Supplement Working Draft – Version 3 – for Public Review

Supplemental Information for ACLCA Guidance for Accounting Mass Balance Chain-of-Custody Approaches in Life Cycle Assessments (LCA) and Environmental Product Declarations (EPDs)

Interpretative assessment of mass balance credit-method (MB-CM) conformance with widely accepted Life Cycle Assessment (LCA), Environmental Product Declaration (EPD), Product Category Rule (PCR), and Carbon Footprint of Product (CPF) standards was a fundamental task undertaken by the working group in development of the ACLCA mass balance chain of custody guidance and guardrails. This supplemental document summarizes the results and conclusions of the conformity assessment. This supplement highlights the standards that were assessed and stress tested by the working group posing challenging questions and positions, both for and against Mass Balance in LCAs/EPDs. This ultimately led to the development of the final guardrails and guidance presented in the main document

The table below lists the relevant clauses, identified by the working group, which potentially contained requirements which could have questionable acceptance of the application of MB-CM. The working group debated each of these clauses and determined that different interpretations are possible among experts.

A survey polling of the working group is presented after the table, which indicates that the majority of the working group strongly agreed that MB-CM with appropriate guardrails could conform to the LCA and CFP standards. Likewise, the majority of the working group agreed that MB-CM with appropriate guardrails could also conform to the EPD and PCR standards. Please note that these conclusions were not unanimous and that in all cases there were individuals who strongly disagreed with the conclusion of standards conformance. Industry participants were largely in agreement but not unanimous. Consultant participant opinions were more variable.

It should be noted that the review of ISO 14025 was based on the 2006 version which was in effect at the time of the review. In June 2026, an updated version of ISO 14025 was published which includes clear indication that mass balance chain of custody can be implemented in EPD systems (see clauses 3.3.17, 5.2.2 (e)(5), 7.2.1.2(r), and 7.5.3(c)(4). The ISO 14025:2026 update is also described in Section 1.5 of the ACLCA MB guidance and guardrails document.

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Reference citations to the standards are provided in the Works Cited section of the main paper.

The specific text requirements for the various clauses are not included in this publication out of respect for the copyright status of these standards. These ISO and EN standards are available for purchase online.

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Assessment of MB-CM conformance to existing LCA, CFP, EPD, and PCR standards

#	Standard Scope	Standard reference	Interpretation that MB-CM does NOT conform to standard	Interpretation that MB-CM does conform to standard
1	PCR	EN 15804 +A2:2019 section 6.4.3.1 Allocation of input flows and output emissions	Mass balance credits would be considered prohibited as they do not follow physical flows e.g. physical connection is not required for mass balance credits. Multisite MB-CM is especially challenging if there is no physical connection between inputs and outputs. Also, may be challenging when substituted inputs are not physically identical to conventional inputs.	6.4.3.1 also says "The use of upstream data, which does not respect the allocation principles described in this standard shall be clearly stated and justified in the project report. These data shall be in line with EN ISO 14044:2006 allocation rules." Mass balance in upstream products can be justified. See item #6 for allocation rules. For foreground system, MB-CM can reflect the possibility of a physical flow. MB-CM often substitutes one physical input for another physical input with a specified characteristic. Physical link is required to establish physical connectivity. With MB-CM, the total combined physical relationship between inputs and outputs at the system level is respected.

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2	PCR	EN 15804+A2:2019 section 5.3 Comparability	Biogenic carbon based on C14 must obviously be physically present. This would mean mass balance credit should NOT be an option for bio.	MB-CM focuses on attribution of specified characteristics for intermediate flows. MB does account for elementary flows in the inventory. MB is attribution of inputs to outputs.
3	PCR	EN 15804+A2:2019 section 6.3.7 Selection of data	Mass balance credits are not credible within this requirement, They would "break" this "shall be" rule.	This is written as a general rule. MB is a special case and can be part of the defined goal and scope of the study. EN 15804 was not written with MB in mind. A guardrail is needed to clearly differentiate a chain of custody EPD from a conventional EPD.
4	PCR	EN 15804+A2:2019 section 6.3.9 Developing Product Level Scenarios	If only able to achieve product with specified characteristic at a low limit, then this is applicable. For example, if only able to use 30% recycled fiber in order to achieve printing characteristics in paper, then shouldn't attribute 70% recycled fiber to a product. Guardrail is needed here.	ISO 22095-2 MB requirements require attributions to be technically feasible, which follows an existing and operable route. This satisfies the practicality requirement of EN 15804+A2:2019. ACLCA Guardrail 2.7 addresses this also.

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5	PCR	EN 15804+A2:2019 section 6.4.3.2 Allocation	MB-CM violates the requirement for allocation to reflect underlying physical relationships. Multisite mass balance credit transfers violate the underlying physical relationship requirement of allocation.	Attribution is different from allocation; therefore allocation procedures do not apply to the attribution step. EN 15804 does not provide guidance on attribution. ACLCA guardrail 2.1 clearly differentiates a chain of custody EPD using mass balance credit method from a conventional EPD.
6	PCR	EN15804+A2:2019 section 6.3.8.2 bullets 7, 9 & 10	MB attribution cannot satisfy "physical reality" including geography and technology as there is no requirement for physical connection. Datasets shall be based on one year averages. Site-to-site credit transfers in MB-CM pose additional challenges in meeting geographical coverage criteria.	These shall requirements are "as far as possible" and deviations are allowed if justified. The goal and scope of a Chain of Custody LCA and EPD is to include the chain of custody perspective. ACLCA guardrail 2.1 clearly differentiates a chain of custody EPD using mass balance credit method from a conventional EPD.

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				With MB, datasets can still be based on one year averages, while factoring in the attributions. ACLCA Guardrail 2.7 requires that the possibility of physical presence as defined in ISO 22095-2 shall be required
7	Env statements	ISO 14020:2022 section 4.10 Principle 9	Stakeholders do not understand mass balance chain of custody	Mass balance chain of custody is standardized, applied to thousands of commercial products. MB is a new concept to most consumers but awareness and understanding is growing as more certified products enter the market. Manufacturers have published materials to help consumers to understand mass balance. Access to information is available and growing. Stakeholder understanding of mass balance can potentially be met by providing additional transparency around MB-CM information in LCAs and EPDs Guardrails 2.1, 2.6 and 2.9 all promote transparency and clarity to purchasers to assist with understanding the nature of the purchased item and the environmental claims being made.

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8	Env statements	ISO 14020:2022 section 4.2 Principle 1	Mass balance credit attributions (upstream of a final product) that are not disclosed could be hard to verify and considered misleading.	It is important for mass balance chain of custody to follow standards, to be audited, and to be 3rd party certified. ACLCA Guardrail 2.5 requires 3rd party certification. Materials need to be available to educate consumers.
9	Env statements	ISO 14020:2022 section 4.7 Principle 6	Mass balance chain of custody inhibits innovation by enabling large producers to utilize existing assets	Mass balance CoC makes circular economy innovations economically feasible and can reduce environmental impacts by leveraging existing infrastructure. It is an enabler of transformation. (Beers, 2022)
10	EPD	ISO 14025:2006 section 4 Objectives Note: ISO 14025:2026 was published after this assessment work was completed. The assessment in this row is for the 2006 edition of ISO 14025	Mass balance credits satisfy a short term demand but stifle long term innovation and environmental improvements. LCA must support only physical reality and there may be an issue with additionality for MB-CM. Concerns exist with decoupling Environmental Attribute Certificates (EACs) from their physical systems. Drop in solutions into existing infrastructure have an economic advantage over some new technologies. MB-CM should have a guardrail for technical limits. Beware of increasing overall enviromental impact.	A key purpose of MB is to help drive commercialization of more sustainable and innovative technologies. It does not stifle long term innovation but has the opposite effect. It signals the market and supports conversion to more sustainable production. The intent is to drive more investment into more sustainable practices. In principle it should be a benefit. By enabling assessment of alternatives it helps us identify where we would see value. ACLCA Issue Brief has a principle that overall net environmental impact must be

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				transparent. This point in 14025:2006 does not discourage use of MB-CM. ACLCA Guardrail 2.6 requires that resulting environmental claims on the product(s) shall be truthful, accurate, and not misleading.
11	EPD	ISO 14025:2006 section 6.7.2 Comparability Note: ISO 14025:2026 was published after this assessment work was completed. The assessment in this row is for the 2006 edition of ISO 14025	Mass balance approach would undermine the ability to make comparative claims as they do not follow the physics and the chemistry of the process/products studied. If the point of MB-CM is to show differentiation against a conventional product then allocation methods would not be the same. Intent of an EPD is to reflect physical reality. Comparability is not achieved without consistent PCRs.	Comparative claims can be supported through MB-CM. ACLCA guardrail 2.1 clearly differentiates a chain of custody EPD using mass balance credit method from a conventional EPD. MB uses attribution, not just conventional allocation. PCRs can be adapted to address comparability for MB-CM.
12	EPD	ISO 14025:2006 Section 7.2.3 Additional Environmental information Note: ISO 14025:2026 was published after this assessment work was completed.	No challenge, just a question of which EPD section the MB-CM results belong in. One could imagine a case where the LCIA results in the EPD do not use mass balance, but the AEI communicates that the product is certified to be "100% recycled" based on whatever chosen chain-of-custody model. That way, the	There is no challenge for MB-CM method here, but there is a question of where the results belong- in the main section of the EPD or in Additional Environmental Information (AEI)? ISO 14025:2006, clause 7.2.3 states that AEI covers "information related to environmental issues, other than the environmental information derived from

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		The assessment in this row is for the 2006 edition of ISO 14025	LCIA results would still reflect the physical reality of a mixed production with only X% recycled content, but the EPD would have the added benefit of the 100% recycled marketing claim.	LCA, LCI, and information modules" and that "this information shall be separated from the information described in 7.2.2", which is the section that governs the predefined LCIA and LCI indicators to be declared. For Chain of Custody EPD using Mass Balance Credit Method, the primary results are based on mass balance attributions.
13		ISO 14026:2017 Section 6.2 General requirements	Care should be taken to ensure that PCRs that are developed are in line with ISO 14027 to preserve elements a) through h) as shown in ISO 14026:2017. Mass balance approaches that are included in non ISO conforming PCRs/guidance may lead to accusations of greenwashing or misleading statements, undermining the credibility of LCAs as scientific tools.	MB-CM fulfills communication requirements a) through h) when cleared documented, certified, and communicated

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14	LCA	ISO 14040:2006 section 4.1.3 Principles of LCA	MB-CM uses an economic aspect, not environmental, which makes it outside the scope of LCA. Economic aspects are more than just monetary value. Economic reasons are driving the use of MB.	By economic aspects, this section is referring to life cycle costing. MB-CM is not life cycle costing. It attributes mass of specified characteristics, not monetary value, and therefore this clause does not apply. LCA standards allow use of economic allocation. Must look at this in context. The last sentence about "combined" also supports MB as a more extensive assessment. LCA with credit-based mass balance is used to assess the environmental impacts of a product system via Life Cycle Impact Assessment. Accounting for MB-CM in LCA is not used for calculating economics or social benefits.

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15	LCA	ISO 14040:2006 Section 4.1.8 Priority of scientific approach	Value choices are only allowed when other scientific approaches are not possible. Aspects of MB-CM such as multi-site can break the physical connectivity and thus violate natural science principles. Mass balance and book and claim w/o physical connection cannot satisfy this requirement to be based on natural science. Natural science is preferred over economics. Economic allocation is a critical allocation method for many commodities, and it may be separate from its value in use in MB-CM.	Economic allocation is not based on natural science yet is widely accepted. Decisions based on value choices in MB-CM are allowed under ISO 14040:2006 if needed to satisfy goal and scope of study. ACLCA Guardrail 2.7 requires technical feasibility for mass balance attributions which preserves scientific integrity.
16	LCA	ISO 14040:2006 Section 4.4 General concepts of product systems	Mass balance credits would be considered prohibited as they do not follow physical flows e.g. physical connection is not required for mass balance credits. Multi-site transfer would certainly not meet this requirement. MB-CM uses attribution to define what the final product is.	This clause poses no challenge to MB-CM. It is about definition of product systems in terms of functional unit and functional performance within product system as a whole. Functional performance is independent of mass balance attributions.

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17	LCA	ISO 14040:2006 section 5.2.3	Problematic with multi-site mass balance because they are different physical system. This could also occur within one site. There can be physical limitations of throughput which require extra controls for CB MB. Physical systems are described by physical input and output flows into processes. In mixed production there is physically one combined output flow, whereas CB MB is effectively virtual.	LCA with MB-CM does assess the impacts of physical systems. RECs are not strictly physical and are widely accepted in LCAs. Likewise, it is acceptable for physical systems to be allocated by economics, which is not physical. MB-CM applications are limited to what is technically feasible in the product system. ACLCA Guardrail 2.7 enforces technical feasibility including possibility of physical presence. This clause is from the system boundary section, if MB-CM is part of goal & scope within system boundary then it can be acceptable.
18	LCA	ISO 14044:2006 Introduction and 4.2.3.7	Introducing mass balance as an allocation method would negate the ability to use the results in comparative assertions. How would critical reviewers understand multiple allocation methods (including credit transfers) across complex and long value chains such as chemicals cradle to gate or cradle to grave? MB-CM can result in concentrating benefits on a subset of products which inherently creates a comparison to residual products. Comparisons in LCA happen outside of comparative assertions. Claims of MB-CM could be	The resulting products and co-products from MB-CM are calculated with consistent rules, assumptions, and modeling choices. This enables comparison. ISO 14044:2006 allows any differences between product system parameters to be identified and reported. Therefore, products with Chain of Custody LCA's using mass balance credit method may be compared to products with conventional LCA so long as the key parameters of the chain of custody

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			misleading and benefit a company doing less technological innovation than another company.	system are identified and reported. This is satisfied by ACLCA Guardrail 2.9.
19	LCA	ISO 14044:2006 Section 4.3.3 Calculating Data, 4.3.3.1 General	Actual production mix is required. Mass balance attributions or credit transfers would not be considered the actual production mix.	There are precedents of acceptance, if in line with the goal and scope of the study, for determining elementary flows based on chain of custody attribution rather than physical production mix. For example, in the use of RECs for electricity, contractual electricity is widely accepted in the inventory instead of the physically delivered grid mix.

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20	LCA	ISO 14044:2006 section 4.3.4.2 Allocation Procedure steps 2 and 3	Step 3 is challenging. Following MB-CM is a mathematical accounting, not a physical relationship. MB-CM may create an allocation where there wasn't one before, thereby turning a single output system into a multi-output system. Mass balance credit transfer will contradict the fundamental step-wise allocation approach that has been accepted and practiced since 2006.	MB-CM is partitioning input and output flows to create a virtual distinction between products. MB-CM attributions are "other relationships" and can follow step 3. Alternatively, MB-CM may involve virtual subdivison as a methodology approach to avoid allocation.

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21	CFP	ISO 14067:2018 Section 5.5 Priority of scientific approach	Mass balance cannot be seen as a natural science as it is purely a mathematical accounting scheme based on value choices.	There is a place where value choices such as MB-CM are needed. Mathematics is used throughout the LCA process. MB-CM attributions require technical feasibility of inputs to outputs. MB-CM attributions are value choices. MB-CM does follow natural science to the extent that physics and chemistry aspects such as technical limitations and yields (conversion factors).

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22	CFP	ISO 14067:2018 Section 6.4.6.2 Allocation procedure Steps 2 and 3	Mass balance credit transfer does not satisfy section 6.4.6 step-wise approach as it breaks the underlying physical relationships (e.g. mass or energy or stoichiometric allocation, proportional yields, or C14 measurement of bio). Physical allocation should be the first step. The "shall" statement is above this section. If MB-CM is subdivision, then it is indeed virtual.	MB-CM works when physical relationship alone doesn't fit the goal and scope of the study. MB is an “other relationship” based on value choices. Note that economic allocation breaks the physical relationships and is accepted. Economic allocation is often used when it makes more sense, even when physical allocation is possible.
23	PCR	ISO 29130:2017 section 7.1.6 System boundary between product systems	MB-CM is not a conservative approach. Attribution creates uncertainty about physical reality	MB-CM requires the administrative records (document that warrants unique ownership of the entitlement to claim the use of specified characteristics at a point in the chain of custody) to be connected to the physical flow of products as the custody is transferred from one organization to the next in a supply chain. (ISO 22095-2, 2026) There is no uncertainty about when products using MB reach the physical boundary between product systems.
24	PCR	ISO 29130:2017 section 7.1.7 system boundaries and technical information scenarios	MB-CM is not representative of physical reality	MB-CM is representative of production systems and their underlying economic relationships and value choice. Per ACLCA Guardrail 2.7, MB-CM attributions shall be technically feasible.

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25	PCR	ISO 29130:2017 section 7.1.9 Selection of data and data quality requirements	MB-CM is not specific to physical reality and is not calculated using average data.	This is written as a general rule, however, MB is a special case and can be part of the defined goal and scope of the study. EN 15804 was not written with MB in mind. ACLCA guardrail 2.1 clearly differentiates a chain of custody EPD using mass balance credit method from a conventional EPD. MB-CM LCA can be performed using a 12 month manufacturing data. Any deviation to use of "average" data shall be justified in the report.
26	PCR	ISO 29130:2017 section 7.2.4 Principles for allocation for both allocation situations	MB-CM does not reflect physical flows	Specific inherent properties are not attributed using MB-CM. Instead, specified characteristics are.
27	PCR	ISO 29130:2017 section 7.2.5.2 Co product allocation procedure	MB-CM attributions do not reflect underlying physical relationships	This section provides guidance on allocation but is silent about attribution. Each step is written as a should requirement, not a shall. In order to conform to ISO 29130:2017, any Chain of Custody EPD using Mass Balance Credit Method would need to clearly report that the "should" requirements of 7.2.5.2 are not conformed to. For first bullet, it may be possible in MB-CM methodology to apply a virtual subdivision.

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28	PCR	ISO 29130:2017 section 7.2.5.5 Allocation by subdivision	Relies on underlying physical relationships thus mass balance multisite credit transfer would not satisfy this requirement.	MB-CM can apply virtual subdivision when required data are available. Such segregation shall be described and justified in the project report. With mass balance attribution, the ratio between co-products (with and without attribution) can be varied based on value choices.

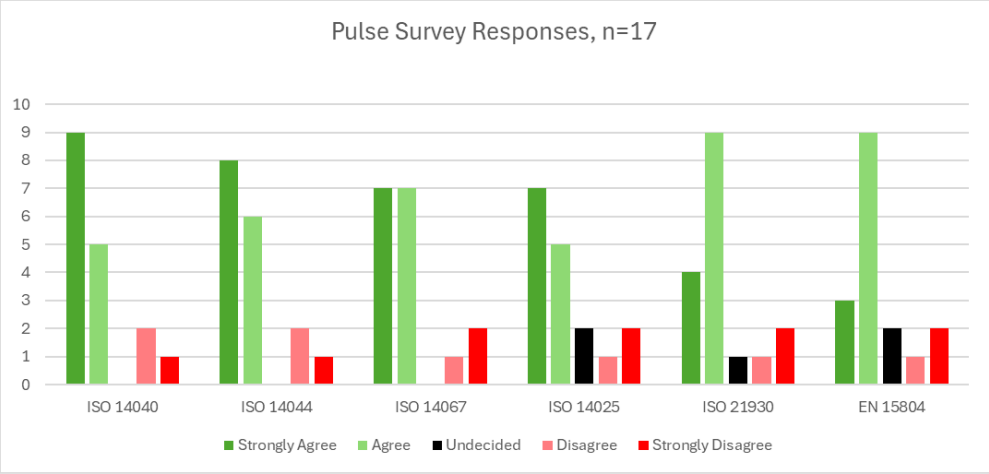
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ACLCA Working Group Polling Survey on MB-CM conformance to common LCA/PCF/EPD/PCR standards

Note: results for ISO 14025 are based on assessment of 2006 version, not the more recent 2026 version

Working group survey results

Do you believe that chain of custody mass balance credit method with appropriate guardrails can achieve conformance to the following LCA/PCF/EPD/PCR standards?



Polling survey results after extensive review & discussions with team of ~40 participants. 17 team members responded to the survey (less than half of working group)

Strong majority view that MB credit method with appropriate guardrails can acceptably conform to both LCA and EPD/PCR standards

Majority strongly agree with conformance to LCA standards

Majority agree with conformance to ISO 21930 and EN15804

Standards review process helped define some specific guardrails needed

External Use

For review and discussion only within ACLCA Committees and Working Group

Figure A-1: ACLCA Working Group Polling Survey on MB-CM conformance to common LCA/PCF/EPD/PCR standards

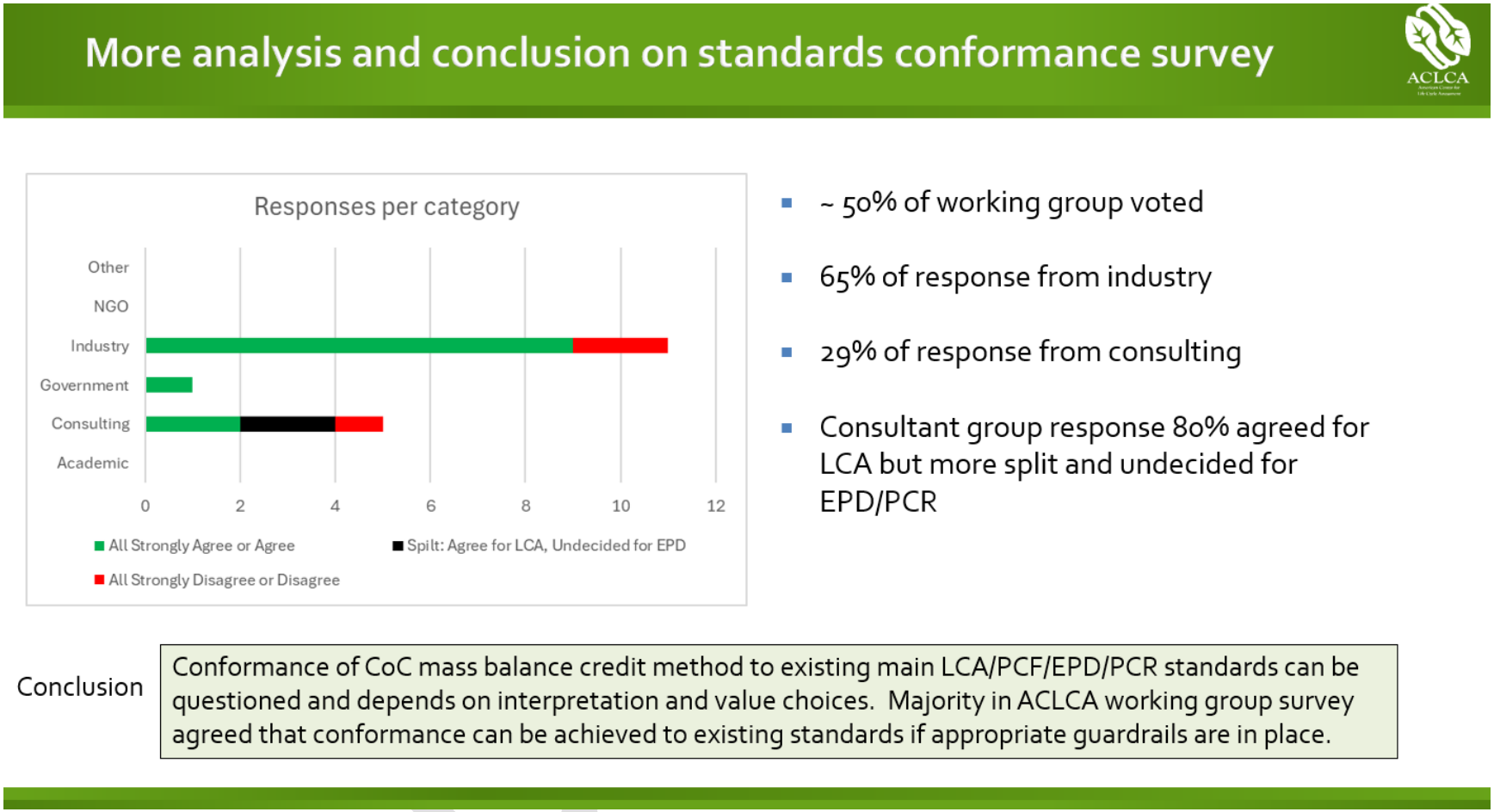


Figure A-2: Additional details on polling survey for standards conformance