Securing robust Environmental Product Declarations for construction materials: why credit-based Chain of Custody models must be avoided

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Summary

There is increasing industry interest in the use of Chain of Custody (CoC) models, particularly those based on credits rather than actual physical flows of inputs and outputs with specified characteristics, such as biobased or the use of secondary materials. These "mass balance" approaches are already common in sectors such as chemicals, plastics, and metals. Additionally, there is interest in using such "credits" as the basis for Life Cycle Assessments (LCAs) and Environmental Product Declarations (EPDs) in the construction sector in particular.

This paper sets out concerns in using CoC approaches, particularly:

- Not complying with requirements set out in core EPD rules defined in EN15804+A2 such as co-product allocation, EPD comparisons, and inclusion of carbon offsets;
- Clashing with current and upcoming EU laws;
- Creating barriers to decarbonisation and innovation;
- Endangering fair choices and leading to greenwashing
- Misleading end-users of EPDs (such as architects or consumers) and reducing the credibility and reliability of EPDs;
- Leading to problematic digital data available at building level, gambling the management of circularity with products not containing what has been claimed

Taking these concerns together, there is a strong argument for prohibiting the use of any Chain of Custody (CoC) approaches based on credits rather than the physical flows of inputs and outputs – while performing LCA and EPDs.

Introduction

What are Chain of Custody models?

ISO 22095:2020[1] defines Chain of Custody (CoC) as **"a process by which inputs and outputs with a specified characteristic such as recycled content or biobased content are transferred, monitored and controlled as they move through the supply chain"**.

Several methods of CoC are described in the same standard. They vary based on the level of physical presence of a specified characteristic along the supply chain, while making a claim about a product's characteristic. Certain models, such as identity preserved model, segregated model or controlled blending model, are not necessarily problematic because they ensure the claimed content of the specified characteristic always equates to the physical content in a product. However, other CoC methods, such as mass balance, **allow inputs or outputs with specified characteristics in one product to be "attributed" to other products produced at the same site, another site, or even a completely different organisation or country**. ISO 22095 describes three distinct mass balance models.

Problematic Chain of Custody models

1. Mass balance rolling average percentage: Acceptable but with limitations

This model can be used across one or several of an organisation's sites over a specific claim period (e.g. one year), and for all products produced at the sites. When applied, it allows to claim the rolling average input content of a specified characteristic over the selected period. It is called a rolling average percentage model because it averages series of averages within datasets. For example, monthly averages are used to calculate an annual average.

This model has been long used to conduct LCAs for construction materials and generate EPDs. Yet, specific conditions must be me to ensure reliability and transparency. In particular this method can be used when **claims made for sites and products where the claimed content and rolling averages correspond to the same year.** This is because calculated average content for the EPD and claimed content using the model are usually the same (or the claimed content could be lower).

However, this method is problematic and highly discouraged when:

- the claimed average content for several products is used for a specific product EPD,
- the claimed average content for several sites is used for products from a specific site, where the manufacturing data and actual average content for the product in the EPD and the claimed content do not correspond.

[1] https://www.iso.org/obp/ui/#iso:std:iso:22095:dis:ed-1:v1:en

2. Mass balance credit method: highly problematic

This method can cover one site, or several sites for one or many organisations, even in different countries. **The claimed content of the input for a particular product does not need to reflect the physical presence of the input with a specified characteristic within the product**. Instead, a credit-like mechanism is used, allowing for an input used across the site or different sites to be accounted as a credit. Additionally, every time a content claim of a product with the same specified characteristic is made, an overall discounting happens from the overall balance. Over a "balancing period", which ISO 22095 states should be as short as possible, the overall account of the characteristics' quantities must be in credit. This system is supposed to ensure that content with the specified characteristic has always been used over the balancing period at the site or sites, to back any claim of content. However, the claim is only virtually (or mathematically) attributed to a certain product line.

This methodology leads to different outcomes, allowing manufacturers to flexibly claim benefits that do not fully correspond to reality. For instance, if an input with a specified characteristic is physically shared equitably across all products at 10% average input, this method allows manufacturers to claim that 10% of the products have 100% input with that specified characteristic. Yet, that might not correspond to reality. The flexibility of the methodology can also allow manufacturers to claim a product with no input as containing 100% of a certain characteristic, if the considered product takes credit from other products having this characteristic. Moreover, this method allows for claiming inputs used at one site to be credited to another site, including if the latter produces a completely different product.

For these reasons, and additional ones described later in this paper, the use of the mass balance credit method in LCA and EPDs is highly problematic. This is because the claimed content could differ completely from the actual content in the product, and the related manufacturing impacts reported in EPDs. In other words, this method allows manufacturers to not consider the physical link between the claim and the reality of the product. The question, whether certain characteristics are inherent properties of products or not is considered to be irrelevant if it comes to transparent and fair information to EPD stakeholders.

3. Book and claim method: to be limited to few and specific applications

Like the mass balance credit method, the book and claim method uses credits to prove that for each purchase for which a claim is made (e.g. a green electricity certificate), materials, energy or products with the same specified characteristic have been produced. **This model allows credits to be traded across organisations in a geographical area, completely disconnected from the physical flow of materials or products throughout the supply chain**. This means that manufacturers can claim benefits that do not correspond to reality.

Nevertheless, ISO 22095 and EN 15941 state that the book and claim method can be suitable for intangible materials or products, such as energy (electricity and gas supply), under very specific requirements. This means that this method can only be used in circumstances where the entire market is controlled by a geographical official institution. This institution can ensure that credits are reliably controlled, including that double counting of credits is avoided.

The use of Guarantee of Origin for renewable electricity and associated registries is the most common use of the book and claim method. In EPDs, this has been permitted for energy, in accordance with EN 15941:2024. However, it is subject to very strict restrictions provided in Annex E, such as the need for a single, independent registry and use of the residual mix for any energy not covered by Guarantee of Origin, to avoid double counting.

Overall, **this method shall remain applied to very limited intangible applications (such as in the accounting of green electricity or biogas). The availability of transparent, public registries that are the only ones in their region and controlled by third parties independent from the manufacturers are a basic condition for the book and claim model. Such registries are not yet established for solid matter (here a need for global registries would occur) and under the current economic and political situation that seems impossible to realise.**

What are the concerns with the use of credit-based Chain of Custody approaches?

1. Compliance issues

A. Reflecting physical reality and processes

In section 6.3.8.2 relating to data quality requirements, EN 15804 states that **"technological coverage shall reflect the physical reality for the declared product or product group as far as possible"**. Providing EPDs based on claimed content that does not reflect the physical reality for the product will lead to a decreased technical and geographical representativeness of the data.

Moreover, **manufacturers are proposing certifications - based on mass balance - which are currently neither possible nor allowed.** To give a few examples, a large cement company intends to use a certified mass balance approach to model carbon capture and storage for the clinker process. According to their model, 100% of emissions will be captured and presented as such on certain products or sites, rather than the 50% possible[2]. This will allow them to use credits for sites where carbon capture and storage does not exist. Siemens Energy also plans to use mass balance to claim for 100% scrap-based BF/BOF steel[3], while the reality of the content of the products would be different. **If used in EPD, these approaches would require a shift from using data from current production to model production.**

EN 15804 (par. 6.3.9) does not allow the use (for scenarios) of processes "that are not in current use, or which have not been demonstrated to be practical." It is clear that EN 15804 prohibits manufacturers from providing scenario data for processes which are not in current use or practical, whilst delivering an EPD. This makes it impossible to provide such data for EPD modules A1-A3.

[2] https://www.evozero.com/
[3] Potential use of mass balance in the steel industry modelling 100% scrap-based production from the BF/BOF route. Source: https://www.linkedin.com/pulse/stepping-up-green-steel-transition-efforts-using-mass-iosifidou-qpjmf/

In France, the Inies EPD programme has placed a ban on the use of mass balance credit method and book and claim models since 2022[4]. The justifications provided for the ban were:

- **ISO 14044** (section 4.3.4.2 step 2) requires allocation procedures to reflect the underlying physical relationships illustrating how the inputs and outputs change with quantitative changes in the products; and
- **EN 15804** (section 6.4.3.2) requires material flows with specific inherent properties (i.e. energy content, composition (such biogenic carbon content) to be allocated in such a way as to reflect physical flows, regardless of the allocation chosen for the process.

EN 15804+A2 (section 6.4.3.1) also states that when co-product allocation is undertaken, the specific inherent properties of co-products (such as biogenic carbon content), and of secondary flows (such as the use of secondary materials) shall not be allocated but must always reflect the physical flow.
As such, using the mass balance credit method when delivering an EPD, for either biobased or secondary materials content, is not compliant with the co-product allocation rules of EN 15804. The question if a characteristic is an inherent property or not is not of relevance to fulfil the "spirit" of ISO 14044 and EN 15804+A2.

B. Comparability of EPDs

When comparing EPDs, **EN 15804 (section 5.3) indicates that comparison is possible under specific conditions. The key condition requires that "the elementary flows related to material inherent properties, such as biogenic carbon content, the potential to carbonate or the net calorific value of a material, are considered completely and consistently".** ISO 14025 (section 6.7.2) also requires that the allocation of material flows is equivalent for any EPD comparison. Comparing normal EPDs and EPDs based on credit methods is not possible because the way impacts are allocated is different and prevent proper comparison.

An EPD making use of book and claim or mass balance credit methods would consider the allocated flows of biobased material or secondary materials in a completely different way compared to an EPD following rules contained in EN 15804. The latter would therefore allocate benefits on the basis of physical flows, or account for the average content over a year. As such, EPDs using the mass balance credit or book and claim methods cannot not be compared with other EPDs performed according to EN 15804+A2.

C. Inclusion of carbon offsetting within EPDs

Mass balance credit approaches are already used to generate certified credits from carbon reduction projects associated with various sites and products within an organisation. These are then made available to offset impacts of unrelated products produced by the organisation[5].

However, **the use of offsets is not allowed under EN 15804+A2**. Its section 5.4.3 clearly states that, "*carbon offset processes are not part of the product system under study. Carbon offset shall not be included in the calculation of Global Warming Potential (GWP)*". The same standard describes carbon offsets as "a reduction in emissions of carbon dioxide or other greenhouse gases made in order to compensate for an emission elsewhere".

[4] Annex J, https://www.inies.fr/wp-content/uploads/2021/06/Reglement_du_programme_INIES_novembre2022_valide_pour_diffusion.pdf
[5] https://products.tatasteelnederland.com/brands/green-steel-solutions/zeremis-carbon-lite

This covers activities made in one product system (e.g. by using biobased or recycled input with reduced carbon emissions), and generating credits for this content, to compensate for and reduce carbon emissions in another product system, where these inputs have not been used. This is exactly what is done through mass balance credit and book and claim methods. Hence, these are using the claimed content and associated reduction in carbon emissions from another product system to offset the emissions within the product system modelled in the EPD. **This is not compliant with EN 15804, as carbon offsets cannot not be considered in the calculation of products' GWP.**

2. Credit-based Chain of Custody approaches lead to greenwashing rather than ensure decarbonisation and innovation

For the environment, nothing is gained by virtually distributing benefits among market players. Instead, **CoC methods contribute to an unlevel playing that allows competition based on false claims.**

The standard ISO 14040 sets out LCA principles, which are "fundamental and should be used as guidance for decisions relating to both the planning and the conducting of an LCA". As provided by the standard, **the third principle of LCA clearly states that economic and social aspects should be left outside the scope of LCA. However, the use of credit-based CoC methods brings economic forces right into the heart of LCA.**

The introductory paragraphs to EN 15804+A2 indicate that EPDs must communicate verifiable, accurate and non-misleading environmental information for products and their applications, thereby supporting scientifically-based fair choices. This echoes the objectives of ISO 14025[6] on environmental declarations, which states that "the overall goal of environmental labels and declarations is to encourage the demand for, and supply of, those products that cause less stress on the environment, through communication of verifiable and accurate information that is not misleading".

On the contrary, **CoC approaches based on credits allow manufacturers to market themselves as providing sustainable products** and sell those products at a premium. However, compared to manufacturers truly producing low-carbon circular products, manufacturers using credit-based approaches make little to no investment in decarbonising or changing supply chain or production processes.

This is demonstrated in a large chemical company statement on mass balance approaches where the company claims that "there is no additional environmental footprint from building new plants for segregated production, and investment hurdles are lower"[7]. **This statement supports that a key objective of manufacturers making use of credit-based mass balance approaches is to overcome an economic problem associated with the provision of more sustainable products with high contents of specified characteristics.**

Given that a claim using a mass balance approach does not actually have to correspond to reality, no environmental benefit can be associated with purchasing one product over another.

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[6] https://www.iso.org/standard/38131.html

[7] https://plastics-rubber.basf.com/global/en/plastics-hub/BASF_views_on_plastics/Position_Mass_Balance_Approach

Instead, the only benefit is economic and for the manufacturer itself to charge a premium for the product with claimed content despite potentially making a misleading claim. This is a serious competition issue within Europe. Manufacturers obligations to send green products to Europe to fulfil European law must not be weakened by allowing mass balance credit methods.

3. Credit-based Chains of Custody methods clash with EU law

Using credit-based chain of custody is in clear clash with the text and spirit of several EU laws. In particular:

- **The EU's Unfair Commercial Practices Directive (Directive** 2005/29/EC amended 2024/825[8]), states that a **commercial practice shall be regarded as misleading if it "deceives or is likely to deceive average consumers, even if the information is factually correct", and "causes or is likely to cause them to take a transactional decision that they would not have taken otherwise"** (art.6).

- The EU **Green Claims Directive** (still under negotiation) requires that[9] "information used to substantiate explicit environmental claims should make it possible to identify the product's or trader's environmental performance in comparison to the common practice for products in the respective product group, such as food, or in the respective sector." (par.18)

- The EU Deforestation Regulation (Regulation (EU) 2023/1115[10]) clearly forbids mass balance approaches in the FAQ explanation 1.4: "***Mass balance chains of custody*** *that allow for the mixing, at any step of the supply chain, of deforestation-free commodities with commodities of unknown origin or non-deforestation-free commodities* ***are not allowed under the Regulation****, because they do not guarantee that the commodities placed on the EU market, or exported, are deforestation-free.(...).*"

These EU laws ensure claims to consumers are not misleading, while credit-based CoC methods clearly enhance the risk of misleading claims to consumers, including greenwashing.

Major companies are also in favour of avoiding false claims to preserve their credibility. A survey by the International Chemical Secretariat scrutinising 26 major brands, including Unilever, Tarkett and IKEA, found 4 out of 5 brands believing that products claiming a 100% recycled material content must at least be "made entirely from material that has previously been waste". Only one brand felt that this claim could be made using the mass balance credit method[11]. **Companies emphasised that physical connection to the claimed content was essential to maintain credibility and honest communication with their customers.**

[8] https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A02005L0029-20220528
[9] https://environment.ec.europa.eu/publications/proposal-directive-green-claims_en
[10] https://environment.ec.europa.eu/topics/forests/deforestation/regulation-deforestation-free-products_en and https://green-business.ec.europa.eu/deforestation-regulation-implementation_en
[11] Available at https://chemsec.org/reports/not-quite-100-the-importance-of-transparency-in-non-mechanical-recycling/

Overall, credit based CoC methods do not allow compliance with existing EU law nor aligns with credibility needs from major companies. In particular:

- EPDs making use of credit based CoC methods can be considered misleading and not in compliance with the Unfair Commercial Practices Directive. This is because the latter considers it a misleading commercial practice when the product does not contain content associated with its environmental impact.
- Claims made with the use of credits often suggest that a product and its manufacturer perform better than the competition, when in reality, it doesn't. That goes against the principles set in the future Green Claims Directive.

4. Credit-based Chains of Custody do not support fair choices

EN 15804 states that EPDs support fair choices. In many cases, manufacturers have invested in more efficient and decarbonised production methods, which allow them to market products with higher shares of biobased or secondary materials (or other inputs with a specified characteristic.) Allowing manufacturers to claim their products are greener without substantiating their claims risks leaving the door open to greenwashing. The use of credit-based CoC methods prevent innovation and block off a truly fair construction market where manufacturers compete on *actual* environmental performance.

If CoC approaches based on credits is used, rather than physical flows, on certain products, these products are likely to appear environmentally advantageous in comparison to products with real content. This will result in choices that are not fair to consumers, nor to EPD users (such as architects and building actors), nor to manufacturers that wish to decarbonise.

5. Allowing misleading claims on construction materials will reduce the credibility of EPDs

The US Environmental Protection Agency[12] has publicly commented that mass balance approaches are deceptive and allow for easy manipulation by manufacturers. This is echoed in EU legislation regarding the reporting of recycled plastic content in single-use plastic drinks bottles. The latter tracks recycled content from the recycler to the finished product by means of batch level declarations[13] and formally excludes the use of credit approaches.

Mass balance approaches increasingly allow credits to be used at other sites and for different products, completely disconnected from physical flows. They can be therefore assimilated to the book and claim system, where credits are traded on the open market. Yet, conditions to avoid double counting of benefits are rarely satisfied. These approaches rarely provide the control of an entire market, which is a necessary condition to avoid double counting according to ISO 22095.

[12] EPA comments to the Federal Trade Commission in 2023 about the FTC proposed rule entitled "Guides for the Use of Environmental Marketing Claims". Available at https://www.regulations.gov/comment/FTC-2022-0077-1366

[13] Commission Implementing Decision (EU) 2023/2683 of 30 November 2023 laying down rules for the application of Directive (EU) 2019/904 of the European Parliament and of the Council as regards the calculation, verification and reporting of data on recycled plastic content in single-use plastic beverage bottles https://eur-lex.europa.eu/eli/dec_impl/2023/2683

Recent studies[14], investigating supply chain traceability in the agro-food industry) found that "book and claim systems do not create a market for the sustainably manufactured products themselves but only for sustainability certificates, making their sustainability claims too vulnerable for fraud and consumer/public mistrust. **This is endangering the entire landscape of sustainably certified products and markets"** [15].

This echoes other studies[16],which found that mass balance approaches for recycled polymers applied across multiple sites "**may not be sufficiently traceable and, thus, may reduce credibility and threaten consumer trust in recycled content claims"[17].** They noted that "concerns (exist on the fact that) misuse and/or misunderstanding of the mass balance system could significantly undermine credibility of claims."

Construction product EPDs have a reputation for credibility and transparency according to a survey of predominantly European building professionals[18], covering 880 architecture, engineering and construction (AEC) professionals in the US. The latter revealed that of those familiar with EPD, 87% felt they brought value to the design process [19]. **EPDs' reputation is at stake if their results will no longer reflect the real impacts of the product, but attributions flexibly selected for the product.**

Chain of custody approaches which use credits disconnected from physical flows raise considerable concern on reducing credibility, consumer trust, while increasing the potential for fraud and greenwashing. **Allowing these approaches within EPDs will only reduce their credibility and trust which the construction industry has placed in the instrument, thus reducing their perceived value**.

6. Concerns with consequences at building level

Buildings will become "**material banks**" in the future – full circularity in the construction sector is a goal of the European road to sustainability[20]. All building materials will soon be documented for each building project in digital product and building passports and be linked to Building Information Model (BIM). For circularity, it is important to know the real physical characteristics of materials – especially with respect to use of secondary materials.

The use of secondary materials for multi-recycling processes is technically limited for some product groups, such as aluminium window frames. It is currently not possible to make a product from 100% recycled aluminium, a certain amount of primary material needs to be added. With each recycling circle a little more primary material must be added to achieve the full technical functionality and characteristics.

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[14] Mol and Osterveer, 2015
[15] Certification of Markets, Markets of Certificates: Tracing Sustainability in Global Agro-Food Value Chains. Available at https://www.mdpi.com/2071-1050/7/9/12258
[16] Beers et al, 2022
[17] An Assessment of Mass Balance Accounting Methods for Polymers Workshop Report, available at https://doi.org/10.6028/NIST.SP.1500-206
[18] Making use of life cycle assessment and environmental product declarations A survey with practitioners, available at DOI: 10.1111/jiec.13007
[19] Environmental Product Declarations: Use in the Architectural and Engineering Design Process to Support Sustainable Construction, doi:10.1061/(ASCE)CO.1943-7862.0001481
[20] https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2050-long-term-strategy_en

Mass balance credit methods for secondary materials makes it difficult to trace and follow the content and, while some window frame profiles could be claimed to be up to 100% of secondary materials (but in reality is up to 50%), the other "share of the balance" should claim to be 100% primary material (but again, the reality would be close to 50%).

Recycling institutions could be confronted with more impurities or content parts difficult to handle than marked on the products. This would be an obstacle to circularity. If it comes to waste management, materials are classified and not having clarity on physical presence of certain contents may lead to problems.

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