ISO/IEC 17025:2017-Accredited Testing Laboratory

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Ontario Ministry of Environment, Conservation and Parks (MECP)
Cleaner Transportation Fuels (CTF) Regulation: Proposed Domestic Renewable Content Requirement for Diesel Fuel │ Stakeholder Feedback

This comment recommends the use of the Carbon-14 testing method to determine the biogenic (bio-based) carbon content of diesel fuel under Ontario's Cleaner Transportation Fuels Regulation. Biogenic content measurements following standards such as ASTM D6866 Method B currently provide critical value to existing fuel decarbonization programs in Canada and around the world. This comment will discuss how requirements are used by similar programs and the best practices that should be applied to measure the biogenic content of renewable diesel under Ontario's CTF.

Included here you will find:

Recommendations for Ontario's CTF Renewable Content Requirement

Our recommendation is that Ontario's CTF should include biogenic content testing requirements following the ASTM D6866 Method B standard for any fuels seeking recognition of renewable content. Direct biogenic content testing is a well-established best practice for regulating the biogenic content of renewable diesel and other biofuels in prominent fuel decarbonization programs similar to Ontario's. This section will discuss the use of biogenic content requirements to determine the renewable content of fuels under leading programs in Canada and around the world, and how Ontario can implement testing based on the best practices established by these programs.

Direct testing using Carbon-14 analysis is the established best practice for measuring the renewable content of biofuels under leading fuel decarbonization programs around the world. Current

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requirements of quarterly biogenic testing following ASTM D6866 for the production of biofuels under similar prominent programs include (please see specific rules hyperlinked):

- The US Renewable Fuel Standard (RFS) currently requires routine direct testing following ASTM D6866 for fuels produced from co-processing, municipal solid waste (MSW), biogas and renewable natural gas (RNG).[1]
- California's Low Carbon Fuel Standard (LCFS) requires routine direct testing for fuels produced from co-processing and recommends it for fuels produced from MSW.[2]
- Oregon's Clean Fuels Program (CFP) requires routine direct testing following the protocols of the US RFS third-party engineering reviews.[3]
- Washington's Clean Fuel Standard (CFS) requires routine direct testing following the protocols of the US RFS third-party engineering reviews.[4]
- Canada's Clean Fuel Regulations (CFR) requires routine direct testing for any fuels produced from co-processing and their co-products, as well as to verify biogenic feedstocks.[5]
- British Columbia's Low Carbon Fuel Standard (LCFS) requires monthly testing for any fuels produced from co-processing and quarterly testing for their co-products, as well as to verify biogenic feedstocks.[6]
- The EU's Renewable Energy Directive (RED) requires routine direct testing for any fuels produced from co-processing or biogas and renewable natural gas (RNG).[7]

This is especially relevant for this rulemaking because of the focus on renewable diesel, which is often produced by co-processing in existing petroleum refineries. Co-processing is the most common application of biogenic testing requirements under these programs because it is the only reliable method to determine the portion of outputs and co-products that are renewable and fossil. Beta works with many co-processing refineries around the world to optimize the renewable portion of their products by testing throughout the refining process to understand where biogenic content is going and optimize their ability to direct it into the finished fuel.

It is particularly notable that biogenic testing requirements following ASTM D6866 are required by Canada's CFR at the federal level, and in British Columbia's LCFS. Since many of the same producers interested in selling renewable diesel in Ontario under this program are likely involved in the CFR and British Columbia's LCFS, they are likely already conducting routine testing to report to those programs.

[1] 2010. "40 CFR Part 80 Subpart M– Renewable Fuel Standard." *National Archives Code of Federal Regulations*
2023. "40 CFR Parts 80 and 1090– Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes." *EPA*
[2] 2020. "Reporting Co-Processing and Renewable Gasoline Emissions Under MRR." *California Air Resources Board*
[3] 2023. "Oregon Clean Fuels Program." *Oregon Department of Environmental Quality*
[4] 2022. "Chapter 173-424 WAC: Clean Fuels Program Rule." *Washington State Legislature*
[5] 2022. "Clean Fuel Regulations: Quantification Method for Co-Processing in Refineries." *Environment and Climate Change Canada*
[6] 2025. "Low Carbon Fuel Regulation: Co-Processing Methodology" *British Columbia Ministry of Energy and Climate Solutions*
[7] 2023. "Renewable energy- method for calculating the share of renewables in the case of co-processing." *European Commission*

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Both programs have strong reporting requirements, with requirements also applying to co-products seeking recognition of renewable content. Beta works closely with co-processing refineries in Canada which routinely report to these programs.

It's also worth noting that Ontario's Emissions Performance Standards (EPS) requires quarterly testing following ASTM D6866 to report biogenic content in fuel combustion and petrochemical production.[8] Canada's Greenhouse Gas Reporting Program (GHGRP) has this requirement at the federal level as well.[9] Biogenic testing requirements are used by emissions reduction programs to report the renewable portion of emissions from partially renewable sources like co-firing and MSW for the same reason as biofuels, because it is the only reliable way to determine their biogenic content. Since Ontario already requires this testing to determine the biogenic content from fuel combustion, it would make sense to use the same method to determine the renewable portion of the fuels themselves.

Ontario's CTF currently uses calculations to determine the bio-based content of renewable diesel. In the two formulae for calculating bio-based content given in Schedule 1 of the regulation, "A" is given as the volume of bio-based content in "E" and "G", the volumes of blended diesel and gasoline placed in the market, as reported by the fuel supplier. The only verification currently required for these totals is that a professional engineer is of the opinion that the data is reasonable and the calculations are correct. We recommend using routine ASTM D6866 Method B requirements to determine this volume of bio-based content, and having the engineer conduct reviews to check these test results to determine that the reported levels of bio-based content are accurate. This would be in line with the reporting approach used by other leading fuel decarbonization programs and would ensure that the content reported by fuel suppliers is accurate. This is critical for renewable fuels regulations, where there is an incentive for suppliers to claim as much renewable content as possible to maximize the benefits they can receive.

Similarly, given that Section 7.(3)(1) requires the Director to determine whether the data and results in the proposed model for the greenhouse gas intensity of the bio-based content, it is necessary to include direct test results for the data to be verifiable. Only direct testing can provide the necessary information to accurately determine the bio-based content and greenhouse gas intensity of any given fuel, and would provide a quantitative approach to verifying the data reported.

Even further, since the goal of the regulation under Section 8.(1) is for "ensure that the average adjusted volume of bio-based content in the total volume of diesel and blended diesel that [a fuel supplier] places in the Ontario market during a compliance period is at least 4 percent", the only way to measure and report this volume is through direct testing. Routine direct testing requirements would be the most

[8] 2020. "Guideline for Quantification, Reporting and Verification of Greenhouse Gas Emissions." *Ontario MECP*
[9] 2022. "Canada's Greenhouse Gas Quantification Requirements." *Environment and Climate Change Canada*

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effective way to determine whether individual fuel suppliers are meeting this 4 percent requirement, and to track the bio-based portion of the total fuel supply entering Ontario's market. Relying exclusively on calculations to track this requirement would introduce too much uncertainty to confidently determine whether the 4 percent threshold is met. Not only does this approach risk inaccurate reporting due to estimates used in calculations, but it also leaves the program susceptible to fuel suppliers intentionally over-reporting their bio-based content.

The recent experiences of other renewable fuel programs have shown the importance of tying calculations to direct biogenic testing. This need is particularly highlighted by the recent mass balance fraud challenges faced by the ISCC regarding fraudulent biodiesel submissions from China, which "caused a dramatic fall in biodiesel prices in European markets" in July.[10] The response from the ISCC has pointed to the need for certification systems to continuously adapt to deliver on their credibility and stay in front of fraudulent practices. We recommend reviewing the RED's updated method for calculating the share of renewables in the case of co-processing, which was released in June as an excellent example of a rule which allows operators to choose from a variety of calculation based options by integrating routine testing requirements to ensure accuracy and combat fraudulent behaviors.[11]

Beta believes it is not in the best interest of Ontario's CTF to rely on calculation-based approaches, such as mass balance, to be used for reporting biogenic content under this program. For any calculations used by the standard, it is critically important to require routine direct testing to determine the biogenic content value. We stress the importance of reviewing other programs' experiences with these calculation-based approaches to understand the risk they would introduce to the program.

Producers and industry lobbying groups favor calculation-based approaches such as mass balance because they enable facilities to make claims solely based on material inputs in production. These calculations allow producers to assume that all of their biomass inputs end up in their facilities' outputs, despite it being well understood in the industry that the input of renewable feedstocks is not the same as the output because performance varies and renewable feedstocks don't produce the same quantity of material as their fossil counterparts.[12] By basing their calculations solely on production inputs rather than outputs, these methods systematically over-report the renewable share of fuels and emissions.

Calculation-based approaches such as mass balance also use a system of free allocation, meaning they do not have to guarantee that there is any renewable content in a given fuel. Producers prefer this because if 10% of their feedstocks are biogenic, they can claim that 10% of their products are biogenic,

[10] 2023. "ISCC Press Release July 27, 2023." *International Sustainability & Carbon Certification*
[11] 2023. "Renewable energy– method for calculating the share of renewables in the case of co-processing"
[12] 2006. "Determining the modern carbon content of biobased products using radiocarbon analysis." *Bioresource Technology*, 97(16), 2084-2090.

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even if that's not the case, because biobased can go in different amounts to different products in the co-process. Even further, free allocation allows suppliers to claim that 10% of their products are 100% biogenic and the rest are 0%, even if all of the products should be 10% biogenic based on calculations (and would likely C14 test below that).[13] These calculations' reliance on free allocation creates the potential for double-counting of renewable content, leaving low-carbon fuel programs susceptible to a high risk of greenwashing and fraud.

Recently, calculation-based certifications have continued to be an issue for the program, with the EU proposing to suspend ISCC certificates for waste-based fuels for 2.5 years in response to the discovery of widespread fraudulent claims.[14] This included the discovery of projects generating credits for the production of waste-based low-carbon fuels at facilities that were found not to exist at all. Only the direct measurement of real samples can verify the renewable content of these fuels that should be credited.

The importance of limiting the role of calculations for reporting the biogenic content of fuels is articulated very well by a recent opinion of the Advocate General of the EU Court of Justice (CJEU) on the roles of mass balance and C-14 for reporting biogenic content in co-processing. The official opinion found that mass balance calculations are not intended to quantify the share of biogenic material contained in a biofuel produced by co-processing.[15] The opinion was reiterated in the final ruling of the case, which differentiates between determining the sustainable criteria for biofuels (mass-balance) and determining the share of biogenic carbon (C14 testing).[16] This judgment was issued in response to a case brought by BP France against the French government regarding a tax incentive requiring C-14 testing to verify claims of renewable content. BP is also notably a board member of the ISCC.[17]

It is in the best interest of this regulation not to allow any producers to report their biogenic content solely using calculations, and to require that any calculations related to biogenic testing be routinely verified by direct testing. The advantage of the updated RED protocol as a model is that producers can choose to use calculations internally, while the program still ensures the information reported is accurate through direct Carbon-14 analysis. This is the only way to mitigate the risk to the program introduced by these calculations.

[13] 2024. "The Mass Balance Approach." *International Sustainability & Carbon Certification*
[14] 2025. "EU Scrutinizes Fraud in Certification of Biofuels." *The Maritime Executive*
[15] 2024. "Opinion of Advocate General Campos Sánches-Bordona Delivered on 11 January 2024: Case C-624/22." *Court of Justice of the EU*
[16] 2024. "Judgement of the Court (Third Chamber) of 29 July 2024." *Court of Justice of the European Union*
[17] 2024. "Board Members of the ISCC Association." *International Sustainability & Carbon Certification*

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Conclusion

This update of Ontario's Clean Fuels Regulation is a great opportunity to incorporate biogenic testing requirements for renewable diesel seeking recognition of their bio-based content to generate credits under the program. Beta further recommends that routine biogenic testing requirements should be applied to any fuels with mixed or unknown renewable content under this regulation. By implementing best practices for verification established by similar fuel decarbonization and emission reduction programs, MECP can equip this program to successfully achieve and measure its goals. Routine direct testing following ASTM D6866 Method B is the most effective way to incentivize and validate the use of biogenic content under this program.

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 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 ISO 13833. ASTM D6866 is an international standard developed for measuring the biobased carbon content of solid, liquid, and gaseous samples using radiocarbon dating.[18] There are also many international standards based on the specific use of direct Carbon-14 testing, such as ISO 13833, which is an international standard developed for measuring the biogenic carbon content of stationary sources emissions.[19]

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.

[18] 2021. "Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis." *ASTM International (D6866-21)*

[19] 2013. "ISO 13833:2013 Stationary source emissions: Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide." *International Organization for Standardization*

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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 is 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 graphical representation that is easily understood by regulators, policy makers, corporate 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.[20]

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 release 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.[21] LSC

[20] 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.

[21] 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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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 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

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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 carbon-14 measurement to work, be accurate, and repeatable, the facility needs to be a tracer-free facility, which means artificial/labeled carbon-14 is not and has never been handled in that lab. Facilities that handle artificial carbon-14 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 carbon-14 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 in order to be considered for participation in solicitations.

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 Carbon-14 samples in a facility handling artificially enhanced isotopes please see the additional information provided after this comment.

References

2006. “Determining the modern carbon content of biobased products using radiocarbon analysis.” *Bioresource Technology*, 97(16), 2084-2090. https://www.sciencedirect.com/science/article/abs/pii/S0960852405004128

2010. “40 CFR Part 80 Subpart M– Renewable Fuel Standard.” *National Archives Code of Federal Regulations* https://www.ecfr.gov/current/title-40/chapter-I/subchapter-C/part-80/subpart-M

2013. “ISO 13833:2013 Stationary source emissions: Determination of the ratio of biomass (biogenic) and fossil-derived carbon dioxide.” *International Organization for Standardization* https://www.iso.org/standard/54332.html

2018. “Directive 2018/2001 of the European Parliament and the Council.” *Official Journal of the European Union* https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:32018L2001

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2020. "Guideline for Quantification, Reporting and Verification of Greenhouse Gas Emissions." *Ontario Ministry of the Environment, Conservation and Parks*
https://www.ontariocanada.com/registry/showAttachment.do?postingId=30247&attachmentId=42676

2020. "Reporting Co-Processing and Renewable Gasoline Emissions Under MRR." *California Air Resources Board*
https://ww2.arb.ca.gov/sites/default/files/2020-09/MRR_coprocessing-slides_Sept_2020.pdf

2020. "Canada's Greenhouse Gas Quantification Requirements." *Environment and Climate Change Canada*
https://publications.gc.ca/collections/collection_2021/eccc/En81-28-2020-eng.pdf

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.

2022. "Quantification Method for Co-Processing in Refineries." *Government of Canada*
https://www.canada.ca/en/environment-climate-change/services/managing-pollution/energy-production/fuel-regulations/clean-fuel-regulations/compliance/quantification-methodco-processing-refineries.html

2022. "Testing the methods for determination of radiocarbon content in liquid fuels in the Gliwice Radiocarbon and Mass Spectrometry Laboratory." *Radiocarbon*, 64(6), pp.1-10. DOI:10.1017/RDC.2022.35

2022. "Clean Fuel Regulations: Quantification Method for Co-Processing in Refineries." *Environment and Climate Change Canada*
https://www.canada.ca/en/environment-climate-change/services/managing-pollution/energy-production/fuel-regulations/clean-fuel-regulations/compliance/quantification-methodco-processing-refineries.html

2022. "Chapter 173-424 WAC: Clean Fuels Program Rule." *Washington State Legislature*
https://app.leg.wa.gov/WAC/default.aspx?cite=173-424&full=true

2023. "Renewable energy- method for calculating the share of renewables in the case of co-processing." *European Commission*
https://ec.europa.eu/info/law/better-regulation/have-your-say/initiatives/12711-Renewable-energy-method-for-calculating-the-share-of-renewables-in-the-case-of-co-processing_en

2023. "40 CFR Parts 80 and 1090– Renewable Fuel Standard (RFS) Program: Standards for 2023–2025 and Other Changes." *Environmental Protection Agency*
https://www.govinfo.gov/content/pkg/FR-2023-07-12/pdf/2023-13462.pdf

2023. "Oregon Clean Fuels Program." *Oregon Department of Environmental Quality*
https://secure.sos.state.or.us/oard/displayDivisionRules.action?selectedDivision=1560

2023. "ISCC Press Release July 27, 2023." *International Sustainability & Carbon Certification*
https://www.iscc-system.org/news/press-release-27-july-2023/

2024. "Opinion of Advocate General Campos Sánches-Bordona Delivered on 11 January 2024: Case C-624/22." *Court of Justice of the European Union*
https://eur-lex.europa.eu/legal-content/EN/TXT/HTML/?uri=CELEX:62022CC0624#Footnote1

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2024. "Judgement of the Court (Third Chamber) of 29 July 2024." *Court of Justice of the European Union* https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=CELEX%3A62022CJ0624&qid=1736867604637

2024. "Board Members of the ISCC Association." *International Sustainability & Carbon Certification* https://www.iscc-system.org/governance/iscc-association/board/

2025. "Low Carbon Fuel Regulation: Co-Processing Methodology" *British Columbia Ministry of Energy and Climate Solutions* https://www2.gov.bc.ca/assets/gov/farming-natural-resources-and-industry/electricity-alternative-energy/transportation/renewable-low-carbon-fuels/rlcf019_-_coprocessing_methodology_final.pdf

Demand a Tracer-Free Laboratory for Radiocarbon Dating

As part of its commitment to provide high-quality results to its clients, ISO/IEC 17025-accredited Beta Analytic does not accept pharmaceutical samples with "tracer Carbon-14" or any other material containing artificial Carbon-14 (14C) to eliminate the risk of cross-contamination. Moreover, the lab does not engage in "satellite dating" – the practice of preparing individual sample graphite in a remote chemistry lab and then subcontracting an AMS facility for the result.

High Risk of Cross-Contamination

Pharmaceutical companies evaluate drug metabolism by using a radiolabeled version of the drug under investigation. AMS biomedical laboratories use 14C as a tracer because it can easily substitute 12C atoms in the drug molecule, and it is relatively safe to handle. Tracer 14C is a well-known transmittable contaminant to radiocarbon samples, both within the AMS equipment and within the chemistry lab.

Since the artificial 14C used in these studies is phenomenally high (enormous) relative to natural levels, once used in an AMS laboratory it becomes ubiquitous. Cross-contamination within the AMS and the chemistry lines cannot be avoided. Although the levels of contamination are acceptable in a biomedical AMS facility, it is not acceptable in a radiocarbon dating facility.

Biomedical AMS facilities routinely measure tracer-level, labeled (Hot) 14C samples that are hundreds to tens of thousands of times above the natural 14C levels found in archaeological, geological, and hydrological samples. Because the 14C content from the biomedical samples is so high, even sharing personnel will pose a contamination risk; "Persons from hot labs should not enter the natural labs and vice versa" (Zermeño et al. 2004, pg. 294). These two operations should be absolutely separate. Sharing personnel, machines, or chemistry lines run the risk of contaminating natural level 14C archaeological, geological, and hydrological samples.

Avoid the Risks

Find out from the lab that you are planning to use that they have never in the past and will never in the future:

- accept, handle, graphitize or AMS count samples containing Tracer or Labeled (Hot) 14C.

- share any laboratory space, equipment, or personnel with anyone preparing (pretreating, combusting, acidifying, or graphitizing) samples that contain Tracer or Labeled (Hot) 14C.

- use AMS Counting Systems (including any and all beam-line components) for the measurement of samples that contain Tracer or Labeled (Hot) 14C.

Tracer-Free Lab Required

Recently, federal contracts are beginning to specify that AMS laboratories must be 14C tracer-free facilities in order to be considered for participation in solicitations.

A solicitation for the National Oceanic and Atmospheric Administration (NOAA) has indicated that "the AMS Facility utilized by the Contractor for the analysis of the micro-samples specified must be a 14C tracer-level-free facility." (Solicitation Number: WE-133F-14-RQ-0827 - Agency: Department of Commerce)

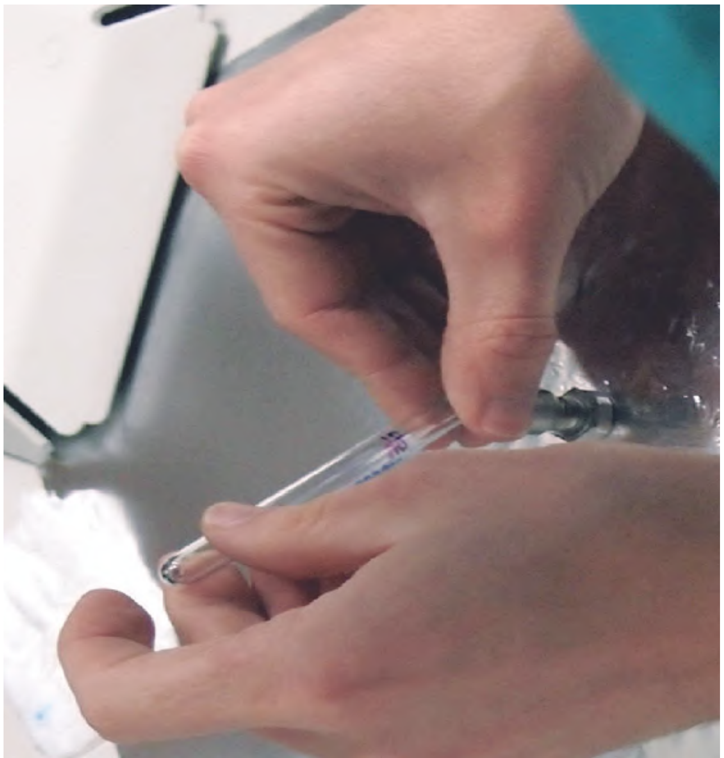
As a natural level radiocarbon laboratory, we highly recommend that researchers require the AMS lab processing their samples to be Tracer-free.

No Exposure to Artificial Carbon-14

According to ASTM International, the ASTM D6866 standard is applicable to laboratories working without exposure to artificial carbon-14 routinely used in biomedical studies. Artificial carbon-14 can exist within the laboratory at levels 1,000 times or more than 100 % biobased materials and 100,000 times more than 1% biobased materials. Once in the laboratory, artificial 14C can become undetectably ubiquitous on materials and other surfaces but which may randomly contaminate an unknown sample producing inaccurately high biobased results. Despite vigorous attempts to clean up contaminating artificial 14C from a laboratory, isolation has proven to be the only successful method of avoidance. Completely separate chemical laboratories and extreme measures for detection validation are required from laboratories exposed to artificial 14C. Accepted requirements are:

(1) disclosure to clients that the laboratory working with their products and materials also works with artificial 14C
(2) chemical laboratories in separate buildings for the handling of artificial 14C and biobased samples
(3) separate personnel who do not enter the buildings of the other
(4) no sharing of common areas such as lunch rooms and offices
(5) no sharing of supplies or chemicals between the two
(6) quasi-simultaneous quality assurance measurements within the detector validating the absence of contamination within the detector itself.

ASTM D6866-22 – Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis.



Useful Reference

1. Memory effects in an AMS system: Catastrophe and Recovery. J. S. Vogel, J.R. Southon, D.E. Nelson. Radiocarbon, Vol 32, No. 1, 1990, p. 81-83 doi:10.2458/azu_js_rc.32.1252 (Open Access)

"... we certainly do not advocate processing both labeled and natural samples in the same chemical laboratory." "The long term consequences are likely to be disastrous."

2. Recovery from tracer contamination in AMS sample preparation. A. J. T. Jull, D. J. Donahue, L. J. Toolin. Radiocarbon, Vol. 32, No.1, 1990, p. 84-85 doi:10.2458/azu_js_rc.32.1253 (Open Access)

"... tracer 14C should not be allowed in a radiocarbon laboratory." "Despite vigorous recent efforts to clean up the room, the "blanks" we measured had 14C contents equivalent to modern or even post -bomb levels."

3. Prevention and removal of elevated radiocarbon contamination in the LLNL/CAMS natural radiocarbon sample preparation laboratory. Zermeño, et. al. Nuclear Instruments and Methods in Physics Research Section B: Beam Interactions with Materials and Atoms
Vol. 223-224, 2004, p. 293-297
doi: 10.1016/j.nimb.2004.04.058

"The presence of elevated 14C contamination in a laboratory preparing samples for natural radiocarbon analysis is detrimental to the laboratory workspace as well as the research being conducted."

4. High level 14C contamination and recovery at XI'AN AMS center. Zhou, et. al. Radiocarbon, Vol 54, No. 2, 2012, p. 187-193
doi:10.2458/azu_js_rc.54.16045

"Samples that contain high concentrations of radiocarbon ("hot" samples) are a catastrophe for low background AMS laboratories." "In our case the ion source system was seriously contaminated, as were the preparation lines."

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