Labelling

N/A

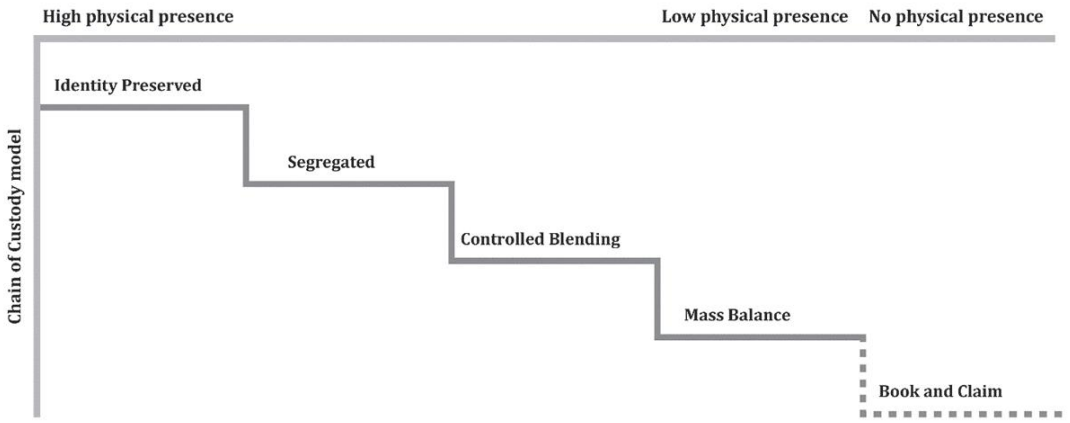
### Transparency Requirements

The principles and requirements for all chain of custody models is that the organization shall:

- Establish and implement one or more Chain of Custody models for all material or products with specified characteristics and shall be transparent about that model.
- Only use the same Chain of Custody model as its supplier or a model with lower physical presence of the specific characteristic in the output.

In the Book and Claim model the administrative flow is not connected to the physical flows throughout the Chain of Custody. Within the same Chain of Custody, it is not possible to switch from the Book and Claim model to other Chain of Custody models.

### Figure 11: Chain of Custody models ranked according to the physical presence of specified characteristics.



### Flexibility Mechanisms

N/A

### Cost of Purchasing the Standard or Attaining Certification

N/A

### Uptake by Industry

N/A

### Reference in Government Policies and/or Regulations

N/A

### Reference in Other Organizations' Purchasing Policies

N/A

### Accredited Bodies

N/A

## A.3.4 International Sustainability and Carbon Certification (ISCC) Plus[83]

### Introduction

ISCC Plus is an international certification program that focuses on the verification of traceability of recycled materials according to mass balance accounting principles.

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

2006, revised December 2019.

### Publishing/Certifying Organization

ISCC System GmbH is one of the world's leading certification systems. The interests of the different stakeholders are represented in the ISCC Association (ISCC e.V.), consisting of more than 130 members.

### Scope

International Sustainability and Carbon Certification Plus (ISCC Plus) is a global voluntary certification system that certifies sustainable, deforestation-free, and traceable supply chains for materials from agriculture, forestry as well as waste and residue raw materials, non-bio renewables and recycled carbon materials and fuels.

The ISCC Plus system is a standard that can be applied to all markets including chemical and energy markets, but also food and animal feed.[84] The certification is site based.

### Associated Standards and Guidance

ISCC operates different certification systems for different markets. In addition to ISCC Plus, there is ISCC EU. ISCC EU is a certification system to demonstrate compliance with the legal sustainability requirements specified in the Renewable Energy Directive (RED) and Fuel Quality Directive (FQD). ISCC PLUS is a certification system for all markets and sectors not regulated by the RED or FQD, such as the food, feed, chemical and energy markets and for technical applications.

ISCC considers and complements best practice initiatives like ISEAL Alliance and international standards like ISAE 30002 and the International Organization for Standardization (ISO). This facilitates and enables a consistent and reliable application of ISCC especially with respect to quality control, risk management, planning and conducting of audits as well as sampling processes, surveillance, and reporting mechanisms.

### Definitions of Recycled Content

It allows and defines post-industrial material as:

> "covers e.g. material derived from waste streams during the system user's manufacturing processes; Material that is reused in the same production process and/or can be assigned to the categories of rework, regrind or scrap generated cannot be claimed as "circular".[85]

**Definition of post-consumer material:** Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product, which can no longer be used for its intended purpose. This includes returns of material from the distribution chain.

### Compliance Mechanisms

For a material to be certified it requires that the whole upstream supply chain starting with point of origin is entirely ISCC certified. Each recipient of sustainable material must verify the validity of the supplier's ISCC certificate. The certificate is valid for one year.

All units that would like to receive an ISCC certificate are subject to an audit conducted by a certified body. The recipient of the material is responsible for verifying the suppliers' ISCC certificate.

### Traceability

Within ISCC PLUS, it must be guaranteed that the whole upstream supply chain up to the point of origin is entirely ISCC certified ("ISCC Compliant"). Any material used in an "ISCC Compliant" supply chain must consist entirely of ISCC material. Material certified under any voluntary scheme other than ISCC cannot be accepted in ISCC PLUS supply chains.[86]

### Method of Measuring Recycled Content

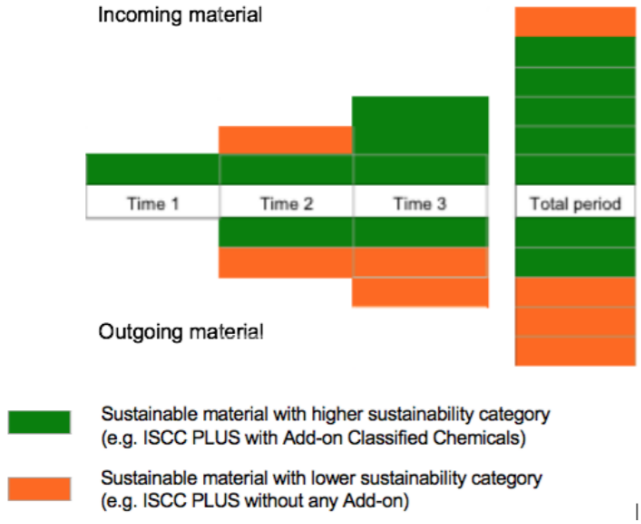
The ISCC Plus system is a Chain of Custody standard. The ISCC certificate uses a mass balance system for the calculation of the recycled material on a bookkeeping basis. The mass balance must be site-and scope-specific.

The mass balance principle used by ISCC PLUS traces the production of each certified product, through each process step based on its input, output, and losses of each certified feedstock separately. Further, the certification is always performed separately for each company site. In this way the mass balance accounting system relates always to specific products produced in specific processes that are used at the specific site.

Under the mass balance system, the sustainability characteristics remain assigned to batches of material on a bookkeeping basis while the physical mixing of material with different sustainability characteristics and the mixing of sustainable and non-sustainable material is allowed. Any kind of mass balance operation and calculation shall only be related to sustainable material. Under ISCC, the maximum timeframe for a mass balance calculation is three months. A mass balance must be site-and scope-specific, i.e. a separate mass balance shall be set up for every production site, even if they are under the same legal entity. The following sustainability characteristics must be distinguished in the bookkeeping:

- Raw material (for example corn or rapeseed/canola) including the type of product (e.g. bio-based)
- Country of origin of the raw material
- Waste/residue status of the raw material
- “ISCC Compliant”, “EU RED Compliant”, “SAI Silver Compliant” and “SAI Gold Compliant” material
- Information on GHG emissions (if add-on “GHG Emissions” is applied)
- Differentiation if a raw material is a post-consumer or post-industrial waste.
- Add-on(s) applied (for every individual add-on or set of add-ons applied a separate bookkeeping must be kept)

## Figure 12: Balancing Sustainable Material




It is possible to downgrade sustainable material with a higher sustainability category (i.e. add-ons were covered by certification), for example to compensate for a negative mass balance of sustainable material with a lower sustainability category (i.e. less or no add-ons applied) (see Figure 12). However, this is only possible if all other sustainability characteristics are identical.

Mass balances shall be kept strictly site-specific. Credits achieved within one site's mass balance cannot be transferred to another site's mass balance. An exception applies for processing units and storage facilities certified under ISCC PLUS. They can transfer credits between different sites under the following conditions:

- Supplier and recipient of credits must be part of the same company/corporate group/joint venture.
- Sites must be located within national borders, or within neighbouring countries (sharing an inland border)
- Applicable only for the same kind of outgoing product
- Mass balances must be kept site-specific.
- ISCC certification must be in place for all sites.
- Certificates must be issued by the same certification body.

Under ISCC PLUS it is also possible to transfer credits between sites that are part of the same or corporate group or joint venture (JV). A corporate group is defined as a number of consolidated legal entities guided by a parent company. Precondition for the latter case is that the company transferring credits to another operational unit (being part of the JV) holds a majority share in the other company. This has to be proven according to the auditor. The other additional requirements for multi-site credit transfer under ISCC as stated above remain unchanged and have to be equally fulfilled.

The mass balancing approach determines the sustainable share and the amount of the sustainable outgoing product being ISCC PLUS certified, based on the amount of ISCC PLUS certified input material. The sustainable share is the amount of sustainable input material multiplied with the respective conversion factor (CF) of the processing unit. The CF is the amount of all outputs divided by the amount of all inputs. The determination of the CF must be conducted based on the operational data of the processing unit. It is not allowed to determine the CF based on theoretical data.

There must be an equivalence between the “ISCC Compliant” input and the respectively claimed output (on a mass balance basis). If this 100% equivalence is not achieved, the percentage must be stated. ISCC PLUS offers different options to conduct the mass balancing for a certified processing unit and to determine the sustainable output of co-processed products.

In general, ISCC PLUS allows the free attribution for the determination of the sustainable share of input material to the output material. Free attribution of certified characteristics to a specific product is allowed, but only if output can be chemically and technically based on respective feedstock in existing equipment at the specific site.

**Multi-Component Products**

Products derived from biochemicals can consist of multiple different bio-based components (so-called multi-component products), all having (one or more) individual sets of sustainability characteristics. These multi-component products may also contain certified sustainable components and non-certified components at the same time. Examples for multi-component products are paint and lacquer. A batch of a material (e.g. bioethanol) that consists of different individual sustainability characteristics is not considered a multi-component product.

Particularly in case of such certified multi-component products, the documentation of the different sustainability characteristics on sustainability declarations and respective mass balancing calculations become increasingly complex. ISCC aims to provide a pragmatic certification approach for such multi-component products certified under ISCC PLUS. Therefore, the sustainability characteristics “type of raw material” and the “country of origin” are voluntary for these chemical multi-component products. This means that the requirements on documentation are reduced and the recipient of a multicomponent product receives a sustainability declaration with a reduced set of information. The sustainability requirements for ISCC certified raw materials (at the beginning of the supply chain) remain unchanged.

This option may only be applied by ISCC PLUS certified economic operators producing or handling multi-component products in the biochemicals sector and operators receiving certified multi-component products from the biochemicals sector. The “type of raw material” and the “country of origin” remain mandatory sustainability characteristics in all other ISCC certified supply chains.

### Requirements for Claims and Labelling

To claim ISCC compliance, it must be guaranteed that the whole upstream supply chain up to the point of origin is entirely covered by ISCC certification. Sustainable material coming from ISCC EU or ISCC DE certified units, which fulfil the above "ISCC Compliant" requirement, shall contain the statement "ISCC Compliant" on its sustainability declaration, to be accepted under ISCC PLUS. The statement "ISCC Compliant" can only be made if the ISCC certified operator has received an equivalent amount of incoming material with the statement "ISCC Compliant" on the sustainability declaration.[87]

### Figure 13: ISCC Claims Label


### Transparency Requirements

Furthermore, ISCC operates the ISCC Integrity Program, which is a tool used to continuously monitor the performance of the ISCC System Users and Certification Bodies (CBs) cooperating with ISCC to ensure and maintain the high-quality standard and credibility of ISCC.

### Flexibility Mechanisms

Unclear, information not available.

### Cost of Purchasing the Standard of Attaining Certification

There is no cost for the standard documents. For entities being certified, there is a one-time registration fee, a fee per certificate (usually annual), and a quantity dependent fee for conversion units, shown at right in Table 13.[88]

### Table 13: ISCC Fees Overview

| Fees for System Users (membership in the ISCC Association is not required to become certified) | | | |
|---|---|---|---|
| Type of fee | Fee classification | | Fee |
| | Group A (turnover in metric tons per year) | Group B (turnover in € per year) | |
| 1. Registration fee (one-time fee) | < 2.000 | < 0,6 Mill. | 50 € |
| | < 10.000 | < 3 Mill. | 100 € |
| | < 50.000 | < 15 Mill. | 150 € |
| 2. Certificate fee (fee per certificate issued; usually invoiced every 12 months) | < 100.000 | < 30 Mill. | 200 € |
| | < 200.000 | < 60 Mill. | 250 € |
| | < 500.000 | < 150 Mill. | 300 € |
| | > 500.000 | > 150 Mill. | 500 € |
| 3. Quantity dependent fee (for conversion units only) | Conversion units with ISCC membership (per metric ton of outgoing product declared as sustainable) | | 0,08 € |
| | Conversion units without ISCC membership (per metric ton of outgoing product declared as sustainable) | | 0,10 € |
| | Miminum quantity fee | | 100 € |

For certification bodies, there is an annual fee and fee per certificate issued. There are also membership fees for companies or individuals who want to join the ISCC Association.

### Uptake by Industry

314 companies and products have ISCC Plus certificates.[89] A complete list of organizations with currently valid certificates can be found on the ISCC website.[90]

### Reference in Government Policies and/or Regulations

ISCC provides a list of governments and organizations that have recognized or comply with ISCC certification.[91]

### Reference in Other Organizations' Purchasing Policies

ISCC provides a list of governments and organizations that have recognized or comply with ISCC certification.[92]

### Accredited Bodies

A complete list of recognized certifying bodies can be found on the ISCC website.[93]

## A.3.5 UL 2809 Environmental Claim Validation Procedure (ECVP) for Recycled Content[94]

### Introduction

UL 2809 Environmental Claim Validation Procedure (ECVP) for Recycled Content sets out the requirements to authenticate the post-consumer, pre-consumer (post-industrial), closed loop or total recycled content. This also includes Ocean Bound Plastic and Ocean Plastic in the source materials. In addition, the program can certify any material or industry and has completed projects in glass, gold, copper, tantalum and cobalt at all stages in the supply chain. Industries served include electronics, jewelry, and batteries. Any material or industry is eligible for certification.

### Status

The standard is ***active***.

### Date of Publication or Launch

First edition November 2012, current version 5 published in 2020.

### Publishing/Certifying Organization

UL, a private company based in the United States that provides a variety of standards, certification, testing and benchmarking solutions on a commercial basis.

### Scope

This procedure provides a framework for the evaluation and validation of Defined Source material content claims in manufactured products when such claims are based on segregated material flows (Section 12 of the standard) or on a credit account or allocation system (Section 14 of the standard). Requirements for Chain of Custody between sites

(Section 13 of the standard) are included and applied when transferring material between multiple facilities.
Segregated material flows or mass balance accounting may be used when evaluating any Defined Source of material. The method(s) used must be included in the claim. Claims typically consist of the manufacturer indicating either an average percentage or minimum percentage of content. This procedure identifies and addresses all substances included as part of the product, part, or material.

### Associated Standards and Guidance

For projects seeking certification to EN 15343 Plastics – Recycled Plastics – Plastics recycling traceability and assessment of conformity and recycled content, record keeping shall include EN 15347 Table 1 for the original batches of waste and further batch identification sufficient to provide traceability through the supply chain.

### Definitions of Recycled Content

UL defines recycled content as "the proportion of pre-consumer or post-consumer recycled material, by mass, in a product or packaging." UL includes pre-consumer material under this scheme:

> "Material that has never reached the end user, having been diverted from the waste stream during a manufacturing process. Excluded is the reutilization of materials generated in a process and capable of being reused as a substitute for a raw material without being modified in any way."

UL's definition of post-consumer material is as follows: "Material that has reached its intended end user, and which is no longer being used for its intended purpose."

Other relevant definitions include:

- By-Product Synergy: is the matching of under-valued waste or by-product streams from one facility with potential users at another facility to create new revenues or savings with potential social and environmental benefits (US BCSD).
- Closed Loop System: A system in which materials are reclaimed, returned to, and reused at the same material technical application equivalence or performance specifications as when the material was first used.
- Defined Content: Content from a defined source which may include but is not limited to recycled, closed loop recycled, by-product synergy, reused, refurbished, ocean plastic or biomass sources of material. (Claims made about material from a Defined Source must retain the identity of the Defined Source in any claims made in the final product about the source of material or can be combined into a single recycled content claim).
- Formal Supplier: A formal entity, directly interlinked and interdependent in serving the manufacturer within scope of the validation. Formal entities include plastic

material suppliers which are covered by the Supplier Code of Conduct of the manufacturer within scope of validation in the supply chain.

- Informal Supplier: An informal entity, indirectly interlinked and interdependent in serving the manufacturer within scope of the validation. Informal entities include:
  1) self-employed plastic waste collectors who remove plastic waste materials from households, businesses, streets, seashores, waste disposal transfer sites, and landfills, and
  2) local collection centers operated by individual or household members that are not formally regulated.
- Refurbished: A component or part which is removed from a discarded product and has undergone substantial repair, rebuilding or remanufacture before use in a new product or a product which has been removed from service and has been refurbished and returned to the field.
- Reused: A component or part which is removed from a discarded product and used in a new product with minimal cleaning or cosmetic improvements or a product which is designed to be used multiple times.

### Compliance Mechanisms

The manufacturing company must undergo an on-site audit undertaken by an approved auditor to obtain the certification. An annual review is needed for a company to maintain the certification.

Chain of Custody Between Sites: Batch ID and records of transfer of the batches between sites linking the materials at each site is required for each pair of processors to document Chain of Custody between the sites.

Allocation System (Mass Balance or Credit Accounting): Material from multiple Defined Sources can be mixed within the same system. The allocation accounting for each Defined Source is maintained separately; however all sources entering the same allocation system must be converted to the same credit unit for entry of credits into the credit system. Similarly, all credits allocated from the system must use the same conversion of units for withdrawal of credits from the system.

Documentation and system requirements:

- Declaration of compliance from manufacturer of additives or materials added to the recycled content. For the recycled content, the operation(s) initially collecting the material must have a system that selects materials likely to be in compliance with Restriction of Hazardous Substances Directive.
- Documentation of a conformance assurance system that demonstrates conformity to the EU RoHS requirements through effective control of the supply chain.

## Traceability

For recycled content originating from household waste, traceability and record keeping shall begin at the sorting and separation center. For material content of industrial origin (pre-consumer), traceability and record keeping shall start at the organization generating the waste to be recycled, reused, refurbished, or used as a by-product synergy. In general the system must provide enough documentation to demonstrate assurance of the goals of the management system (absence of a substance or limit on substance concentration for example).

Each credit system shall use a tracking system for inputs and withdrawals from the system. Each entry in the tracking system must include at a minimum the following: the date of the entry, a record of the shipping documents for material going into the system, documentation of the source of material, documentation of the composition of the shipment (including the percent Defined Source content), the mass (or volume) of material in the shipment, conversion factors used to create credits for the shipment, and the number of credits added to the account. For withdrawals, the tracking system must record the date the credit is used, the identity of the material or substance carrying the recycled content, the conversion factors for converting credits to recycled mass units, the mass (or volume) of shipments of the material, the percent allocated recycled content being carried by the material, and shipping records. A percent allocated recycled content less than 100% is allowed. All shipping records shall be able to connect the credit or debit to an actual shipment of material.

## Method of Measuring Recycled Content

The recycled content is calculated using the following equation:

% Defined Source Content = Mass of Defined Source Material / Mass of Finished Product

During the required annual review, Defined Source content will be recalculated based on production records and when changes, such as production reformulation and updates to reclaimed material suppliers, occur.

The certification process is based on mass balance principle and the certification allows credit transfers.

Material is converted from mass material entering the system (mass $_{\text{incoming}}$) to credits.

Credits = f $_{\text{(mass incoming)}}$

Credits can use one of several units of measure, for instance mass where the conversion is mass-to-mass where grams entering is equal to credits in grams. Material leaving the system is converted from credit units to mass allocated recycled content.

Mass $_{\text{allocated}}$ = f (Credits) × [loss factor]

The efficiency factor is determined by subtracting the losses in the system due to leakage, processing efficiency, conversion efficiencies or any other factors which reduce the total

pool of material available for allocation to consignments. Typically it is calculated by subtracting from 100% the sum of fractions lost to waste, converted to energy or any other losses which do not convert source material into final product leaving the system. All losses in the system must be included. Total efficiency of material conversion within the system shall be measured and the available credits diminished by an amount equivalent to the efficiency losses of the system (efficiency factor).

Credits in the account have a lifetime of 365 days. In the absence of any another documented method, a first-in, first-out method for retiring credits will be used. Negative balances in the credit account are not allowed. If no credits are available, the outgoing material shipment cannot be allocated Defined Source content.

Allocation of credits within the mass balance system boundary may be further directed or split based on process flow yields for different process co-products. Credits may be allocated to co-products based on the percentage yields of the co-product streams. Claims must state when yield splits are used for allocation of credits. Free allocation is allowed for co-products if chemically linked.

In supply chains consisting of several systems, the material carries allocated Defined Source content by mass between systems. The mass is converted to credits at the boundary to the next system the material passes through.

### Requirements for Claims and Labelling

Each facility receiving recycled material must document sufficient information regarding the incoming shipment:

- Supplier name
- Date when the shipment was received
- Quantity of material received
- Unique identifier of the shipment for inventory tracking system

The certification also requires that each recycled material batch has its own ID and that the company keeps records of transfer of the batches between sites.

Acceptable recycled content claim wording is listed below:

- [Product/actual product name/packaging] contains a [minimum/average] of XX% [pre/post-consumer] [Defined Source] content.
- [Product/actual product name/packaging] contains a [minimum/average] of XX% recycled content, consisting of XX% [Defined Source] [raw material/component].
- [Product/actual product name/packaging] contains a [minimum/average] of XX% [Defined Source] [raw material/component].
    - Include footnote in the final report stating total recycled content: [Product/actual name/packaging] contains a [minimum/average] of XX %

recycled content, consisting of XX% [Defined Source] [raw material/component]

- [Product/actual product name/packaging] contains XX% pre-consumer and XX% post-consumer [Defined Source] content.

If using an average content claim wording, the recalculated content must be within 3% of the previous year's average calculated content for the manufacturer to make the same average % claim. If using a minimum content claim, the recalculated value must be equal to or higher than the previous year's minimum calculated content for the manufacturer to make the same minimum % claim. An example of a claim label is shown at right.

**Figure 14: UL Label Example**


### Transparency Requirements

Consumers can find information about UL certified products using the UL SPOT® Product Guide, a free UL SPOT® account that enables consumers to identify validated products by product category, company name, product name or type of claim.[95]

### Flexibility Mechanisms

Unclear, information not available.

### Cost of Purchasing the Standard of Attaining Certification

There is no cost for the standard documents. Certification costs can range from $6,000-$7,000 per product or more depending on the supply chain and type of auditing.[96]

### Uptake by Industry

Uptake for this specific standard in unclear, but as whole, UL reaches 2 billion global consumers annually with safety, security and sustainability messages and UL Marks appear on tens of billions of products globally.[97] Over 1,000 products are currently certified with recycled content.

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

UL.

## A.3.6 SCS Recycled Content Standard V7.0[98]

### Introduction

The purpose of the Standard is to describe the requirements for third-party substantiation of the recycled content claims asserted by companies with regard to specific products. This Standard allows a company to demonstrate that:

- Its product contains materials that are classified using definitions based on ISO 14021:1999(E) Environmental labels and declarations – Self-declared environmental claims (Type II environmental labeling) and United States Code of Federal Regulations Title 40: Protection of the Environment, Part 261- Identification and Listing of Hazardous Waste
- Its marketing claims conform with the Federal Trade Commission (FTC) Guides for the Use of Environmental Marketing Claims
- Its products contain materials that may conform with the Material & Resources criteria for Recycled Content for building products according to the United States Green Building Council (USGBC) Leadership Energy and Environmental Design (LEED) Green Building rating system

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

SCS was launched in 1993.

### Publishing/Certifying Organization

The SCS Environmental Claims Certification Program is the leading scientific program for independently certifying environmental claims for manufactured goods and materials. All claims are certified in accordance with U.S. Federal Trade Commission's Guides for the Use of Environmental Marketing Claims and ISO14021 standards.[99]

### Scope

The Standard applies to any material used in a product for which the manufacturer is making a claim about the recycled content and type of material in the final product. The Standard allows the input materials to be qualified and quantified for the purposes of making a percentage-based recycled content claim. The recycled content claim shall be based on the total recycled content in the final product (also known as "minimum content"), and/or on the total recycled content of a particular component in the final product (also known as "made with"). The claim shall be based on production at a single manufacturing site, or as a weighted average of production at multiple manufacturing sites (also known as a "plant-wide weighted average"). The claim includes, but is not limited to, materials that may be classified as post-consumer or pre-consumer recycled.

## Associated Standards and Guidance

The following normative documents contain provisions that are used in the standard:

- ISO 14021:1999, “Environmental labels and declarations – Self-declared environmental claims (Type II environmental labeling).”
- ISO 14024:1999, “Environmental labels and declarations – Type I environmental labeling – Principles and procedures.”
- ISO 14020:2000, “Environmental labels and declarations – General principles.”

Conformity with SCS Recycled Content's standard is verified by an independent organization (third party) following ISO 17011 Accreditation, ISO 17021 Management system certification, ISO 19011 QMS and EMS auditing (and auditor qualifications), ISO / IEC Guide 65 Product Certification.

## Definitions of Recycled Content

Recycled Content: Proportion, by mass, of recycled material in a product or packaging. Only pre-consumer and post-consumer materials shall be considered as recycled content. (Source: ISO 14021:1999)

Recycled Material. Material that has been reprocessed from recovered [reclaimed] material by means of a manufacturing process and made into a final product or into a component for incorporation into a final product. (Source: ISO 14021:1999)

Note: SCS may interpret a material to be recycled if it is “used, reused, or reclaimed” according to United States Government Code of Federal Regulations Title 40: Protection of Environment Part 261.1: (4) A material is “reclaimed” if it is processed to recover a usable product, or if it is regenerated… (5) A material is “used or reused” if it is either: (i) Employed as an ingredient (including use as an intermediate) in an industrial process to make a product (for example, distillation bottoms from one process used as feedstock in another process). However, a material will not satisfy this condition if distinct components of the material are recovered as separate end products (as when metals are recovered from metal-containing secondary materials); or (ii) Employed in a particular function or application as an effective substitute for a commercial product (for example, spent pickle liquor used as phosphorous precipitant and sludge conditioner in wastewater treatment).[100]

Other relevant definitions include:

- Bill of Materials (BOM): A list of the raw materials, sub-components, components, parts, and quantities of each needed to manufacture an end product.
- Certification Assessment: Independent evaluation of a product claim using specific, predetermined criteria and procedures with assurance of data reliability.
- Certified Product: Finished product and raw materials, subassemblies, components, and accessories for which a manufacturer has demonstrated full conformance to the requirements of the standard, and for which the manufacturer is therefore

authorized to apply the SCS Certification Label, as evidence that the product complies with the program requirements.

- Chain of Custody: The path that a material/product takes from its point of production to the end consumer, consisting of each entity that takes legal and/or physical possession along this pathway.
- Claim: Oral, written, implied, or symbolic representation, statement, or advertising or other form of communication presented to the public or buyers of products that relates to a product's environmental claim such as the percentage of recycled content. An environmental marketing claim must be consistent and compliant with Federal Trade Commission guidelines.
- Component: A material or ingredient used in the manufacture of a product.
- Content: Proportion, by mass, of a type of material in a product or packaging.
- Data Review Period: The 12-month period of time represented by the data submitted for an assessment. This is typically comprised of the four most recent consecutive quarters, and at a minimum the most recent quarter. The data review period shall be the same for all data included in the review. Data provided for this period shall be for materials used for salable production only. Note: In the case that requested data are not available for the most recent twelve consecutive months because of an acceptable circumstance, the data review period shall be set by SCS. Acceptable circumstances are subject to the discretion of SCS. If certification is granted based on a limited data review period, additional data may be requested to verify the claim after initial certification, per the auditor's recommendation.
- Gross Production: The total amount of product coming off the manufacturing line, including any waste from trimming or finishing, defective products, and all non-saleable material. Also referred to as "total production."
- Manufacturer: Organization or individual responsible for the production of the product undergoing certification assessment.
- Manufacturing Site: The physical location where the production of the product undergoing certification assessment occurs.
- Post-Consumer Material: Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain. (Source: ISO 14021:1999) Note: For the purposes of the SCS certification program this is being interpreted to mean that any material returned from the distribution chain must meet the requirement of being from end-users to be considered post-consumer.
- Post-Industrial Material: Another name for pre-consumer material. Use of the term, "post-industrial material" has been phased out.
- Pre-Consumer Material: Material diverted from the waste stream during the manufacturing process. Excluded is the reutilization of materials such as rework,

regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it. (Source: ISO 14021:1999)

- Private Label Customer: The primary entity that purchases a SCS certified product directly from a SCS Certified Client for the purpose of selling said product as a private label product, with only label and/or packaging modifications.
- Product: A product is an item with defined materials, function, and styles. It may be associated with a specific stock-keeping unit (SKU). When considering the material basis, ancillary materials may be considered. Secondary materials may relate to type, style, fabrication method, or specific function.
- Product Category: A product category is a grouping of products that have similar key material basis and serve a similar function. Records. Any information in written, visual, or electronic form that documents the activities undertaken by a user to demonstrate conformance with this Standard.
- Scrap: Rejected or discarded material generated by a manufacturing process. Scrap cannot be claimed as pre-consumer recycled material if it is fed back into and reused in the same process that generated it without any further processing before reuse. Examples of scrap include material from manufacturing equipment (e.g. start up/shut down material), side/end trimmings, material generated from sanding, off-spec/non-conforming product, etc.
- SCS Supplier Affidavit Form: A form that is required from suppliers of recycled material. The form requires disclosure that the supplier has done business with the manufacturer, information about the company (e.g. length of time in business, business license, etc.) and information about the type of recycled material provided (e.g. amount sold, source of recycled material, waste stream source, etc.). The form must be signed by a duly authorized representative.
- Stakeholders: People who are, or who might be, affected by any action taken by users of this Standard. Examples include customers, workers, partners, contractors, suppliers, etc.
- Standard: When capitalized, refers to this Standard (SCS Recycled Content Standard).
- Supplier: Organization that supplies a material, product, or service to the manufacturer. Brokers are not considered suppliers unless they provide a physical chain of custody from actual suppliers.
- Traceability: The ability to trace materials and/or products sequentially throughout a manufacturing process and/or value chain in a way that is verifiable through objective evidence.
- Waste: Anything for which the generator or holder has no further use and which is discarded or is released to the environment (Source: ISO 14021:1999).
- Waste Stream: The aggregate flow of waste material from homes, businesses, institutions, and industry that is recycled, burned or landfilled.
- Waste Stream Source: The specific origin of a waste material.

### Compliance Mechanisms

The manufacturer shall provide a signed SCS Supplier Affidavit Form from all suppliers of recycled material providing ≥2% of total recycled material by weight. A signed SCS Supplier Affidavit Form must be received from suppliers of recycled material accounting for at least 95% of material by weight. Suppliers may be contacted by SCS to confirm validity and, on condition of their consent, may be subject to further review.

At its discretion, SCS may choose to employ alternative or supplemental means of qualifying sources of recycled material, which could include an onsite audit of the supplier or evidence of the implementation of a robust vendor selection process and supplier requirements.[101]

### Traceability

Traceability practices shall be employed by the manufacturer to ensure that products conforming to the standard can have their material basis tracked back to the origin of all input materials.

The manufacturer is required to maintain a documented procedure for segregating and clearly identifying conformant and non-conformant products in stages such as receiving, storage, transfer to shipping, and shipping.

The manufacturer must also provide a diagram and/or a description of the manufacturing process showing how recycled materials are tracked and how a chain of custody is maintained. It shall also describe all inputs of materials, all internal material flows (e.g., reuse or recycling of scrap), and all material outputs (including, but not limited to, finished products, intermediary products, and waste).

### Method of Measuring Recycled Content

To be certified, a mass balance calculation must demonstrate that there are sufficient supplies of recycled material to produce the amount of product reported. The manufacturer shall provide a bill of materials (BOM) or similar documentation that describes the dry weight of each component in a product. This documentation should identify the dry weight of virgin, pre- and post-consumer recycled material in a product. The manufacturer shall have a mechanism for controlling the product formula.

Evaluation of requirements includes a desk audit and, if deemed necessary, an onsite audit. After the completion of the desk or onsite audit the auditor may have formal audit findings regarding the degree of the manufacturer's compliance with the requirements of the Standard. Audit findings may be a non-conformity report, a new information request, or an opportunity for improvement.

### Requirements for Claims and Labelling

Once a product qualifies for certification, based on conformance with the Standard, an SCS Recycled Content certificate of achievement is issued. Certificates are valid for one year, provided that the manufacturer maintains conformance with the requirements.

An annual audit to demonstrate continued conformance with the Standard is required if the manufacturer wishes to continue making a certified claim.

All uses of the SCS Certification Label or references to the certification on the product and in product advertising shall be conducted in conformance with U.S. Federal Trade Commission guidelines or other national guidelines if outside of the U.S.

### Transparency Requirements

SCS aims to lead the fight against greenwashing with marks, ecolabels and environmental product declarations that tell the story accurately. All environmental marketing claims must be consistent and compliant with Federal Trade Commission guidelines.[102]

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

There is no cost for the standard documents, and cost of attaining certification ranges from $4,000-$6,000 USD.

### Uptake by Industry

The SCS website lists over 1,000 products with certified recycled content. Some examples include: Vidrepur, Swojin Enterprise, Owens Corning LLC, SABIC Innovative Plastics, and Biobag Americas.[103]

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

SCS.

## A.3.7 APR Postconsumer Resin (PCR) Certification Program[104]

### Introduction

The Association of Plastic Recyclers (APR) recognizes it is essential that PCR certification be reliable, consistent, and accessible by both producers and users of recycled plastic resins. The APR PCR Certification Program provides converters and brand owners certainty that the material they are buying and incorporating into their packaging is truly PCR. This program aligns with APR's primary goals of increasing supply and demand, while also enhancing the quality and communicating the value of recycled plastics.

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

The Association of Plastic Recyclers (APR) launched their PCR Certification Program in March, 2020.[105]

### Publishing/Certifying Organization

The Program was launched by the Association of Plastic Recyclers is an international trade association representing the plastics recycling industry.

### Scope

APR Postconsumer Resin (PCR) Certification Program has three components:

1. APR endorses third-party companies to conduct certifications.
2. Reclaimers hire these companies to conduct certification.
3. APR promotes a listing of certified PCR available from reclaimers who are APR members.

### The PCR Certification program increases accessibility to and confidence in certification across a diversity of PCR applications. Associated Standards and Guidance

The APR aligns with the postconsumer resin definition in ISO 14021:2016.[106]

### Definitions of Recycled Content

PCR means material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product which has been used for its intended use or can no longer be used for its intended purpose. This includes return of material from the distribution chain. (ISO 14021:2016 Section 7.8.1.1)

Other relevant definitions include:

Post-Industrial Recycled (PIR) Content: Material diverted from the waste stream during a manufacturing process. Included as PIR and excluded as PCR is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed with the same process that generated it.[107]

### Compliance Mechanisms and Types of Certifications

To achieve certification, participants will be required to undergo an audit from an accredited certification body and demonstrate conformance with the standard. All certified claims are recertified annually for the certifying company to evaluate any changes within the product, operations, or recycling processes to ensure continued compliance with the established criteria.[108]

The program allows for chemical recycling and mass balance but only if feedstock is post-consumer material and the claim is not used for an on-pack label. The claim can contribute to a company's overall goals for using recycled content, but not on an individual product basis.

### Traceability

The required documentation allows for a traceable process. The certifying company will use 6 to 12 months of data from the past year that clearly describes and includes:

- Recipe and documentation for recycled content materials detailing the amount and type of raw materials used to manufacture the material (percent by weight basis).
- Total production of specified material, during the period being examined.
- Documentation of recycled content material suppliers including the material provided, the quantity of the material supplied, and the amount of PCR in each material.
- An address, name of responsible person and contact information for each of the recycled content material suppliers to enable an audit and certification of their claims and verify the PCR designation.
- Any information of supplier variability including frequency of change in suppliers, changes in source location of recycled content material, etc.
- Purchasing documentation for the recycled content materials which contain data clearly describing existing plant inventory, production, and shipping information along with invoices to match.[109]

### Method of Measuring Recycled Content

A mass balance analysis is conducted of all material flows within the recycling facility to ensure enough PCR raw materials were purchased and used in production to consistently meet the recycled content claims within the certification period.

There is an evaluation of the source of the recycled raw materials to ultimately determine the total percent (by weight) of the PCR being used to manufacture the product.[110]

The certifying company will:

- Conduct a review of the actual bill of material/recipe for the specified recycled content product
- Verify the pre-and post-consumer designations of the raw materials through supplier interviews and a documentation collection and verification process
- Validate the total amount of PCR content (on a percent by weight basis) within each constituent within the final product/material

### Requirements for Claims and Labelling

APR members that receive certification may present it to be recognized by APR and listed on the APR website. Through this endorsement program, APR ultimately seeks to increase PCR

supply and demand of PCR plastics. APR will actively promote APR member companies with certified resin through webinars, website, articles, and other forms of media to reach an audience.

### Transparency Requirements

Any APR member that wants their PCR pellet/flake/regrind certified must contact one of the APR-endorsed certifying bodies to schedule an audit. APR endorsement of PCR certifying organizations is at-will and is valid for three years, with the stipulation that the accreditation certificate is maintained, at which point the certifying organization may choose to re-apply with APR.

### Flexibility Mechanisms

Although this program may be followed to certify products in the future, APR is taking a phased approached and it is currently focused on certifying the source of pellet/regrind PCR only.

### Cost of Purchasing the Standard of Attaining Certification

There is no cost for the standard documents. To obtain certification, companies must first be APR members. Membership costs are listed below:

- Level 1: over 100 million pounds per year $9,350/yr USD.
- Level 2: 50 to 100 million pounds per year $7,150/yr USD.
- Level 3: under 50 million pounds per year $5,500/yr USD.

Additional costs of certification, such as fees paid to 3rd party certifying organizations are unknown.

### Uptake by Industry

Since being first launched in March 2020, the program has seen much faster acceptance in the marketplace than anticipated according to APR.[111]

The current list of APR members that manufacture certified PCR includes: Avangard Innovative, EFS-plastics Inc., Envision Plastics, Fizlestari Plastic Sdn Bhd, Fresh-Pak Corp., KW Plastics, Merlin Plastics, PetStar, PreZero US Services, LLC, Revolution, rPlanet Earth, and Unifi Manufacturing Inc.[112]

### Reference in Government Policies and/or Regulations

California Senate Bill 270 creates standards that reusable bags distributed or sold in California must meet certain standards, including recycled content. Any plastic reclaimer's PCR which has been certified under the State of California's SB 270 requirements would be considered certified PCR by APR.[113]

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

The current list of APR endorsed certifiers includes:[114]

- AM Testing & Services, Inc.
- Green Circle Certified, LLC
- SCS Global Services
- UL Verification Services Inc.

## A.3.8 Recycled Material Standard (RMS)[115]

### Introduction

GreenBlue's Recycled Material Standard (RMS) is a voluntary, market-based framework that enables consistent labeling of products and packaging that contain or support verified recycled material, either through a certified chain of custody or via the Attributes of Recycled Content (ARC) certificate trading system.[116]

### Status

The RMS is still in the development phase. The RMS website says companies may begin to prepare for participation, however they have not yet announced eligible certification bodies and other implementation pieces are still under development.[117]

### Date of Publication or Launch

Founded in 2019 and released for public comment at the end of 2020.[118]

### Publishing/Certifying Organization

It was founded by GreenBlue, an American non-profit focused on sustainable materials management, and NSF International, an American not-for-profit focused on product testing, inspection, and certification.

### Scope

The RMS will only certify entities in North America. Currently, it has a specific module for plastics but plans to develop guidance for other materials in the future.[119]

Allows for group level mass balancing, which allows certified material to be transferred within a group of companies where there is not a direct physical link, but where the same equivalent non-certified material is made in another part of the business (sometimes referred to as ***Qualified Credit Transfers***).

### Associated Standards and Guidance

The standards were developed in accordance with the following principles:

- International Social and Environmental Accreditation and Labeling (ISEAL) Credibility Principles: The ISEAL Credibility Principles of Sustainability, Improvement, Relevance,

Rigor, Engagement, Impartiality, Transparency, Truthfulness, and Efficiency were used to guide development of the Standard.

- GreenBlue Recycled Material Standard Good Practice Principles: Organizations intending to certify material under RMS must submit a signed commitment to uphold the GreenBlue Recycled Material Standard Good Practice Principles. Organizations suspected or found to be in violation of these Principles may be subject to suspension or revocation of certification.

### Definitions of Recycled Content

The scheme considers both post-consumer and post-industrial material as recycled content.

- Recycled content: The proportion by mass of recycled material in a product or packaging. Fillers, coatings and additives are excluded from the calculation. Recycled content is expressed as a percentage and is calculated based on the primary material category as follows:
  - RC = 100 x RM / (RM + VM)
    Where RM = mass of recycled material; VM = mass of virgin material, RC = recycled content
- Post-consumer material: Material generated by households, or by institutional, commercial or industrial facilities as end-users of products, that can no longer be used for its intended purpose. This includes returns of materials from the distribution chain such as obsolete inventory or damaged goods.
- Post-industrial material: Material diverted from the waste stream during a manufacturing process that cannot be reclaimed within the same process that generated it. May also be referred to as pre-consumer material. Note: A manufacturing process is defined by a combination of equipment, operational settings, material specifications and formulation of materials. The same or similar equipment using different input materials is not considered the same process.[120]

Other relevant definitions include:

- Attribute of Recycled Content (ARC): A tradable environmental commodity (certificate) representing the environmental attributes associated with producing one metric ton of recycled material.
- Base material: Physical recycled material eligible for RMS claims that is used to generate ARC certificates.
- Functional unit: The base amount of recycled material used for the accounting of recycled material throughout the chain of custody and in the ARC system. In the ARC system, the functional unit is specified as 1000 kg of recycled material.
- Lower heating value: Also known as the net calorific value or lower calorific value, the amount of heat released during combustion of a material, less the heat of vaporization of water.

- Material classification: Assignment of the recycled status and material type of eligible material. For example, material may be classified as “post-consumer recycled polypropylene” or “recycled pulp”.
- Material Identification Code: The letter-number combination that represents the material type and recycled status for the purpose of consistent classification for the RMS. Material ID Codes are provided in the Material Modules.
- Materials Recovery Facility (MRF): A facility that sorts reclaimed materials into specific packaging categories.
- Material type: The standard categorization to identify certified materials under RMS. Refers to the material category based on chemical, physical, or functional properties. Material types are further defined within each Material Module.
- Material group: The general family of material (e.g. plastic, glass, paper, or metal) applicable to the material being certified under RMS.
- Reclaimed material: Material that would have otherwise been disposed of as waste or used for energy recovery but has instead been collected and recovered [reclaimed] as a material input, in lieu of new primary material, for a recycling or a manufacturing process. May also be referred to as scrap materials or scrap.
- Recycled material: Material that was diverted from the waste stream and has been collected, sorted and reprocessed and converted into a feedstock to be used in a product. Recycled material includes post-industrial and post-consumer sources.
- Recycled status: The designation used to identify eligible RMS material and differentiate between qualified claims. RMS recycled statuses include: recycled, post-consumer recycled, and post-industrial recycled.
- Required participant: Entity that is required to be audited and certified to RMS in order for material to carry RMS claims.
- RMS Claim: An RMS claim represents the information required on sales documents (such as invoices and delivery documents) that convey the amount of recycled material represented by the claim expresses as a percentage, the recycled status, and the accounting system designation. RMS claims are required to maintain chain of custody.
- RMS Disclaimer: An RMS disclaimer is required on sales documents at ARC generating facilities for materials sold without recycled content status.
- RMS On Product Label: An RMS on product label is a graphic depiction supported by specific language that allows consumers to recognize and identify RMS certified products in the marketplace. The use of labels is optional.
- Scrap: A term used to describe recycled materials prior to re-processing. Within the context of the Recycled Material Standard scrap refers broadly to the recyclable inputs that are converted to recycled material outputs. May also be referred to as reclaimed materials.

- Value chain: The framework for the transfer of material from generation through to end use. The value chain may include entities such as processors, brokers, distributors, and brands.
- Value chain participant: Any entity that participates in the movement or sale of material. Value chain participants may or may not be exempt from certification under RMS.

### Compliance Mechanisms and Types of Certification

To achieve certification, participants will be required to undergo an audit from an accredited certification body and demonstrate conformance with the standard.[121]

### Types of Certification

There are three types of claims:

- Average Content
  - The classic "percentage-based" claim
  - Manufacturers track and trace production on each batch of materials
  - Allows for separate tracking of post-consumer and post-industrial sources
- Mass Balance
  - Materials are accounted for at the facility level
  - Claims are allocated to designated product groups
  - Inputs balance with outputs to assure no double counting
  - A critical enabler for facilities with complex material handling processes (e.g. chemical recycling)
- Attributes of Recycled Content (ARC)
  - ARCs are a new environmental commodity traded on a certificate basis. The sale of certificates is intended to support investment in new recycling technology.
  - Each ARC represents the environmental benefits associated with producing 1 metric ton of recycled plastic
  - In order to generate plastic ARCs generators must prove that ARCs are additional and driving increased investment in plastics recycling (i.e. beyond business as usual).

### Traceability

The chain of custody system specifies material management requirements along the full value chain in order to assure the accuracy and transparency of claims associated with recycled materials. The chain of custody system allows for claims to be made using either an average percentage method or mass balance allocation and includes traceability for both post-consumer and post-industrial sources.[122]

### Method of Measuring Recycled Content

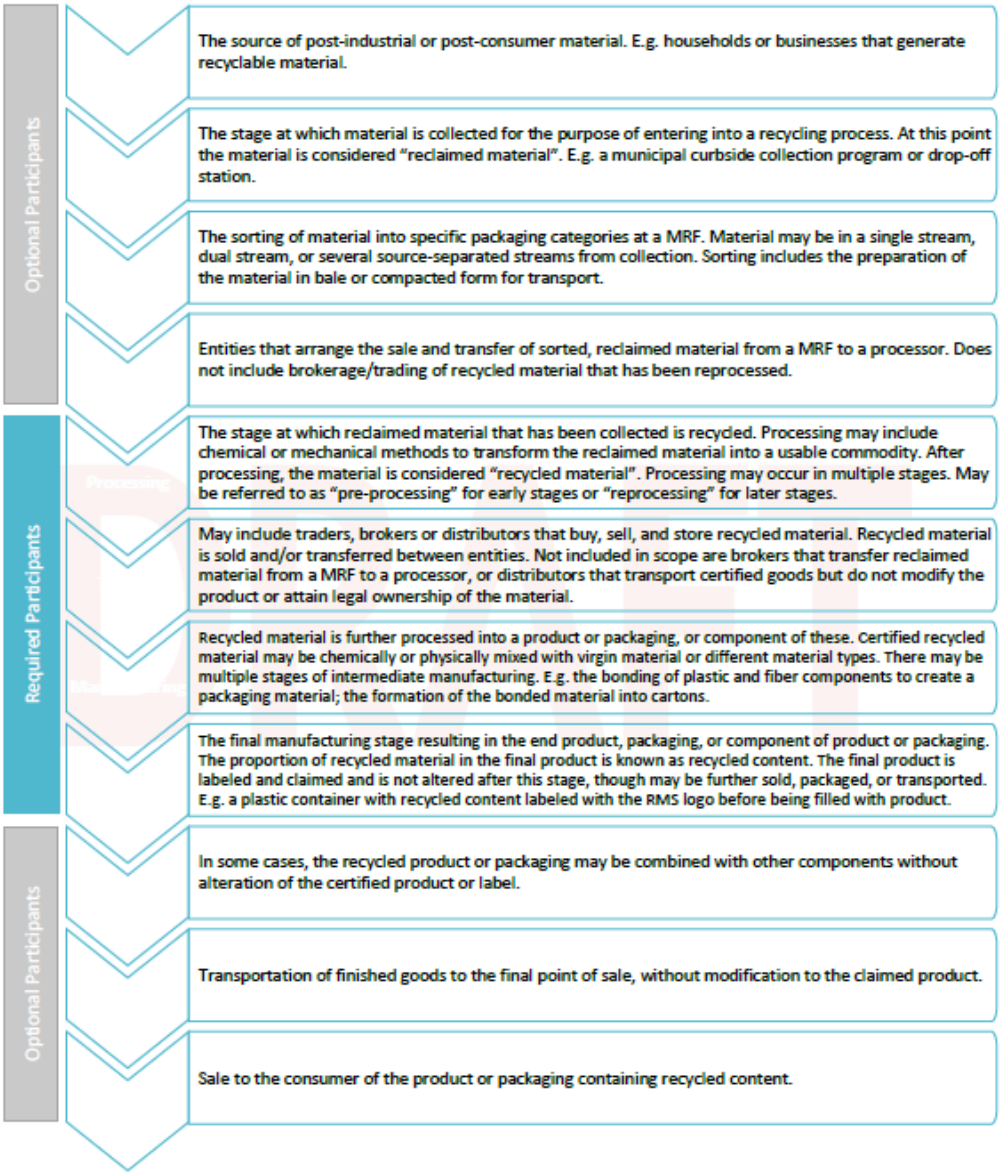
Recycled content is expressed as a percentage and is calculated based on the primary material category as follows:

RC = 100 x RM / (RM + VM)

Where RM = mass of recycled material; VM = mass of virgin material

RMS certified material must maintain a continuous, unbroken chain of custody for all required participants in order to carry an RMS claim. Uncertified inputs may only enter the chain of custody system from value chain participants not that are not required to be certified. Otherwise, uncertified materials entering the system may not carry a claim. Once certified materials leave the chain of custody system, they may not carry a claim. The required and optional participants for chain of custody are shown in Figure 15 below.

## Figure 15: Required and Optional Participants for Chain of Custody




The RMS certification relies on a Chain of Custody, wherein participants must check that certified suppliers have valid certification status. Uncertified suppliers may also be used but must undergo due diligence from the buyer. The RMS grants participants certification of single sites, multi-sites, and groups. To obtain certification, participants must organize an annual audit with a Certification Body and auditor. These audits may be on-site or in the form of a document review.[123]

The RMS allows both a Chain of Custody and a Book and Claim system.[124] Certificates for trading (Book and Claim) are referred to as an 'Attribute of Recycled Content (ARC)'. RMS specifies eligibility requirements for the ARC system, such as:

- "ARC certificates shall be generated only once for the same base material".
- "All organizations participating in the ARC system must submit a valid application to the GreenBlue RMS Program and comply with the GreenBlue Good Practice Principles." [125]

The RMS has introduced an additional requirement that the plastic must undergo a 'phase change' which essentially requires material to be remelted.
The RMS indicated that virgin material processing losses are differentiated from recycled material losses. RMS plans to guide its auditors on the kinds of losses to verify, including different losses for recycled and virgin material.
Certified material is assigned different statuses depending on the nature of the recycled content: Post-Consumer (PC), Post-industrial (PI) and Recycled (R) for a mixture of both. The first is considered as the most impactful, and the last as the least impactful claim. Material claims also differ depending on the adopted Chain of Custody model. If the recycled content of a material has at any point been determined through mass balance allocation, the material may not carry an average content claim (a percentage). Claims that do include a percentage must be rounded to the nearest whole number.

For systems generating co-products, the certified material should be attributed to the outputs (and losses) in the sale mass ration that the co-products are produced. Referred to as proportional allocation. Currently as drafted participants may apply non-proportional allocation for chemical recycling facilities. Free allocation is allowed for co-products except for fuels. However, they are receiving some pushback for this and considering creating a different certification for fuels: 'Recycled Fuel.'[126]

### Requirements for Claims and Labelling

On-product labeling is permitted in accordance with the RMS Labeling Guidelines. Labels must be approved by the appropriate oversight body according to those Guidelines. Labels must be supported by product claims verified through the appropriate chain of custody control system and/or the retirement of ARC certificates. The certified content must represent a minimum percentage of the claimed product component(s), by mass, for the product to be eligible for the RMS label. The minimum percentages by claim type are outlined in the Labeling Guidelines.

The label shall contain the following elements:

- Material type of the certified content
- The certified percent content (average content claims only)

**Figure 16: RMS Label Example**

- Recycled status
- Certified product component(s)
    - The component(s) of the product comprised of or including claimed RMS content must be sufficiently described to clearly indicate the claimed component to the consumer and not misrepresent the product.
    - If the product contains only one component OR the component is clearly identifiable by the material type OR all components contain 100% certified content, this component need not be described separately as long as the label can be clearly understood and is not misleading.
    - If a label is applied to a package that contains a product made of similar materials, the label must clearly indicate whether the claim is associated with the product or the package.

**ARC Claims**

Certificates must be retired in order for ARC purchasers to make any RMS claims. ARC claims must accurately reflect the ARCs being retired. ARCs may be used to make product-level claims (e.g. on-product labeling) or general claims, such as those made on a website or marketing materials or to fulfill corporate commitments.
If ARC certificates are used for product-level claims, the ARC(s) retired must represent the same material type as contained in the product. When the product consists of mixed material types the user may retire multiple ARCs of different types, provided that the allocation can be justified based on the product composition. In order to generate ARCs generators must prove that the ARCs are additional and driving increased investment in plastics recycling (i.e. beyond business as usual)

### Transparency Requirements

The requirements in the RMS are intended to be science-based, provide transparency, and offer credibility for manufacturers in making claims related to the use of recycled content in their product(s) and/or supply chain(s). The RMS certification is based on a continuous and transparent chain of custody of certified material.

The main body of the label provides specific information about the material type and clarifies whether the claim refers to the product or the package. Supporting full transparency, different claims will be used depending on whether the claim is based on average volume (x%), a mass balance allocation, or the purchase of ARCs.

To achieve certification, participants will be required to undergo an audit from an accredited certification body and demonstrate conformance with the standard. The RMS is currently looking to build capacity within the audit community so that multiple certification bodies are able to provide this service.

Companies that meet the RMS requirements will be eligible to use labels to identify products and packages that use recycled materials. RMS labels contain information about

the type of materials used and whether the claim refers to the product or the packaging. Inclusion of the RMS Certified website allows consumers to seek out additional information about the standard and the use of recycled materials. The figure at right shows four examples of RMS labels.

### Flexibility Mechanisms

Recycling content can be based on mass balance across products.

### Cost of Purchasing the Standard of Attaining Certification

The current version of the standard documents is free to download. Costs of certification are unknown.

### Uptake by Industry

N/A – the RMS is still in development and not yet released for use.

### Reference in Government Policies and/or Regulations

N/A – the RMS is still in development and not yet released for use.

### Reference in Other Organizations' Purchasing Policies

N/A – the RMS is still in development and not yet released for use.

### Accredited Bodies

N/A – the RMS is still in development and not yet released for use. A list of approved certification bodies will be provided on the RMS website soon.

## A.3.9 EUCertPlast[127]

### Introduction

EUCertPlast is a voluntary European wide certification for recyclers of pre- and post-consumer plastic waste. The aim of the scheme is to recognize plastic recyclers operating at a high standard. The scheme is based on the European Standard EN 15343:2007 and was designed to encourage environmentally friendly plastics recycling.

Certification is issued for each recycling process at a specific site and is valid for one year. Recycling companies can be awarded one of three different levels of traceability by the auditor in their final report.[128]

The output of the certified facility is classed as a certified recycling input into traceability certification schemes such as Recyclass detailed in Section A.3.7.

### Status

The scheme is active.

### Date of Publication or Launch

This certification system was developed between 2009 and 2011 as part of a three-year project co-financed by the EU and has been in operation since 2012.

### Publishing/Certifying Organization

The organization is based in Belgium and members include the European Association of Plastics Recycling and Recovery Organizations (EPRO), Plastic Recyclers Europe (PRE), European Plastic Converters (EuPC), and Recovinyl, the European Rigid PVC Film Association (ERPA), as well as the Extended Producer Responsibility Alliance (EXPRA) and cyclos GmbH as affiliate members.[129]

### Scope

EUCertPlast is different from other schemes in that it applies to recyclers rather than an entire supply chain or final product.

Certification focuses on material traceability throughout the recycling process, assessment of conformity, management systems, environmental and administrative operating standards and associated legal compliance as well as recycled content calculation in the end product.

Certification shall be issued for each Recycling Process operating at a site.

The standards EN 15343, 13347, 15342, 15344, 15345, 15346, and 15348 are used in the assessment of plastic recyclates which are produced by the certified recycling companies from post-consumer waste. The following elements are assessed during the audit:[130]

- Operational and environmental permits
- Training, qualifications of staff and organization
- Procedure and checks for incoming materials
- Inventory management
- The recycling process and associated mass balance
- Checks of recyclates
- Environmental protection
- Subcontracted work
- Quality management and traceability

### Associated Standards and Guidance

Information not available.

### Definitions of Recycled Content

For the production of recyclates, only post-consumer waste is taken into account by Eucertplast. These recyclates may contain virgin material and pre-consumer waste, but the flows cannot be taken into consideration as recycled content. Eucertplast defines pre- and post-consumer waste as follows:

Pre-consumer waste is permitted and defined as:

> "Covering material diverted from the waste stream during a manufacturing process. This excludes re-utilized material, for example rework, regrind or scrap that has been generated in a given process and is capable of being reclaimed within that same process."[131]

Post-consumer material is defined as:

> "Covering material generated by the end users of products, that has fulfilled its intended purpose or can no longer be used (including material returned within the distribution chain). For specific materials such as PVC, sector definitions apply."

### Compliance Mechanisms and Types of Certification

Recyclers can apply for a EuCertPlast certification via a certification body. In order to obtain certification, recyclers who want to be certified either select an accredited EuCertPlast auditor (list available on the website) or are assigned one by one of the compliance schemes. The recycling plant is then inspected on-site by the chosen auditor. Information is exchanged between the recycler and the auditor prior to and after the audit. This includes information on the recycler's licenses, permits and certificates (e.g. environmental permits, waste transport licenses, etc.); insurances; management team (e.g. information on staff qualifications); incoming material procedures and controls (e.g. purchase specifications, supplier details, hauler details); stock management; recycling process (e.g. site capacity, equipment capacity, mass balance calculation); controls on recycled outputs (e.g. evidence of sales, evidence of by-product treatment or use); environmental protection procedures; and quality management system. In the case of an initial audit, a third-party auditor checks anonymously all the reports from companies audited for the first time to ensure uniformity and reliability. In addition, spot checks are done randomly on monitoring audits.

The audit includes calculating the post-consumer recycled content independently from the pre-consumer waste, and when possible differentiating household from commercial post-consumer waste.[132]

Certification works according to EN 15343:2007 and focuses on material traceability throughout the recycling process, assessment of conformity, management systems, environmental and administrative operating standards and associated legal compliance as well as recycled content calculation in the end product. Certification shall be issued for each recycling process operating at a site.

**Types of Certification**

There are five types of audits, all of which are scheduled and pre-arranged with the recycler:

- Initial certification: Issued for a recycling process which is carried out in one facility and the recycler can present production records from the previous 12 months of recycling operation.

- Monitoring certification: Shall be carried out for a recycling process renewing their EuCertPlast Certification for one facility. They can present production records from the previous 12 months of recycling operation.
- Provisional certification: Certification given to recyclers when a recycling process has been in operation for less than 12 months or there are less than 12 months of production or mass balance records. In order to issue this certification, a minimum 3 months of data is needed.
- Multisite certification: Certification issued to recyclers when a recycling process takes place in two or more separate locations under the same ownership. The recycler must designate one location as main address for administrative purposes of certification. All locations must be visited and listed in the audit report and summary sheet during the audit and traceability among all locations shall be verified.
- Change of recycling process certification: The recycler will need to request a 'change of recycling process' audit when, during the period of certification, significant changes are made for the recycling process. Changes considered as significant are:
    - When equipment capacity is changed by more than 50%
    - When the legal authorization is modified, or after suspension of the legal authorization
    - When input plastic waste is changed (either a change in polymer or form, I.e. rigid or flexible)
    - When recycled output is changed

Certification has a validity of one year and after that shall be renewed. In order to renew the certificate, a monitoring certification audit can be arranged 6 weeks prior to the expiry of the existing certificate. The date of the new certificate will be from the expiry date of the old one or the date of the audit (if this is after the expiry date).

In the case of a failed audit during a spot check quality control of the audit report, the certification will be revoked.

### Traceability

With respect to traceability, the recycler needs to show appropriate documentation where the plastic waste comes from and how the recycling process takes place. The recycler also needs to calculate the share of recycled plastic materials in its final product as well as the share of post-consumer recyclates in the final product.[133]

There are three levels of traceability that can be awarded to a recycler. The auditor must decide which level is applicable and show the result on the Final Report. Traceability Level 1 and 2 are applicable to plants accepting baled and bulky material. Traceability Level 3 is only applicable to plants accepting bulky waste.[134]

**Level 1: Full traceability**

- Control of input material: Input controls as per EN 15347:2007 for each incoming batch of input plastic waste. Each batch or input plastic waste is identifiable in the stock area.
- Control of the recyclates production process: The recycling process is fed with individual batches of input plastic waste or mixtures of batches of input plastic wastes of known composition. Process variables are recorded. Outputs are prepared in batches and details of the date and time of production recorded. Quality controls are carried out on recycled outputs. There is full traceability from the input batches to the output batches.
- Controls on output material: The recycler can provide the characteristics of each batch of recycled output produced (in line with relevant EN recyclates characterisation standard or/and customers' requirements) to the end user.
- Recycled content: It can be calculated using the formula in section 6 of EN 15343:2007 (so there must be a known blend of recycled and virgin / other material).
- Record keeping: Records are kept of all of the above data.

Recyclers producing PET food contact or PET recycled output intended for food contact applications must meet traceability Level 1. If they do not, they should not be awarded certification.

**Level 2: General traceability**

- Control of input material: Input plastic waste is stored by the recycler in two or more storage bays. The batches of input plastic waste which make up the contents of a storage bay are known and fully documented. Each individual batch of incoming waste plastic does not need to be separately identifiable within a storage bay.
- Control of recyclates production process: The recycling process is fed with the contents of a storage bay (one storage bay at a time ensuring that it is completely emptied before introducing input plastic waste into recycling process from a different storage bay). Recycled outputs can be traced to input plastic waste from a specific storage bay and therefore to known batches of input plastic waste. This is fully documented. Recycled outputs are prepared in batches and details of the date and time of production recorded. Quality controls are carried out on recycling outputs.
- Recycled content: This can be calculated using the formula in section 6 of EN 15343:2007 (so there must be a known blend of recycled and virgin / other material).
- Record keeping: Records are kept of all of the above data.

**Level 3: Enlarged general traceability**

- Control of input material: Input plastic waste is stored by the recycler in one or more storage bays. Batches of input plastic waste are documented in a monthly average. Each individual batch of incoming waste plastic does not need to be separately identifiable within a storage bay.

- Control of recyclates production process: Recycled outputs can be traced and documented on a monthly average to input plastic waste. Recycled outputs are prepared in batches and details of the date and time of production recorded. Quality controls are carried out on recycling outputs.
- Recycled content: This can be calculated using the formula in section 6 of EN 15343:2007 (so there must be a known blend of recycled and virgin / other material).
- Record keeping: Records are kept of all of the above data.

In all cases, the auditor is required to justify in the audit report why he granted each traceability level according to the given variables.

### Method of Measuring Recycled Content

EuCertPlast uses a mass balance approach to calculate participants' recycled content.[135] The mass balance calculation is an overview of all the material flows of the recycling process for a period of 12 months (the period of evaluation). When a mass balance is produced only using input plastic waste and recycled output, a period of 3 months is granted to the recycler to alter their systems and add other categories to the calculation that might be missing.

The recycled content of a recycled output is calculated according to the procedure described in Section 6 of EN 15343:2007.

During the audit, the auditor calculates the share of pre-consumer and post-consumer content. The volumes for post-consumer recycled content should be further detailed between household and commercial waste. If products with different shares of post-consumer contents are produced, the exact percentages for the products (product name/product code) together with the related PC-content have to be shown. If only one product is produced, this fact must be described.

Certification is issued for each recycling process at a specific site and is valid for one year. Recycling companies can be awarded one of three different levels of traceability by the auditor in their final report.[136]

Each batch of recycled plastic should be identifiable. The scheme also requires that information is recorded on all input materials as well as all produced materials/products. In this way batches of input plastic waste and recycled output can be traced back to the supplier of the waste. As in the case of Recyclass system, the certified plant must use a stock management system to record all stock movements and weight of stock present at all times.[137]

The recycler who wants to be certified can select its auditor or be assigned one. The audit includes calculating the post-consumer recycled content independently from the pre-consumer waste, and when possible differentiating household from commercial post-consumer waste.[138]

For recyclers producing recycled material that will be in contact with food the scheme has additional requirements:

- authorization from the European Food Safety Authority;
- meet traceability level 1;
- show specific evidence of storage conditions, the stock management system and quality management.[139]

EUCertPlast is different from most other schemes in that it applies to recyclers rather than an entire supply chain or final product. It remains relevant to the study due to its focus on plastic and insight into recyclers specifically.

Of note is that it attributes a specific level of traceability to the recycler, that auditors can be chosen by the recyclers themselves and that the scheme enforces additional rules on food grade materials.

### Requirements for Claims and Labelling

The use of the EuCertPlast logo and certificate is reserved to certified recyclers during the validity of the certificate. Companies that are not certified by the scheme are not allowed to use the EuCertPlast logo and certificate for their products.

The logo and certificate can be used by certified companies in websites, presentations, brochures, and any other communication material, and the logo must be legible when used.

### Transparency Requirements

Clear records must be kept showing when input plastic waste has been sent downstream for recycling. At a minimum, recyclers must record: the date input plastic waste was sent for downstream recycling; the company name and address of the party carrying out downstream recycling; and the grade of input plastic waste and tonnage sent for downstream recycling. All downstream recyclers are required to hold EuCertPlast certification. Copies of the downstream recyclers' certificates is considered evidence that they are certified.

In addition to the above, recyclers must track and record which batches (or parts of batches) of input plastic waste supplied to them are subsequently sent for downstream recycling. The supplier of the material must be informed in writing when this is occurring either on a case-by-case basis or for an agreed tonnage of input plastic waste over a period of time. However, this requirement only applies to deliveries of input plastic waste; the recycler is not required to inform the supplier when other grades of waste plastic supplied to them or by-products of the recycling process are sent to third parties for recycling.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard or Attaining Certification

There is no cost for the standard documents. Information not available for attaining certification.

### Uptake by Industry

According to EuCertPlast's website, there are now 214 recycling facilities certified by the scheme, up 27% compared to 2019. The leader, with a share of 30% of the EuCertPlast certified facilities, is Germany, followed by Italy at 12%. Low-density polyethylene (LDPE) and PET are the most widely certified polymers representing over half of the total capacity; 108 EuCertPlast certified facilities recycle these types of polymers.[140]

Most certified facilities are located in the EU, but there are also some in China and Malaysia.[141]

Among the first post-consumer plastics recyclers in Europe to achieve the standard was MBA Polymers for its plant in Austria. The plant uses waste electrical and electronic equipment (WEEE) as its raw material source to produce high quality post-consumer ABS, HIPS, and PP plastic resins.[142]

Tarkett is another example of a company that has received EuCertPlast certification. In 2020, Tarkett's Motron Extrusionstechnik sports facility in Abtsteinach, Germany was the first to obtain the EuCertPlast certification for recycling post-consumer artificial turf. The certification confirms the plant's use of at least 15% post-consumer artificial turf in the production of its FieldTurf's ProMax HydroFlex infill.[143]

According to one report, "the packaging market (PET bottle, LDPE film) is the main user of this certification scheme because both the production and the demand are European... EuCertPlast certification for plastic recycled content is not a common practice in EEE market because converters are not in Europe and because of the only recent introduction of the level 2 certification."[144]

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

- EUCertPlast Certification is recognized by the Italian National Consortium for the Collection and Recycling of Plastic Packaging (COREPLA) as an official auditing process to guarantee the quality procedures of plastics recyclers.
- The auditing process used in EuCertPlast is in line with those of LAGA (German Federal / State Working Group on Waste) authorities who recognize EuCertPlast as an official certification for plastics recyclers in Germany.

- Since 2013, the sources and composition of the recycled plastic used in products that have been awarded the German ecolabel “The Blue Angel” must be shown and certified according to EuCertPlast.
- Recovinyl, an initiative of the European PVC industry set up in 2003, acts as a mediator between recyclers and converters and registers and certifies quantities of recycled PVC based on the EUCertPlast scheme.[145] Both PVC recyclers and converters can participate in the Recovinyl program. Recovinyl works with 3-year service agreements to be annually reviewed. Recovinyl certifies the following activities:
    - The output of recycled material at the recycling facility
    - The production batches to be identified with a unique ID number
    - The percentage of recycled material, origin (post-industrial or post-consumer) and type of applications
    - Input of recycled material at converters (the incoming streams with specific data and ID numbers)
- Citeo, the company in charge of Extended Producer Responsibility (EPR) for household packaging and graphic papers in France, notes on page 56 of its 2019 Declaration Guide Packaging that “a Eucertplast certificate of compliance from the recycled PE supplier may be required” by suppliers in order to provide proof that they use at least 50% exclusively post-consumer waste for the production of their recycled PE resin.[146]

### Accredited Bodies

EuCertPlast audits can only be performed by an accredited auditor who has the authorization to carry out the inspection of the recycling plant. Each auditor is required to meet relevant educational and professional requirements and must have the technical knowledge necessary to assess the suitability of the plant regarding the specific input material. Specifically, auditors must have above average knowledge on the following technical topics:

- Waste management basics, including knowledge about different possibilities of collecting waste such as recycling and disposal operations, recycling and sorting methods, recycling processes for different materials, waste logistics, and materials science and treatment procedures
- Basic knowledge of polymer chemistry
- Treatment technologies, including processing techniques, standard equipment configurations, problems that occur when processing contaminated material, etc.
- Evaluation whether the plant is a final recipient or merely a conditioner

In addition to the above technical requirements, auditors must meet a number of personal requirements, including for example:

- Completion of studies at a recognized university in the field of engineering, science, law or economies

- Or successfully completed vocational training in the field of waste management or technicians specializing in environmental, waste and mechanical engineering or supply and waste disposal and at least three years (with higher education qualification) or a minimum of 5 years of self-employed activity (with training education) in the waste industry
- Must be 30 years old at the time of the application
- Must have passed the training on the EUCertPlast certification scheme

The list of accredited auditors is available on the EuCertPlast website (https://www.eucertplast.eu/certification). This list is updated on a monthly basis.

## A.3.10 Recyclass Recycled Plastics Traceability Certification[147]

### Introduction

The Recycled Content Certification aims at recognizing use of recycled plastics in compounds, products or semi-finished products and is designed for companies using recycled material who want to guarantee the origins and traceability of their material along the whole value chain. The Certification focuses on the traceability of the material in the different process steps that must be verified throughout the whole chain of custody of the material. It verifies the calculation of recycled content shares (pre- and post-consumer).[148]

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

The audit scheme was published in July 2020.[149]

### Publishing/Certifying Organization

This is a voluntary audit scheme developed by Plastics Recyclers Europe and designed to track the content of recycled plastic in products from all industries. The scheme is based on two main principles in accordance with the definitions of ISO 22095: 1) Traceability and 2) Chain of Custody.[150]

### Scope

Certification aims at recognizing responsible use of recycled plastics in products or semi-finished products. It specifies requirements for companies using recycled material in the production of plastic products who wish to claim their recycled content under a comprehensive Certification Scheme.

Certification focuses on the traceability of Certified Recycled Input within a Site and the calculation of the recycled content shares (pre-/post-consumer) of plastic products or group

of products along the whole value chain. Certified Outputs and Sites may use claims on recycled content according to the document “Use of Claims Guidance”.

Traceability of the material in the different process steps must be verified throughout the whole chain of custody of the material in order to make a claim of recycled content in final products. Therefore, Certification may be granted to different companies who play a part in the value chain and hold custody of the recycled plastics including but not limited to compounders, converters, blow moulders, fillers, etc.

### Associated Standards and Guidance

The Scheme is developed according to ISO 22095 Chain of Custody – General terminology and models and EN 15343:2007 Plastics. Recycled Plastics. Plastics recycling traceability and assessment of Conformity and Recycled Content.

### Definitions of Recycled Content

The recycled content of Recycled Output shall be calculated according to the procedure described in Section 6 of EN 15343:2007.

Other relevant definitions include:[151]

- Certified Recycled Input: Batches of certified material identifiable with a unique transaction code for which Site is applying for Certification. Certification must be granted by EuCertPlast or an equivalent Certification Scheme based on EN 14353 for recycled flakes or pellets or this same Certification for traceability of recycled content by RecyClass.
- Uncontrolled Recycled Input: Batches of recycled material originated in a non-certified Supplier and/or without traceability.
- Known Recycled Content: Percentage by weight of Certified Recycled Input in Output. It must be defined between Pre-consumer Material and Post-consumer Material.
- Output: Material, semi-finished product or product produced by the Production Process for which Certification is being applied for.
- Production Process: Process producing an Output for which Certification is being requested.
- Subcontracted Processing: Certified Recycled Input delivered to Site which is toll produced by a third-party company also certified under Certification where Site retains ownership of Output from the third-party company.
- Post-consumer material: Term describing material, generated by the end-users of products, that has fulfilled its intended purpose or can no longer be used (including material returned from within the distribution chain). Note that the term “post-use” is sometimes used synonymously.
- Pre-consumer material: Term describing material diverted from the waste stream during a manufacturing process. Note that this term excludes re-utilized material,

such as rework, regrind or scrap that has been generated in a given process and is capable of being reclaimed within that same process. The term “post-industrial material” is sometimes used synonymously.

- Off cuts, scrap, regrind material: Term describing material reprocessed within the same Production Process.
- Minor Discrepancy: A relatively small discrepancy found during the audit which the Recycler has 3 months to rectify. The guidance notes explain what is considered to be a minor discrepancy, where applicable. Where a discrepancy is not rectified to the satisfaction of the auditor within 3 months Certification should be withdrawn.

### Compliance Mechanisms and Types of Certification

Recyclass for example, requires supplier information, certification for all recycled input, technical specifications for all recycled input, and weight of all incoming input.

### Types of Certification

- **Initial Certification:** Initial Certification should take place in a site who must present production records from the previous 12 months of production process. This certification is valid for 1 year.
- **Monitoring Certification:** Monitoring certification should take place in a site who must present production records from the previous 12 months of production process. Monitoring certification will be granted to site when certification is available from the previous year. This certification is valid for 1 year.
- **Provisional Certification:** Provisional Certification should be issued when a site has been in operation for less than 12 months or there are less than 12 months of production records. A minimum of 3 months of data are required in order to issue a Provisional Certification. This certificate will be valid until data from 12 months is available up to a period of 9 months.
- **Multisite Certification:** Multisite certification should be issued when a production process takes place in two or more separate locations under the same ownership of site. Site shall designate one location as main address and contact for the purposes of Certification. Both locations must be visited during the audit, listed in the report, and traceability among both locations shall be verified. This certification is valid for 1 year.

### Method of Measuring Recycled Content

Under RecycClass, auditors check product content for additives to deduct from the recycled content total and refuses to certify recycled content from chemical recycling sources (only certifies mechanical recycling). Recyclass entails a mass balance Chain of Custody approach.[152]

**Certified Recycled Input**

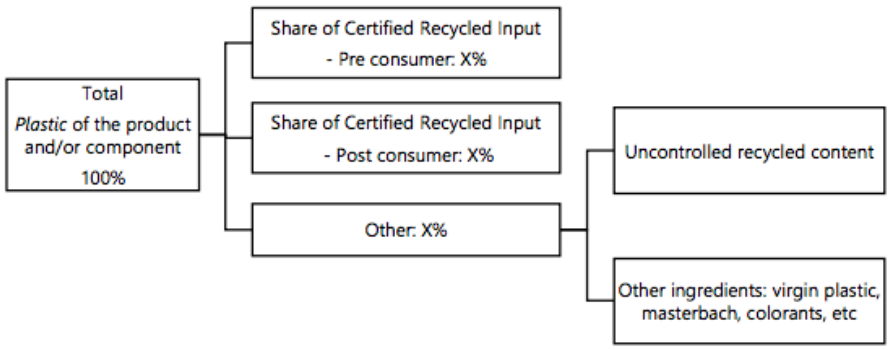
*Batches* of certified material identifiable with a unique transaction code for which *Site* is applying for *Certification. Certification* must be granted by EuCertPlast or an equivalent Certification Scheme based on EN 14353 for recycled flakes or pellets or this same Certification for traceability of recycled content by RecyClass.

Recycled Input:

*Batches* of recycled material originated in a non-certified Supplier and/or without traceability.

**Calculation of known recycled content[153]**

Recycled content shall be expressed in percentage of the total weight of a product or component considering the following categories:




The calculation shall only account for products or group of products using Certified Recycled Input for Certification. Certified Recycled Input may consist of a particular share of pre-/post-consumer which shall be considered into the calculation. The calculation must reflect the reality of the recycled content (pre-consumer and post-consumer) present in different products or components aiming for Certification. The ratio between different Certified Recycled Inputs should be known for Output all the times for a determined volume. The calculation of recycled content may be grouped by different families where the same recipe is used during production. All products must be listed in the Audit Report and Summary Sheet with their respective percentages described. The calculation shall take into account the plastic weight of the product or component produced at the site. Any Uncontrolled Recycled Input or other product ingredients (e.g. virgin plastics, additives, etc.) shall be deducted from the calculation. Non-plastic materials should considered in the calculation (e.g. inks, adhesives, coatings, barriers, etc.).

The auditor shall calculate the recycled content of a product, group of products or component according to ISO 14021:2016 using the described formula:

$x$ (%) = $AP$×100

X is the share of pre-consumer or post-consumer material which should be reported separately;

A is the mass of Certified Recycled Input;

P is the total mass of a product (or group of products).

The certified plant must use a stock management system to record all stock movements and weight of stock present at all times.

Each site must record:

- Supplier information (contact details, code and validity of certification, description of input, purchasing documentation of recycled content input)
- Certification for all certified recycled input (the certificate and summary sheet including the list of certified products)
- Specifications for batches of certified recycled content (polymer type, product code identifiable per each individually purchase certified recycled input, volume, recycled content information according to Certified Recycled Input Certification)
- Weight of incoming batches, product code and date of delivery
- All materials that go into a production process including certified recycled input, additives, master batches, virgin material or non-certified recycled input, scrap/regrind material recirculated in the process, output, rejections.

Certified recycled stock must be identifiable with a product code linked to the supplier and each site must have a stock management system that records the following movements:

- Certified recycled input and output; and
- Regrind/scrap material that is recirculated into the production process.

### Requirements for Claims and Labelling

The use of the logo on-product will be reserved for final products pledged on the market where the different plastic components of the final product will be considered for the final calculation. Certification holders may use the Certificate itself or the recycled content percentage for certified products or components along the value chain in communication such as website, press releases, social media channels and direct communication with stakeholders, costumers and suppliers. Certification holder can also use the claim or logo in their documentation, delivery notes, product boxes or product specification sheets corresponding to certified products. The logo must use the percentage as stated in the Summary Sheet and it should clarify the origin of the material accurately. These claims must be paired with a link to the Recycled Content Traceability Certification (e.g. certificate code) and a reference to RecyClass.[154]
Product labeling claims range from recycled content (post and pre consumer) to post-consumer recycled content. The messaging against these included:

- X% recycled plastics “Pre-consumer origin”

- X% recycled plastics “post-consumer origin
- X% recycled plastics “mixed origin”

Claims and logo for certified products, compounds or components can only be used with a recycled content percentage equal or higher than 10%.

On the other hand, components or semi-finished products can communicate their recycled plastics content via off-product communications.

### Transparency Requirements

Information not available.

### Traceability

Information not available.

### Flexibility Mechanisms

Recycled content calculation must refer to real percentages, not credit between streams.

The calculation of recycled content may be grouped by different families where the same recipe is used during production.

### Cost of Purchasing the Standard of Attaining Certification

There is no cost for the standard documents. Information not available for attaining certification.

### Uptake by Industry

Information not available.

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations’ Purchasing Policies

Information not available.

### Accredited Bodies

There are requirements for certification bodies and auditors[155] and a list of accredited auditors on the certifications website.[156] 23 certification bodies around Europe are recognized to perform the audit, listed below in Table 14.[157]

### Table 14: Recyclass Accredited Bodies

| Certification Body | Country |
|---|---|
| **AIMPLAS** | Spain |
| **AJIU** | Spain |

| | |
|---|---|
| **Almaland sp. Z o.o.** | Poland |
| **B-Pack BVBA** | Belgium |
| **Cirrus Environmental** | UK |
| **Cyclos GmbH** | Germany |
| **DQS doo Belgrade** | Serbia |
| **DQS Hellas Ltd.** | Greece |
| **HTP GmbH & Co. KG** | Germany |
| **Dott. P.I. Marco Tabani** | Italy |
| **ecocycle GmbH** | Germany |
| **Ecogrant MB** | Lithuania |
| **EcosustentávelUnipessoal LDA** | Portugal |
| **KIWA Nederland B.V.** | The Netherlands |
| **KPMG** | Spain |
| **Lms consulting** | Austria |
| **Plastship** | Germany |
| **QHSE cert GmbH** | Germany |
| **SachverständigenbüroMechthild Ahaus** | Germany |
| **SachverständigenbüroFrank Widmayer** | Germany |
| **SGS Hungária Kft.** | Hungary |
| **TERRA SA** | France |
| **ZN ZertifizierungsNetzwerk GmbH** | Germany |

## A.3.11 Recycled Claim Standard (RCS) and Content Claim Standard (CCS)[158]

### Introduction

The RCS was originally developed in partnership with Outdoor Industry Association's Sustainability Working Group's Materials Traceability Task Force in 2013. It is now owned and administered by the Textile Exchange. Textile Exchange also owns and administers the Content Claim Standard (CCS) and the Global Recycled Standard (GRS).

The objectives of the RCS are:

- Alignment of recycled definitions across multiple applications.
- Track and trace recycled input materials.
- Provide consumers (both brands and end consumers) with a tool to make informed decisions.
- Provide assurance that materials are actually recycled and in a final product.

The standard includes for both post-consumer and pre-consumer material.

The standard covers recycling facilities that supply the recycled material as well as organizations involved in the production and trade of the recycled content products.

The Goal of the Content Claim Standard (CCS) is to ensure the accuracy of content claims. The CCS accomplishes this goal by verifying the presence and amount of a given raw material in a final product. It provides a strong chain of custody system from the source to the final product and is certified by an accredited third-party Certification Body. It allows for transparent, consistent, and comprehensive independent evaluation and verification of material content claims on products. The Standard is a business to business tool to substantiate content claims of products. To this end, the CCS also serves as the chain of custody foundation for RCS. The CCS logo cannot be used as a consumer facing logo.

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

Original release date: July 1, 2017. The next scheduled revision of the RCS is in 2021.

### Publishing/Certifying Organization

It is owned and administered by the Textile Exchange. Textile Exchange also owns and administers the Content Claim Standard (CCS) and the Global Recycled Standard (GRS).

### Scope

The RCS is an international, voluntary standard that sets requirements for third-party certification of recycled input and chain of custody. Its objectives are:

- To align recycled definitions across multiple applications
- To track and trace recycled input materials
- To provide consumers (both brands and end consumers) with a tool to make informed decisions
- To provide assurance that materials are actually recycled and in a final product[159]

The RCS is adapted to work with all types of recycled content, and is intended for use with any product that contains at least 5% recycled material. Each stage of production is required to be certified, beginning at the recycling stage and ending at the last seller in the final business-to-business transaction.

The standard provides verification of chain of custody for Recycled Material, in accordance with the Content Claim Standard.
The standard includes consumer-facing labeling; only products that have been certified up to the seller in the last business-to-business transaction are eligible.

The RCS allows for both mechanical and chemical recycling certification.

### Associated Standards and Guidance

The standard was not developed according to ISO 22095 Chain of Custody – General terminology and models and EN 15343:2007. Plastics recycling traceability and assessment of Conformity and Recycled Content.

The following guidance documents were used in the development and/or revision of the standard:

- ISO/IEC Directives, Part 2: Rules for the structure and drafting of International Standards
- ISO/IEC Guide 59: Code of Good Practice for Standardization
- ISEAL Code of Good Practice for Setting Social and Environmental Standards

### Definitions of Recycled Content

The RCS uses the ISO 14021 definition of recycled content:

> "Proportion, by mass, of Recycled Material in products or packaging. Only Pre-Consumer and Post-Consumer Materials shall be considered Recycled Content."

It defines **pre-consumer material** as:

> "Material diverted from the waste stream during a manufacturing process. Excluded is reutilization of materials such as rework, regrind or scrap generated in a process and capable of being reclaimed within the same process that generated it."

It defines **post-consumer material** as:

> "Material generated by households or by commercial, industrial, and institutional facilities in their role as end-users of the product that can no longer be used for its intended purposes. This includes returns of the materials from the distribution chain."

Other relevant definitions include:

- Recycled Material: Material that has been reprocessed from Reclaimed Material by means of a manufacturing process and made into a final product or into a component for incorporation into a product.
- Reclaimed Material: Material that would have otherwise been disposed of as waste or used for energy recovery, but has instead been collected and reclaimed as a material input, in lieu of new primary material, for a recycling process."

### Compliance Mechanisms

Entities involved in material recycling of inputs to be used in RCS certified products must submit declarations for the materials they are supplying. They are also required to inspect all incoming shipments of reclaimed material to confirm that they are not virgin material and request transaction certificates for all outgoing RCS certified goods. Entities involved in material recycling are also required to hold valid Reclaimed Material Supplier Arrangements for all suppliers of Reclaimed Material and collect and retain completed Reclaimed Material Declaration Forms from their suppliers for all Reclaimed Material Inputs. These forms shall be collected at least annually or if the reclaimed material source changes.

"Certification bodies shall evaluate all materials listed on Reclaimed Material Declaration Forms or otherwise claimed as Recycled Material input to ensure that they meet the definition of Recycled Material."

### Traceability

Amongst other requirements, all organizations involved in the production or trade of RCS products shall meet the following requirements relating to traceability:

- All Recycled Materials entering the supply chain shall have a valid Transaction Certificate (TC) issued by an approved certification body.
- Pre-Consumer and Post-Consumer Recycled Material Content percentage shall be recorded separately for each batch at every certified site and recorded on the transaction certificate.[160]

### Method of Measuring Recycled Content

The Recycled Claim Standard appears to involve a mass balance Chain of Custody approach. The Recycled Claim Standard[161] indicated that virgin material processing losses are differentiated from recycled material losses.

### Requirements for Claims and Labelling

Claim requirements are extensive but differ between material recyclers and those involved in the production and trade of RCS products. Material recyclers who collect their own re-claimed material, as defined by ISO 14021:1999[162], will also need to keep records "to verify their volume of recycling." This requires the following records:[163]

- Records of all materials entering the recycling process;

- Description of reclaimed material and the stage where the waste was collected;
- Any other relevant transfer notes.

When audited, the fraction of material that is recycled internally is compared with similar companies in the industry to ensure that companies do not recycle excessive amounts of material internally to inflate their recycling rate.

A Recycled Content claim can only be made for materials that have been recovered or otherwise diverted from the solid waste stream, either during the manufacturing process (pre-consumer) or after consumer use (post-consumer).

### Transparency Requirements

Information not available.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

First site fee is $250 (US) with subsequent fee of $225 (US).

### Uptake by Industry

Information not available.

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

A full list of authorized accreditation bodies is included on the Textile Exchange website,[164] only one is global and as such would cover Canada and that is IOAS.

## A.3.12 RSB Standard for Advanced Products[165]

### Introduction

The standard applies to non-energy advanced products which include plastics, textiles, pharmaceuticals, packaging, tableware, cosmetics, nutritional supplements, food, feed, pulp, paper and many others.

Like advanced fuels, advanced products are being increasingly used. The upstream supply chains of advanced products are similar if not in most cases identical to advanced fuel supply chains. Participants in the advanced fuel and advanced product supply and production chains are often the same operators, thereby serving a number of market segments. Substances such as bio-naphtha or biomethane can be used both as a fuel or as a feedstock for further processing into products. Therefore, the supply chains for advanced products may overlap with advanced fuels, generating the same environmental and social impacts as already covered by the RSB Standard. Supply chains of advanced products are often significantly more complex than for fuels. In the case of advanced products, both the supply chains and the final products may be much more complex, although fuel processes may also generate non-energy co- or by-products. The supply chains normally encompass different sites across the globe.

This standard describes sustainability requirements for operators involved in the supply chains of advanced products.

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

Members of the Roundtable on Sustainable Biomaterials approved the Advanced Products Standard in 2018.

### Publishing/Certifying Organization

RSB is a multi-stakeholder organization committed to ensuring best practice in sustainable biomaterials. RSB is a collaboration of more than 60 businesses, NGOs, academics, government and UN organizations.

### Scope

The RSB Global Advanced Products Certification is a voluntary certification scheme that applies to non-energy products such as plastics, packaging, textiles, and numerous others. Products can receive certification if they belong to one of three categories:

- Bio-based products (Category I);
- Products with recycled content (Category II); or
- Products from bio-based or recycled fossil feedstock, produced in combination with virgin fossil feedstock (Category III)[166].

A minimum certified content is required to obtain certification. For Category II, products must contain no less than 25% of recycled carbon content relative to the total carbon content of the product. For Category III, at least 25% of the fossil feedstock needed for the product must be from bio-based or recycled fossil alternative materials[167]. A minimum GHG reduction is also necessary to obtain certification. Final products should be responsible for 10% less lifecycle GHG emissions than a comparable standard fossil product[168].

### Associated Standards and Guidance

RSB is an ISEAL Code Compliant Member.[169] Claims and communication using the RSB trademarks and RSB compliance claims must meet the provisions of ISO 14021 (2016) (Environmental Labels and Declarations – self-declared environmental claims (type II environmental labelling)).[170]

### Definitions of Recycled Content

The RSB Global Advanced Products Certification defines recycled carbon content as the fraction of carbon derived from recycled carbon in a product. Only pre-consumer and post-consumer materials shall be considered in line with ISO 14021:2016.[171]

Other relevant definitions include:

- Batch: A specific quantity of a product that is intended to have uniform characteristics and qualities.
- Final Product: Goods and services that are ultimately consumed by the end user rather than used in the production of another good or services (Source: Greenhouse Gas Protocol – Product Life Cycle Accounting and Reporting Standard, 2011).
- Intermediate Product: Goods that are used as inputs for the production of other goods or services (Source: Greenhouse Gas Protocol – Product Life Cycle Accounting and Reporting Standard, 2011).
- Material balance: Comparison of physical quantities, expressed by mass, of inputs and outputs for a product in the manufacturing process of this product, over a specific time-period (Source: EN 16785-2).
- Production Residue: Material that is a secondary product of a process which is inelastic in supply and that has an economic value ratio of ≤ 5% with respect to the sum of primary product(s), co-products and other by-products generated from the same production process.

### Compliance Mechanisms

The operator shall determine the recycled carbon content by calculating a material balance for a representative product batch, by following the steps:

- Quantification of the feedstocks, by mass and recycled carbon content, used for the advanced product under consideration, and

- Quantification of losses, by mass and recycled carbon content, in the production unit, for each lost material, if any, and
- Quantification of the output(s), by mass, and
- Calculation of the recycled carbon content from these data.

### Traceability

RSB certified material must be tracked from the origin to the final user, each time it passes through an internal processing step or changes ownership (i.e. custody) along the supply chain (or "chain of custody"). A supply chain includes each stage of processing, conversion, transformation, manufacturing, trading and distribution where progress to the next stage involves a change of legal and/or physical control. Supply chains can begin at the stage of feedstock production, or in the case of waste and residue-based chains, at the Point of Origin.[172]

RSB also publishes a procedure for traceability of RSB certified material (RSB Chain of Custody Procedure),[173] which applies to RSB AP standard and which refers to ISO22095 as well as a manual for book and claim which is currently under development.

### Method of Measuring Recycled Content

RSB AP certify systems consisting of one site, to several sites at the same location to sites at different locations.

RSB AP has thus broad system boundary for their mass balances and are also, in principle, open to certify different legal entities as one system. The focus is instead that the operator has control of the book-keeping system so that double-booking can be avoided. In fact, RSB AP, in their documentation actually avoids the term mass balance altogether and describe it instead as "certification of products produced in a production system that processes bio-based feedstock or non-bio-based end-of-life products of production residues in combination with virgin fossil feedstock".

The balancing methodology uses generalized feedstock equivalents, which are based on the feedstocks chemical value (depending on process). The calculation of the feedstock demand is based on the actual product records of the certified product (i.e. bill of materials), so that losses are taken into account. Different types of certified feedstocks will thus be interchangeable in the overall balance into final products, for the entire certified system. For each site, however, specific products are certified, based on the sites' actual production of those products. However, due to the interchangeability of certified feedstocks, the production need not be physically linked to the actual certified feedstock used.174

RSB allows group level mass balancing, which allows certified material to be transferred within a group of companies where there is not a direct physical link, but the same equivalent non-certified material is made in another part of the business (sometimes refer to as Qualified Credit Transfers). Does not specify any geographic limitations.

The RSB Global Advanced Products Certification allows 'production residue', defined strictly and on the basis of economic value rather than a physical property or at a specific point in the value chain:

> *"Material that is a secondary product of a process which is inelastic in supply and that has an economic value ratio of ≤ 5% with respect to the sum of primary product(s), co-products and other by-products generated from the same production process".*[175]

Certification according to RSB AP requires fulfillment of 12 RSB sustainability principles, including a strong focus on social aspects such as human and labor rights and rural and social development and non-GHG related environmental aspects. In addition, calculation of GHG emissions is included as a requirement, with at least 10% GHG emission reduction. RSB AP recognizes some other certification schemes, depending on the type of certified feedstock, but not all EU Renewable Energy Directive approved schemes. Recognition is based on a benchmark analysis.

The related chain of custody procedure sets out the chain of custody documentation that must be kept for different players in the supply chain. Free allocation is allowed for co-products if chemically linked.

**Figure 17: RSB Label Example**


### Requirements for Claims and Labelling

All operators in the supply chain must be certified for final products to carry RSB claims. RSB certification requirements vary depending on the operator's type, of which there are three:

- Traders: "Operators carrying out buying and selling of materials or product, including raw materials, intermediates and final products. Traders do not carry out any processing activities.
- Industrial Operators: Feedstock processors, intermediary producers, advanced product producers.
- Mechanical Operators: Subgroup of industrial operators only conducting mechanical processes, i.e. mixing, assembling, sorting, molding, cutting[176]."

Whilst operators may have different requirements to meet for certification, they must all have a chain of custody procedure and respect specific standards on balancing material.

### Transparency Requirements

All operators in the supply chain must be certified for final products to carry RSB claims. When an operator first applies for certification, RSB publishes their application on its website for two weeks of public comment[177].

To gain certification, operators must undergo an audit from an independent 3rd party. Operators may choose from two certification bodies to carry out their audits and, should an

audit identify severe non-conformities, operators are given 90 days to resolve the issues and still be given certification[178].

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

There are three fees for certification:

- $500 USD application fee to RSB, one time
- Auditor fees paid to certification body, independent of RSB
- License fees paid to RSB for being certified and using the RSB label

### Uptake by Industry

There are currently 15 operators with valid certificates, of which 3 are in the chemical industry.[179]

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

RSB currently works with two certification bodies: SCS Global Services and Control Union.

## A.3.13 RAL Gütezeichen Wertstoff PET (RAL Quality Mark for Recyclable PET)[180]

### Introduction

The RAL Quality Mark for Recyclable PET is awarded to fillers, bottle and preform manufacturers and recycling companies that comply with the quality and testing regulations. Companies that use at least 25 percent of recycled PET material in the production of new PET drinks packaging and continuously monitor and document this may also use the quality mark.

### Status

The scheme is ***active***.

### Date of Publication or Launch

The RAL Quality Mark for recyclable PET beverage containers (Wertstoff PET-Getränkeverpackungen) was launched in 2014. At the end of 2019, the Quality Assurance and Test Specifications were revised and extended to include the Special Quality Assurance

and Test Specifications for the production of PET flakes. The current version is dated June 2020.

### Publishing/Certifying Organization

The RAL Quality Assurance Mark for Recyclable PET was created by RAL Deutsches Institut für Gütesicherung und Kennzeichnung e.V. (the German Institute for Quality Assurance and Labelling E.V.), which was founded to further promote use of recycled content in PET beverage bottles. Its members include PET recyclers for the production of recyclates for food contact; preform manufacturers; and beverage producers (bottlers) of mineral wasters and soft drinks.[181]

### Scope

RAL Gütezeichen are quality marks attributed to German services or products of high quality to make them more easily identifiable to consumers. Multiple companies or associations can come together to create a specific quality mark.

A group of companies apply to RAL to establish a Quality Assurance Association together and ultimately create their own quality mark. RAL then carries out a verification process involving relevant industry stakeholders before approving the new quality mark. It has uniform specifications for members provided by the Quality Assurance Association. Over 160 different RAL quality marks already exist, spanning all types of sectors.[182]

The RAL Quality Mark for Recyclable PET covers all PET beverage containers. This includes bottle containers, as well as other beverage containers such as cans or barrels made of PET. The scope of application includes the entire container of the primary packaging including labels, closures etc. Its purpose is to promote the use of recycled PET in beverage bottles. The quality mark can only be attributed to bottles containing at least 25 per cent recycled content. [183]

It may be attributed to:

- “PET recyclers for the production of recyclates for food contact (food grade);
- Preform manufacturers;
- Beverage producers (bottlers) of mineral waters and soft drinks”.[184]

There is limited publicly available information regarding conditions of the quality mark and traceability. According to the website, recyclers must adhere to certain requirements along the whole recycling process (incoming materials, process control and outgoing materials), such as:

- Compliance with Regulation (EC) 282/2008 (which pertains to recycled plastic materials intended to come into contact with foods);
- “Only material from collection systems for PET beverage packaging may be used;
- Only machines for the production of food-grade granulate and flakes may be used”.[185]

System boundary: Batch

### Associated Standards and Guidance

Information not available.

### Definitions of Recycled Content

The RAL Quality Mark for Recycled PET is unlike other schemes in that it does not accept pre-consumer waste as recycled content—as the focus is specifically on encouraging post-consumer recycled content in PET bottles.

### Compliance Mechanisms

The quality association is obliged to monitor the use of the quality mark and the compliance with the General and Special Quality Assurance and Test Specifications. Proof of the continuity of monitoring must be provided to RAL by means of a monitoring contract with an independent testing institute or testing agent.

In order to comply with the Quality Assurance and Test Specifications, every user of the quality mark must carry out continuous self-monitoring based on the Quality Assurance and Test Specifications. This self-monitoring must take place at least once a month and be documented in writing and can be reproduced at any time.

The Quality Committee or its representative may inspect the records at any time. The quality mark holder subjects his quality-assured products and/or services to surveillance testing by the Quality Committee or its representative to the extent and frequency in accordance with the general and special requirements of the Quality Assurance and Test Specifications.

### Traceability

All the process steps – from sorting and reprocessing to the use of recyclates in individual products – are documented and inspected at all production sites. Independent appraisers and technical experts contracted by the RAL quality association carry out the certification. Regular checks by the company itself and third-party inspections every two years ensure that the information provided is transparent.[186]

### Method of Measuring Recycled Content

Recycled content is measured via the mass balance method. Additives and fillers are excluded from calculations.

### Requirements for Claims and Labelling

In order to carry the uniform RAL quality mark, it is necessary to produce new PET bottles with a minimum of 25 percent recycled PET material. According to the latest GVM study, an average of 26 percent PET recyclate is currently used in German one-way PET bottles.[187] The RAL quality association has set itself the goal of achieving an average recyclate content of 50 percent in the quality-assured products by 2022.

Passing the initial testing process is a prerequisite for the award and use of the quality mark. Within the scope of the initial testing process, it must be checked whether the applicant's products completely fulfil the requirements laid down in the General and respective Special Quality Assurance and Test Specifications. The applicant is obliged to submit to the Quality Assurance Association in full the documents required for the initiation and implementation and to enable the external inspector appointed by the Quality Assurance Association to check the applicant's quality level. The initial testing process will be arranged by the Quality Committee of the Quality Assurance Association, and an independent and technically suitable testing institute will be commissioned to carry out the inspection.

### Transparency Requirements

The RAL Quality Mark for Recycled PET does not use accredited auditors and believes that their own auditors are more specialized in the subject than those officially recognized.

### Flexibility Mechanisms

N/A

### Cost of Purchasing the Standard of Attaining Certification

The costs of any testing/monitoring carried out shall be borne by the applicant or quality mark holder internal costs.

Charges due upon application (plus 7 % VAT)

- € 1,500.00 flat-rate application charge
- € 2,000.00 advance payment for preparing the RAL approval process. Once the process has been completed, this advance payment is offset against the flat-rate charge of € 4,800.00.

### Uptake by Industry

More than 9,000 German and foreign companies use a RAL certification mark from all economic sectors in the German, European, and global market.[188]

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

Self-accreditation.

## A.3.14 Quality Assurance of Content and Eco-data of Recycled Materials in Polymeric Products (QA-CER)[189]

### Introduction

The certification scheme is targeted at the certification of industrial companies that produce polymer recyclates and/or use them in extrusion processes.

### Status

The certification scheme is active.

### Date of Publication or Launch

The requirements for QA-CER certification were first published in January 2013. The current version of the scheme was published in August 2017.

### Publishing/Certifying Organization

The QA-CER certification scheme was developed by the accredited certification body BQA in cooperation with the accredited laboratories Centexbel and Flanders' PlasticVision (Flemish Plastics Centre). BQA is an ISO 17021 certified company located in Grant, Belgium.[190]

### Scope

The QA-CER certification scheme applies specifically to:

- Sorting and recycling companies dealing with post-industrial and post-consumer waste plastic, textiles, or composites
- Plastic and textile processors and composite producers that use post-industrial and post-consumer waste
- Assembly companies that make fabricated products with recyclates of plastic components or textiles

A QA-CER certificate can be received by a company for all or some of its activities. QA-CER recycled content assures the quality system related to the recycling processes and use of recycled materials. Both the recycled content and the quality of the end product are addressed in order to support the principle of sustainability.

### Associated Standards and Guidance

QA-CER is based on the main principles of the ISO 9001 quality management system, supplemented by requirements from European recycling standards, including requirements for the characteristics of plastic waste flows as listed in EN 15347 and requirements for a traceability system for plastic waste flows as defined in EN 15343.

### Definitions of Recycled Content

The certification scheme defines a recyclate as:

*"A raw material resulting from a recycling process (as defined in CEN TR 15353: recycling = processing in a production process of [plastic] waste materials for the original purpose or for other purposes but excluding energy recovery) where the chemical structure of the raw material is not significantly altered, or a waste flow used as a raw material".*[191]

In this context, the definition of recycled content is very inclusive; it includes both external and internal recycling, post-consumer and pre-consumer recycled content.[192]

QA-CER distinguishes 'pre-consumer', 'post-consumer' and 'internal recycled' materials separately.[193] In this way companies are incentivized to use internal process waste even though it cannot be claimed as pre-consumer.

### Compliance Mechanisms

Organizations are required to establish records to provide proof that recyclate flows are followed up. Records relating to end products containing recyclate shall also be managed.

### Method of Measuring Recycled Content

Segregation, mass balance CoC model

QA-CER specifies ***site level*** mass balancing

Mass balance geographical limitations: n/a

### Traceability

Setting up (a) a comprehensive traceability system for the entire value chain and (b) a system of certification for a suitable Quality Assurance system for the different links in the total value chain is a viable alternative to the above approach.

Periodic certification of the systems applied within companies (traceability and quality management system) by an independent party should ensure transparency and confidence for the different parties involved (recycling companies, production companies, customers, governments etc.).

### Requirements for Claims and Labelling

The QA-CER certification system is composed of three different levels:

- QA-CER Certificate Level 1 (System Certificate): The management aspects of the recyclate flows and applications of recycled materials are the basic requirements for this certificate. Chemical characterization of the materials is not a necessity.
- QA-CER Certificate Level 2 (System and Product Certificate): Includes all requirements of level 1 and applies to companies desiring to guarantee the technical specifications of their products, both of the recycled material and the end product. The company shall clearly describe the products in the scope of the certificate. Additional requirements:
    - Product inspection by an accredited organization.

    - Control frequency: at least once per annum
    - Sampling by BQA
    - Control labs: accredited lab or approved by BQA. If the company has its own lab, it can carry out tests itself under the supervision of the BQA auditors.
- QA-CER Certificate Level 3 (System and Product Certificate): Includes all requirements of level 2 with an additional inspection at system level of the ECO parameters of the product or recycled material. Additional requirements:
    - The company must demonstrate that it follows up all the environmental legislation parameters, for example that it has built in sufficient control systems to ensure that no products are present that feature on the REACH or RoHS list.
    - Administrative control by BQA to establish whether the documented process and laboratory tests are managed with ECO parameters.

The certification scheme requires that incoming goods have the necessary information regarding recyclate content. The organization must be able to identify the recyclate throughout the production process for the product. The applicant must also provide proof that recyclate flows are followed up, including records of the end products containing recyclate.

### Transparency Requirements

Companies are required to establish records to provide proof that recyclate flows are followed up.

QA-CER highlighted an auditing risk that could influence the final recycled content claim.[194] In their view, auditors should be accredited, to ensure adequate level of subject training and impartiality.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

Information not available.

### Uptake by Industry

In 2018, the ECO-oh! group obtained a Level 2 QA-CER certificate.[195]

Other companies that have been certified by BQA in accordance with the QA-CER certification system:

- Govaerts Recycling, a collection and recycling company for plastic and rubber waste (awarded the QA-CER certificate level 2)
- Beaulieu Technical Textiles, a producer of various technical textile products such as carpet backing, agrotextile, construction textile, geotextile, packaging, etc.

Further information not available.

### Reference in Government Policies and/or Regulations

Flemish Regulation on the sustainable management of material cycles and waste (VLAREMA) (7th package of amendments)[196] states that ”when using recycled plastics, the declared proportion of recycled plastics shall be demonstrated by means of a certified management system (e.g. QA-CER or equivalent) issued by an accredited body, which guarantees the origin and recycled plastics content of the bags.”

### Reference in Other Organizations’ Purchasing Policies

Information not available.

### Accredited Bodies

Information not available.

## A.3.15 Plastica Seconda Vita[197]

### Introduction

Plastica Seconda Vita, "Plastic Second Life," is an environmental product certification system dedicated to materials and manufactured articles obtained from the recycling of plastic waste. It is the first Italian brand dedicated to recycled plastic.[198]

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

The standard was introduced in 2004, following a decree enacted in 2003 (the law of “Green Public Procurement (DM 203/03 and CM 4/08/04) that imposed environmental criteria on Italian municipalities in all phases of the procurement of goods and services.[199]

### Publishing/Certifying Organization

The publishing organization is the Istituto per la Promozione delle Plastiche da Riciclo (IPPR) [Institute for the Promotion of Recycled Plastics]. This organization was created to promote the development of the recycled plastics market by boosting the visibility and facilitating the trade of “green products”, helping match supply and demand among both private and public enterprises.

### Scope

Plastica Secunda Vita ("Plastics Second Life") is a voluntary product certification scheme that certifies recycled plastic. It was developed in Italy and was designed to make recycled plastic products more visible and identifiable to public administrations and companies with predominantly public capital. It’s worth noting that it’s only one of a few schemes that

refuses to certify recycled content from chemical recycling sources (although it is considering this down the line[200]). It only certifies mechanical recycling processes.

### Associated Standards and Guidance

Information not available.

### Definitions of Recycled Content

The scheme includes pre-consumer plastic waste as recycled content, which it identifies as:

> "Materials or objects deriving both from the production and from the transformation of polymers thermoplastic or thermosetting, with or without additives with fillers or materials reinforcement, of which the producer / holder discards or intends or is obliged to discard, to deliver them to operators authorized for waste collection and management".

The scheme defines post-consumer material as:

> "Plastic products placed on the market for their own original function which the producer / holder discards or has the intention or obligation to dispose of them, to give them to operators authorized to collect and manage waste, after they have performed the function for which they were produced."

### Traceability

Information not available.

### Compliance Mechanisms

Amongst other obligations, certification requires a company to provide the following:

- Documentary traceability for the recycled materials from final product to original waste;
- A register for materials used in the production processes.

Audits are performed once a year. The certification body reviews the documentation before an audit is carried out in the field. IPPR has a centralized register of auditors, who are appointed by the certification body to do the audit. The certification body verifies the mass balance calculation during the audit. It checks that the quantities of products manufactured and the relative percentages of recycled material used are compatible with the raw materials used, taking into account the losses incurred during all phases.

### Method of Measuring Recycled Content

The system is based on mass balance approach that takes losses incurred at each phase of the recycling process into account.

According to Plastica Secunda Vita, if outputs include less than 5% pigments and additives, this can be considered as recycled content.[201]

Maximum system boundary for mass balance: batch

Geographical limitations for mass balance: n/a

### Requirements for Claims and Labelling

The certification provides different labels depending on the category of waste:

- 30-100% material derived from separate collection
- 30-100% material derived from industrial waste
- 30-100% material derived from a mix of both
- Materials for contact with food and complying with relevant regulations
- Materials derived from reusable bags

### Transparency Requirements

Information not available.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

Information not available.

### Uptake by Industry

Information not available.

### Reference in Government Policies and/or Regulations

Information not available.

### Reference in Other Organizations' Purchasing Policies

Information not available.

### Accredited Bodies

Information not available.

## A.3.16 Cradle to Cradle[202]

### Introduction

The Cradle to Cradle recycled content certification is used to assess recycled content materials for the purposes of Cradle to Cradle certification. Recycled content materials in products being assessed for Cradle to Cradle certification are assessed following the recycled content methodology along with the general Cradle to Cradle Material Health Assessment Methodology.

### Status

The certification scheme is ***active***.

### Date of Publication or Launch

The recycled content certification method was first published in 2017.

### Publishing/Certifying Organization

The Cradle to Cradle Products Innovation Institute is dedicated to powering innovation for the circular economy through products that have a positive impact on people and planet. Through the Cradle to Cradle Certified™ Products Program, the Institute sets standards for products that are safe, circular and made responsibly.[203]

### Scope

This scheme applies to all recycled content materials from post-consumer and post-industrial sources, with several exceptions, listed below:

- Metals of known alloy grade,
- Glass for which elemental analysis has been carried out
- Chemically recycled polymers,
- Other post-industrial or post-consumer recycled materials that can be traced back to the original manufacturer(s)/formulator(s), for which the trade name is known and full material disclosure has been obtained.[204]

### Associated Standards and Guidance

This standard refers to parts of the Material Healthy Assessment Methodology by Cradle to Cradle. This standard assigns an A, B, C, X, or GREY material assessment rating to each homogeneous material subject to review in a finished product that is applying for Cradle to Cradle certification. The procedure uses toxicity data for individual chemical substances, and/or toxicity data on homogeneous mixtures where available, from peer reviewed studies, authoritative lists, and other sources, as well as a qualitative exposure assessment that considers specific product manufacturing, use, and end-of-use scenarios to determine whether the material contains one or more substances that have the potential to adversely impact human or environmental health.

### Definitions of Recycled Content

Cradle to Cradle provides four definitions of recycled content depending on the type:

Type 1 – Post-industrial from a SINGLE DEFINED source

Type 1 recycled materials are those coming from a single known source, where the manufacturer name, trade name, and grade of the material are known and it is possible to obtain disclosures for the full material composition.

Type 2 – Post-industrial from MULTIPLE DEFINED sources

Type 2 recycled materials are those coming from multiple post-industrial sources, but are of a specific type or grade, and/or from a specific manufacturer. All inputs are defined, consistent, and pure, but the material may contain two or more different grades from

known raw material manufacturers with the ability to obtain trade names and grades of the resins and additives used.

Type 3 – Post-consumer from a DEFINED source

Type 3 recycled materials are those from a post-consumer source, but segregation has limited the scope to a very consistent and narrow group of inputs of a single material type and variation. Some examples include 100% transparent high density polyethylene (HDPE) milk containers, 100% clear polyethylene terephthalate (PET) water bottles, 100% specific laundry detergent bottles, 100% specific food packaging containers, and 100% uncoated car bumpers from a specific car line.

Type 4 – Post-consumer from UNDEFINED sources

Type 4 recycled materials are those from a post-consumer source where there is low regard for separation, identification, and/or cleaning the materials to a higher level of purity. Examples include aggregation of various types of plastic that are simply molded into parts with heat, and untreated (i.e. not re-pulped) mixed post-consumer recycled paper. Compliance Mechanisms.[205]

### Compliance Mechanisms

Information not available.

### Traceability

For chemically recycled polymers and recycled materials that can be traced back to the original manufacturers, the relevant manufacturer(s) must provide a description of the collection and recycling process, including controls on contamination that are in place. The assessor is responsible for ensuring that the material is not at risk of being contaminated and/or that it is cleaned to remove possible contaminants if it is to be assessed per the general Material Health Assessment Methodology. If contamination is a concern, for example if post-industrial material is mixed with other items on the manufacturing floor and then swept up to be mechanically recycled, use of the general Material Health Assessment Methodology alone is not permitted. Note that it is rarely possible to assess post-consumer recycled materials from mixed or multiple sources per the general Material Health Assessment Methodology.

### Method of Measuring Recycled Content

For recycled content to count toward the required percentages, the amount of cycled content must be verified based on chain of custody documentation (with the exception of steel and aluminum material that can be traced via specification).[206]

### Requirements for Claims and Labeling

In addition to gathering chemical composition information, the assessor is required to determine what type (i.e., Type 1-4) of recycled content is under review by gathering information from the manufacturer and/or suppliers as relevant about the recycling

process. In cases where the material will be A, B, or C assessed and/or used in Silver, Gold, or Platinum certified products, a complete description of the process must be available to the assessor. Figure 18 shows the rating scheme.

**Figure 18: Cradle to Cradle Rating Scheme**

| | |
|---|---|
| A/B | Recycled content is defined to exact chemical composition and meets requirements of the A or B material assessment rating. |
| C | Recycled content is defined to exact chemical composition and meets requirements of the C material assessment rating.<br>OR<br>Recycled content meets the requirements for designation as Type 3 post-consumer from a defined source, the analytical testing requirements have been met, and all chemical components identified via full material disclosure and analytical testing are a, b or c assessed. |
| GREY | Recycled content cannot be assessed due to lack of chemical composition information. |
| X | Recycled content contains one or more x assessed substances. |

### Transparency Requirements

Similar to other materials, it is necessary to obtain full composition disclosure from the manufacturer(s) of recycled content materials prior to completing an assessment. The goal is to identify all chemical substances present in each homogeneous material subject to review down to 100ppm (0.01%). Section 3.4.2 of the Cradle to Cradle Certified Product Standard, v3.1 provides guidelines for the collection of chemical composition information specific to the major types of recycled materials. For homogeneous materials containing recycled content, composition data collected from the manufacturer(s) will vary from full to partial depending on recycled material type.

### Flexibility Mechanisms

Information not available.

### Cost of Purchasing the Standard of Attaining Certification

Information not available.

### Uptake by Industry

Information not available.

### Reference in Government Policies and/or Regulations

The Cradle to Cradle Certified Product Standard (not the recycled content standard specifically) has been recognized by the United States Environmental Protection Agency (EPA) in its Recommendations of Specifications, Standards, and Ecolabels for Federal Purchasing.[207]

### Reference in Other Organizations' Purchasing Policies

Various organizations have programs that recognize Cradle to Cradle certified products, including Amazon, Google, LEEDv4 and more listed online.[208]

### Accredited Bodies

Information not available.

## A.3.17 PolyCert Europe[209]

### Introduction

Polycert Europe is not actually a certification program itself, but refers to other standards. As such, all the assessment categories used to outline the other standards do not apply, and are not included below. Polycert builds on the principles of quality certification ISO 9001 including chain of custody. The methodology identifies all waste streams and provides a comprehensive way of calculating the post-consumer recycled content in newly converted products based on the definitions of ISO EN 14021 and ISO EN 472.[210]

### Status

The platform is ***active***.

### Date of Publication or Launch

The consortium was launched in October 2020.

### Publishing/Certifying Organization

The consortium was launched by Centexbel-VKC and the Belgian Quality association (BQA) in collaboration with the European Rug and Carpet Association (ECRA), the European Plastic Converters (EuPC) and the European Single Ply Waterproofing Association (ESWA)cxviii.

### Scope

Polycert Europe is a consortium of nationally accredited certification bodies with a focus on harmonizing and facilitating the verification and auditing of volumes reported into the MORE (Monitoring Recyclates for Europe) platform, a digital platform that was established to monitor the use of recycled polymers in the European plastics converting industry.[211] Its goal is to be an umbrella compliance scheme setting an international standard.

Polycert Europe aims to harmonize existing verification schemes (e.g. Plastica Seconda Vita, RAL and AENOR) and is based on the principle of third-party auditing. It has few tangible requirements and is based on Quality Assurance of Content and Eco-data of Recycled materials in Polymeric Products (QA-CER) principles.[212]

### Definitions of Recycled Content

The scheme is built on principles for quality certification according to ISO 9001 and uses the definitions from ISO 14021 to calculate the content of recycled materials in new products.[213]

### Compliance Mechanisms

There is little publicly available information for the scheme, as it was only initiated in 2020. However, as the scheme aims to harmonize other existing systems, it would be beneficial at a later stage to uncover what discrepancies Polycert believes exist that need to be resolved.

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