Beta Analytic
TESTING LABORATORY

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European Commission
Carbon border adjustment mechanism (CBAM) – establishment of CBAM Registry | Stakeholder Input

This comment specifically intends to recommend including direct Carbon-14 testing within the CBAM Registry to determine the carbon prices and verify emissions within the CBAM mechanism. This would allow the data verification process to be accurate using a scientific and robust standardized methodology. Biogenic content measurements following methods such as ASTM D6866, BS EN ISO 21644 and ISO 13833 currently provide critical value to existing programs around the world covering biogenic emissions from a wide variety of sources.

Included here you will find:

Recommendations for Carbon border adjustment mechanism (CBAM) – establishment of CBAM Registry

We welcome the establishment of a CBAM Registry to improve the transparency and traceability of the CBAM certificates management, declarations and applications. However, it is essential to ensure that the data reported are accurate to ensure the mechanism's goals are met.

One of the main concerns regarding calculating emissions associated with precursor goods in CBAM goods is the risk of over / underpricing carbon emissions due to the lack of appropriate data and the use of methodologies, which have proven problematic. If one of the main goals of the CBAM scheme is to align the ETS requirements with CBAM goods, the scheme should take into account a different carbon pricing for goods produced that emitted emissions with a higher biogenic content. This would ensure that a

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comparable carbon price is paid on imported emissions and domestic emissions and is applied fairly to EU imports in line with the WTO obligations.

One of the main requirements of the EU ETS is direct C-14 testing following ISO EN 13833, ISO 18466 or ASTM D6866 for stationary source emissions seeking to claim biogenic content. Hence, we recommend that the mechanism should include provisions about carbon pricing for emissions with a higher biogenic content. More specifically, the CBAM certificates within the CBAM registry seeking the recognition of biogenic content must be issued following direct testing following recognized scientific standards such as ASTM D6866 Method B, BS EN ISO 21644 Annex A, and ISO 13833 Annex A.

One of the main goals of the EU CBAM is to prevent carbon leakage and align international companies' obligations with EU companies' obligations. T**o do so, the emissions produced by CBAM goods must be determined accurately, especially as calculation methodologies have proven to be misused in many countries outside of the EU to artificially increase the biogenic content of products.** In this regard, the only reliable method to accurately determine the biogenic content of the emissions is the Carbon-14 methodology.

Hence, Approaches solely rely on calculation methodologies, which routinely and systematically overestimate biogenic content, creating an environment ripe for fraud and greenwashing as they can lead to over-reporting / under-reporting of the biogenic percentage of emissions. This is particularly important for CBAM goods as such methodology was at the centre of the biofuel fraud cases encountered by the EU in 2023, which saw a dramatic drop in biofuel prices in the EU and many plant closures. This is why we also recommend that the CBAM incorporates specific guidelines for the reporting and verification of data for CBAM goods, notably the measurement of the CO2 stack emissions at the point of combustion using C14 testing, as it is the most reliable and precise way to measure the biogenic content in CO2 emissions. Similar programs in other countries already require regular biogenic testing such as the US EPA and the UK/EU ETS, which has proven to accurately determine the biogenic fraction of emissions. CBAM goods produced emitting emissions with higher biogenic content should be taken into account while assessing the carbon prices and allowances to ensure that operators around the world are encouraged to follow the best practices and respect the emissions reduction goals.

This would be the most effective approach to achieving the program's goals and would create consistency with the ETS. It would also prevent over-reporting/under-reporting of CBAM goods emissions, which would put EU goods at a disadvantage. As the biogenic content in emissions can vary greatly from one country to another and methodologies might differ, one of the main challenges of the registry will be to ensure that the data collected by different verifiers in different countries are comparable to assess carbon pricing. Measuring the CO2 emissions using C14 is the most reliable method to report data, and for verifiers to verify data. This method also allows verifiers to have standardized results available for them to analyze and assess as they are, easily comparable from one installation to another.

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Direct biogenic content testing is a well-established best practice for regulating stationary source emissions in prominent successful emissions reporting, cap and trade programs. Routine biogenic testing requirements currently provide critical data to the US EPA's Greenhouse Gas Reporting Program (GHGRP), Canada's Greenhouse Gas Reporting Program (GHGRP) and California's Cap and Trade Program[1]. The US EPA's GHGRP is especially important to consider because it has successfully required mandatory quarterly testing and reporting of biogenic content using ASTM D6866 for over 12 years.

Hence, we recommend that the emissions seeking a biogenic content be subject to direct biogenic content testing (^{14}C) requirements following the ASTM D6866 Method B standard or equivalent. Routine direct biogenic testing requirements are the only reliable method of incentivizing the use of biomass-derived feedstocks and guaranteeing compliance. They currently play a critical role in prominent decarbonisation programs around the world. This is particularly true for feedstocks that might have an unknown biogenic content, such as MSW. Including those data within the CBAM Register will allow for the biogenic content to be more transparent and avoid over-estimation. One of the main issues with a calculation-based approach, such as mass balance, is that many data included within the calculation are self-declared and not substantiated. Hence, producers could claim that their feedstocks are 100% biogenic without actually having to justify this biogenic content. The discrepancy will impact directly the sustainable component of the fuels of the CBAM Registry and be misleading.

This threat was particularly highlighted by the recent mass balance fraud challenge faced by the ISCC regarding fraudulent biodiesel submissions from East Asia which "caused a dramatic fall in biodiesel prices in European markets" in July 2023. In response to this situation, the EU quickly updated the Renewable Energy Directive (RED)'s co-processing rules to uniformly require direct testing, including for producers choosing calculation-based approaches to verify their calculations using direct testing to prove and verify claims. Hence, this highlights how difficult tracking and verifying calculation-based methodologies made outside of the EU is, and how strict and easily verified data is a crucial part of the CBAM Registry.

More recently, the US Environmental Protection Agency (EPA) launched a federal action against the mass-balance methodology in August 2024[2]. The Agency highlighted concerns about the mass-balance methodology being used to assess the recycled content of plastics as it misleads the consumers. One of the main concerns is that the mass-balance methodology and accounting can be used to artificially inflate the recycled content of products. A ProPublic investigation revealed in June 2024 that products advertised as 30% recycled through mass balance often contained less than 1% recycled content. Similar concerns were shown by the US EPA as early as 2023, which described the mass-balance methodology as deceptive

[1] 2016. "40 CFR Part 98 Subpart C– General Stationary Fuel Combustion Sources." *National Archives Code of Federal Regulations*
2022. "Canada's Greenhouse Gas Quantification Requirements." *Environment and Climate Change Canada*
[2] 2024, "Biden EPA Rejects Plastics Industry's Fuzzy Math That Misleads Customers About Recycled Content", ProPublica.

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and advised against promoting it[3]. Following the publication of the federal case, the US EPA updated the methodology for its Safer Choice label, requiring the recycled content to be determined by weight post-consumer, effectively prohibiting the mass-balance methodology from being used to certify products under the Safer Choice program[4]. The New York Times also recently published a relevant article on the challenges mass balance presents to the recycling industry, which aligns with the challenges experienced in the renewable products industry[5]. While those examples concern recycled plastic, the issues highlighted by those articles also apply to the low-carbon fuels sectors, even more as this sector is pivotal for the emissions reduction goal. Hence, similar concerns were shown by various member states and environmental organisations for renewable energy, including in the above-mentioned 2023 ISCC-certified Biofuel fraud case. Hence, we recommend improving the traceability of the biogenic content within the CBAM Registry by using regular Carbon-14 testing for feedstocks/emissions seeking a biogenic percentage. Direct testing and reporting will also allow for verifiers to easily verify the data added to the Union database (Article 3(2.)) and improve the reliability of the Database.

Additionally, as the CBAM registry will heavily rely on certificates and declarations, it is also essential that when seeking biogenic content, such declarations be proven by direct C14 testing. Our recommendation as a laboratory that has worked with many programs around the world is that verification of emissions should be performed by accredited bodies with the expertise to accurately verify the data presented by operators. We recommend that one of the minimum criteria be third-party testing by a tracer-free, ISO 17025:2017 accredited laboratory for biogenic content. Third-party biobased testing via carbon-14 testing (ASTM D6866, EN 16640, ISO 16620) should be included for all claims to be directly comparable. Primary data in the form of direct sample testing of biobased materials by a third party will provide greater accuracy in environmental claims of biobased content and can be verified as scientific information. Such concerns were notably raised in May 2024 by the Treasury Inspector General for Tax Administration[6] regarding biofuel tax credits being wrongly awarded. One of the issues was that certificates were falsified, which led to nearly ⅓ of the biofuel tax credits being wrongfully issued.

What is Biogenic Testing (Carbon-14)?

Carbon-14 analysis is a reliable method used to distinguish the percentage of biobased carbon content in a given material. The radioactive isotope carbon-14 is present in all living organisms and recently expired material, whereas any fossil-based material that is more than 50,000 years old does not contain any

[3] 2023, "U.S. Environmental Protection Agency (EPA) comment on the Federal Trade Commission's proposed rule entitled "Guides for the Use of Environmental Marketing Claims". Available here: https://www.regulations.gov/comment/FTC-2022-0077-1366

[4] 2024, "EPA's Safer Choice and Design for the Environment (DfE) Standard, August 2024 update", US EPA. Available here: https://www.epa.gov/system/files/documents/2024-08/epas-safer-choice-and-design-for-the-environment-dfe-standard-with-changes-in-green.pdf

[5] 2024. "Is Your Water Bottle Really Made From Recycled Plastic?" The New York Times

[6] 2024, A case study in Tax Credit fraud and manipulation, Biofuel Edition, CATO Institute

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carbon-14 content. Since Carbon-14 is radioactive, the amount of carbon-14 present in a given sample begins to gradually decay after the death of an organism until there is no carbon-14 left. Therefore, a radiocarbon dating laboratory can use carbon-14 analysis to quantify the carbon-14 content present in a sample, determining whether the sample is biomass-based, fossil fuel-derived, or a combination.

The analysis is based on standards such as ASTM D6866 and its international equivalents developed for specific end uses, such as the European standard ISO 21644. ASTM D6866 is an international standard developed for measuring the biobased carbon content of solid, liquid, and gaseous samples using radiocarbon dating.[7] There are also many specific international standards based on the use of direct Carbon-14 testing, such as ISO 21644, which is a European standard developed for measuring the biogenic carbon content of waste-derived fuels as a fraction of total carbon content.[8]

Carbon-14 analysis yields a result reported as % biobased carbon content. If the result is 100% biobased carbon, this indicates that the sample tested is completely sourced from biomass material such as plant or animal byproducts. A result of 0% biobased carbon means a sample is only fossil fuel-derived. A sample that is a mix of both biomass sources and fossil fuel sources will yield a result that ranges between 0% and 100% biobased carbon content. Carbon-14 testing has been incorporated into several regulations as the recommended or required method to quantify the biobased content of a given material.

ASTM D6866 Method B - The Most Reliable Method

Carbon-14 is a very well-established method which has been in use by many industries (including the fossil fuel industry) and academic researchers for several decades.

Carbon-14 measurements done by commercial third-party testing are robust, consistent, and with quantifiable accuracy/precision of the carbon-14 amount under **ASTM D6866 method B**. The EN 16785 is the only standard that allows a variant of the Mass Balance (MB) method of 'carbon counting' under EN 16785-2. The EN 16785-1 requires that the biocarbon fraction be determined by the carbon-14 method. However, when incorporating this EN 16785 method, certification schemes like the "Single European Bio-based Content Certification" **only** allow the use of EN 16785-1 due to its reliability and the value of a third-party certification. http://www.biobasedcontent.eu/en/about-us/

In ASTM D6866 method B, the carbon-14 result is provided as a single numerical result of carbon-14 activity, with a graphical representation that is easily understood by regulators, policymakers, corporate

[7] 2021. "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis." *ASTM International (D6866-21)*

[8] 2021. "ISO 21644:2021 Solid recovered fuels: Methods for the determination of biomass content." *International Standardization Organization*

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officers, and more importantly, the public. The overwhelming advantage of carbon-14 is that it is an independent and standardized laboratory measurement of any carbon-containing substance that produces highly accurate and precise values. In that regard, it can stand alone as a quantitative indicator of the presence of biobased vs. petroleum feedstocks. When carbon-14 test results are challenged, samples can be rapidly remeasured to verify the original reported values (unlike mass balance).

The quantification of the biobased content of a given product can be as low as 0.1% to 0.5% (1 relative standard deviation – RSD) based on Instrumental error for Method B (AMS). This error is exclusive of indeterminate sources of error in the origin of the biobased content, and manufacturing processes. As such a total error of +/-3% (absolute) has been assigned to the reported Biobased Content to account for determinate and indeterminate factors.[9]

It is also important that the program should always require ASTM D6866 Method B, rather than allow Method C for any use. Where ASTM D6866 Method B uses the AMS Instrument to measure ^{14}C, Method C uses Liquid Scintillation Counting (LSC). In Method B, the AMS Instrument directly measures the ^{14}C isotopes. However, in Method C, scintillation molecules indirectly absorb the beta molecules that are released with the decay of ^{14}C and convert the energy into photons which are measured proportionally to the amount of ^{14}C in the sample. Since Method B directly measures the ^{14}C isotopes and Method C measures them indirectly, Method B is significantly more precise and should be prioritized in regulations.[10] LSC measurements, like those used in Method C, are commonly used as an internal testing tool when samples are limited and accuracy does not need to be extremely high.

About Beta Analytic

Beta Analytic was among the originators of the use of Accelerator Mass Spectrometry (AMS) for the ASTM D6866 biobased / biogenic testing standard using Carbon-14 to distinguish renewable carbon sources from petroleum sources. Beta began testing renewable content in 2003 at the request of United States Department of Agriculture (USDA) representatives who were interested in Beta's Carbon-14 capabilities for their BioPreferred® Program (www.biopreferred.gov). At their request, Beta joined ASTM under subcommittee D20.96. Beta's previous president, Darden Hood, was positioned as a technical contact for the USDA and within 3 months completed the ASTM D6866-04 standard. The Carbon-14 technique is now standardized in a host of international standards including ASTM D6866, CEN 16137, EN 16640, ISO 16620, ISO 19984, BS EN ISO 21644:2021, ISO 13833 and EN 16785. Carbon-14 analysis can be used on various

[9] 2021. Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis. *ASTM International (D6866-21).* pp 1-19. doi: 10.1520/D6866-21.

[10] 2022. "Testing the methods for determination of radiocarbon content in liquid fuels in the Gliwice Radiocarbon and Mass Spectrometry Laboratory." *Radiocarbon*

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types of samples (gas, liquids and solids). Beta Analytic continues to be a technical contact for ASTM D6866 with current president Ron Hatfield and is involved with all their latest ASTM D6866 versions.

The Carbon-14 standardized method is also incorporated in a variety of regulatory programs including the California AB32 program, US EPA GHG Protocol, US EPA Renewable Fuels Standard, United Nations Carbon Development Mechanism, Western Climate Initiative, Climate Registry's Greenhouse Gas Reporting Protocol and EU Emissions Trading Scheme.

We are currently technical experts on Carbon-14 in the following committees:

ASTM D6866 (D20.96) Plastics and Biobased Products (Technical Advisor)
ASTM (D02.04) Petroleum Products, Liquid Fuels and Lubricants (Technical Advisor)
ASTM (061) US TAG to ISO/TC 61 Plastics (Technical Expert)
USDA BioPreferred Program TAC (Technical Advisor)
ISO/TC 61/SC14/WG1 Terminology, classifications, and general guidance (Technical Expert)
CEN/TC 411 Biobased Products
CEN/TC 411/WG 3 Biobased content
CEN/TC 61/SC 14/WG 1 Terminology, classifications, and general guidance (Technical Expert)

ISO/IEC 17025:2017 Accredited Laboratory

To ensure the highest level of quality, laboratories performing ASTM D6866 testing should be ISO/IEC 17025:2017 accredited or higher. This accreditation is unbiased, third party awarded and supervised. It is unique to laboratories that not only have a quality management program conformant to the ISO 9001:2008 standard, but more importantly, have demonstrated to an outside third-party laboratory accreditation body that Beta Analytic has the technical competency necessary to consistently deliver technically valid test results. The ISO 17025 accreditation is specifically for natural level radiocarbon activity measurements including biobased analysis of consumer products and fuels, and for radiocarbon dating.

Required tracer-free facility for Carbon-14

For ^{14}C measurement to work, be accurate, and be repeatable, the facility needs to be a tracer-free facility, which means artificial/labelled ^{14}C is not and has never been handled in that lab. Facilities that handle artificial ^{14}C use enormous levels relative to natural levels and it becomes ubiquitous in the facility and cross contamination within the facility, equipment and chemistry lines is unavoidable. Results from a facility that handles artificial ^{14}C would show elevated renewable contents (higher pMC, % Biobased / Biogenic values), making those results invalid. Because of this, Federal contracts and agency programs (such as the USDA BioPreferred Program) require that AMS laboratories must be 14C tracer-free facilities to be considered for participation in solicitations.

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Areas where cross-contamination might occur include but are not limited to; biomedical or nuclear reactors, isotope enrichment/depletion columns, water, soil, plant, or air samples collected near or at biomedical/nuclear reactor sites, medical, industrial, or hazardous waste sites, samples specifically manipulated to study the uptake/fractionation of stable isotopes due to biological or metabolic processes. To learn more about the risks associated with testing natural levels of Carbon-14 samples in a facility handling artificially enhanced isotopes please see the additional information provided after this comment.

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