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Geologically Stored Carbon Methodology Update

Public Consultation feedback summary and detailed comments

6 June 2024

Public Consultation: Update to the Geologically Stored Carbon methodology

Context

Puro.earth held a public consultation on its proposed update to the Geologically Stored Carbon (GSC) methodology. This revision aims to update current procedures and definitions in alignment with the current scientific understanding in this area and requirements by the Integrity Council for the Voluntary Carbon Market (ICVCM) category assessment, and CORSIA Emission Eligibility Unit Criteria.

This initial public consultation was announced on Puro's homepage on the 3rd of April 2024 and in Puro Newsletter on the same day. The time frame for the consultation spanned from the 3rd of April 2024 until the 24th of April 2024.

The proposed draft with the title **Geologically Stored Carbon** included eight (8) Sections. In addition, the **Puro Biomass Sourcing Criteria** was included in this process to provide additional guidance for BECCS. This document was written to replace the Puro "Geologically Stored Carbon, edition 2021, v.1.1".

The feedback received includes over 235 comments from more than 24 organizations, and 48 questions during the public presentation webinar. This document summarises the feedback received during the public consultation, responses, and the revisions included by Puro.earth because of the comments.

We want to thank all participants for your time and contributions to helping us improve the Puro Geologically Stored Carbon methodology to better serve this growing ecosystem.

General Observations

1. The Public Consultation showed a **significant engagement** in the number of participants (24) and their comments (235).
2. Many **positive comments** support our thinking on what is a "high-quality carbon removal" and the level of transparency necessary for achieving it.
3. Many valuable improvements and clarifications were incorporated into the methodology because of the public consultation process.
4. As the methodology is brought into operation, some suggestions received during public consultations, e.g. regarding mass-balancing for waste-CCS, but not incorporated at this stage, may still be considered in the future.

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Key Comments & Puro Responses

Section 1: Introduction

- Minor clarifications.

Section 2: Point of creation of the CO2 Removal Certificate (CORC)

- Definitions of **Production Facility** and **Crediting Period** were added.
- Definition of **Point of Creation** was clarified.

Section 3: Eligibility requirements

- The list of **pre-approved jurisdictions** for carbon storage sites was extended to include three provinces in Canada: Alberta, Saskatchewan and British Columbia.
- **Storage depth requirement** was relaxed to allow for shallow-storage under specific circumstances.
- Clarifications were added to include examples of evidence to proof that **no hydrocarbons** are recovered.
- The **baseline scenarios** were refined to include sub-cases relating to repurposing/retrofitting of transport logistics and storage sites. The primary determinant of the baseline scenario remains the capture operations.
- In line with General Rules 4.0, rules on **positive impacts on the UN SDGs** were added.
- **Non-double counting** rules were edited to better reflect alignment with ICVCM and Article 6 of the Paris Agreement.
- **Biomass Sourcing Criteria** were refined, including expansion of scope of certain categories (waste ones) and corrections to certain criteria formulations.

Section 4: Quantification of CO2 Removal Certificates (CORCs)

- Major edits for quantifying **the mass fraction of eligible CO_2** based on the eligibility of the CO_2 source and eligibility of utilized biomass feedstocks.
- Clarification for rule on **injection leaks**.
- Definition of **reversal events** was clarified: release of fossil fuels or other hydrocarbons and any previously stored carbon-containing substances from the storage site are accounted as reversal events.
- Clarified the rule for **reversals in case of a shared storage site** to include a possible attribution factor to the calculated value, when necessary.

Section 5: Assessment of life cycle greenhouse gas emissions

- Amortization of **embodied emissions** was aligned with the crediting period (15 years instead of 10 years), and rules were clarified.

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- Added an explicit requirement to **disclose calculation of biomass supply-chain** emissions even if those emissions are attributed to the co-products and not to the CORCs, for transparency and accountability.
- **Cut-off criteria** (levels of significance) were introduced.

Section 6: Determination of leakage

- Separation of **land sector leakage** from **material/energy sector leakage**, and new stricter rules governing land sector leakage applicable regardless of the baseline scenario (for bio-CCS)
- **Leakage mitigation options** edited (some options deleted, other options edited), overall making the options available stricter.
- **Example tables removed**. Instead, similar tables will be provided as supplier guidance.

Section 7: Data collection and monitoring

- Clarified the rule for monitoring **the mass fraction** of the injected CO_2 to include in which conditions the measurement frequency needs to be **increased**.
- Clarified the rule for monitoring for **the fraction of eligible CO_2 in alignment** with the changes made for section 4.
- Minor clarifications for rules on post-injection site monitoring.

Section 8: Risk and uncertainty management

- Added a subrule on **risk assessment**, for cases where the temperature and pressure of the geological storage reservoir are not sufficient to maintain all the CO_2 in the dense phase.
- One reference added.

Detailed Comments and Responses

In the following tables, we will share the comments received and the responses provided by the Puro.earth Team. Comments are shared anonymously. The comments are grouped per Section in the consulted version of the **Puro Geologically Stored Carbon** methodology and the **Puro Biomass Sourcing Criteria**.

All comment were addressed, and changes incorporated to the final draft. We want to thank all participants warmly for improving the rules and the integrity of Voluntary Carbon Markets (VCM) in general.

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Public Consultation feedback and responses

Comment no	Rule or part	Comment	Response	Action
Glossary of terms				
1		this definition is limited to CO_2 dissoloved in water, but should also apply to pure CO_2 in a fluid state	Pure CO_2 in a fluid state is intended to be covered by the definition of CO_2 plume. CO_2 Fluid was chosen as a placeholder term for dissolved CO_2 until a better term was found.	Changed term "CO_2 fluid" to "CO_2 charged water" in the glossary and throughout the document.
2		Add: or the biological sequestration and long-term retention and storage of CO_2 on the surface of the seabed.	Biomass storage in seabed is out of scope for the present methodology.	No change
3		the definition makes use of the word "long-term" without defining what this means. The word "permanent" is used elsewhere in the document, also without being defined. Suggest that Puro selects one of these terms and defines it.	Changed for consistency.	Changed "long-term" to "permanent (at least 1000 years)"
4		Add: including seabed surface for biomass storage. The largest natural CO_2 sequestrator and oxygen producer on the planet is microalgae, which, after a short life cycle, settles to the bottom. This is a natural process that must be used.	Biomass storage in seabed is out of scope for the present methodology.	No change
Section 1: Introduction				
5		why must it be a net removal of over 1000 years and what evidence is required to prove it. Is this a separate geological study aside from what Is required by the regulatory body giving permits and approval?	1000 years is to align with the CORC1000 credit type. Puro.earth considers GSC in general a priori permanent for at least 1000 years when following the requirements of the methodology.	No change
6	Net Removal	"over 1000 years" would appear to be overly conservative in the context of geological storage. <Company name> would like to this numner changed to at least "10,000 years".	1000 years is to align with the CORC1000 credit type. The actual permanence is indeed usually longer, but there is little practical difference between 1000 and 10000 years in terms of credit issuance.	No change
7	Net Removal	Suggest to delete "certain types of industrial wells" because it is very vague	This term was a remnant from previous version, where it referred to e.g. US class VI wells. The current methodology does not mention specific well types anymore.	Deleted 2 references to "industrial wells"
8	Net Removal	"This methodology sets the requirements for eligibility .... by storing eligible CO_2 streams in suitable geological storage sites, such as deep geological formations and certain types of industrial wells." There is no definition or explanation in the document of which industrial wells are suitable for storage.	This term was a remnant from previous version, where it referred to e.g. US class VI wells. The current methodology does not mention specific well types anymore.	Deleted 2 references to "industrial wells"
9	Scope	Suggest to delete "certain types of industrial wells" because it is very vague	This term was a remnant from previous version, where it referred to e.g. US class VI wells. The current methodology does not mention specific well types anymore.	Deleted 2 references to "industrial wells"
10	Scope	Suggest to insert the word "potentially" before "capable" in this sentence: "several types of geological formations capable of permanently storing CO_2"	Changed according to suggestion.	Changed to "potentially capable"
11	p. 9	Replace phrasing of "pure (undissolved) CO_2" used on pg 9, 17 with "overwhelmingly CO_2 phase" (consistent with >95% referenced on page 15)	Although not utilizing exactly the same words as in rule 3.2.2., we feel that the current wording brings the meaning across more clearly. Further, this piece of introductory text is not only applicable CO_2 with >95% purity, but more generally as well. However, to clarify the associated methodology requirement (rule 3.2.6), added cross reference to rule 3.2.2 to provide more clarity on the CO_2 stream definition.	Added a cross reference to rule 3.2.2 in the associated methodology requirement (rule 3.2.6).
12	1.2.3	Is it Puro's intent that EU Directive RED II be binding on US BECCS projects?	The referenced rule 1.2.3 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Sustainability criteria have been significantly expanded in current draft.	No change
13	1.2.6	Recommend clear definition on what would constitute net harm	The referenced rule 1.2.6 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. In current version, relevant requirement have been significantly expanded. The term "net harm" is still utilized in the introduction to section 3 with a clarifying footnote, but the term is no longer utilized in a supplier requirements.	No change
14	1.3.1	Is it Puro's intent to mirror the measurement and QA methodologies/procedures in the GHG Reporting Rule (that will have to be integrated into our MRV Plan)? That would be helpful to streamline compliance/reporting requirements.	The referenced rule 1.3.1 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. In current version, relevant requirement have been significantly expanded.	No change

Comment no	Rule or part	Comment	Response	Action
15	1.3.2	1.3.2.3 - How do you determine a project's "lifetime"? For example, our BECCS project will have an initial term of 12 years (duration of 45Q). The biogenic source of CO_2 will have the potential to last longer, but economics will be based on 12 years since economic uncertainty beyond 12 years is difficult to assess. How about over "its economic lifetime"?	The referenced rule 1.3.2 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Relevant section has been updated in current draft.	No change
16	1.3.2	1.3.2.3 - What equipment and what documents?	The referenced rule 1.3.2 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Relevant section has been clarified in current draft.	No change
17	1.3.2	1.3.2.4 - is "Logistics Operator" here meant to mean pipeline or other Carbon Dioxide transportation service provider?	The referenced rule 1.3.2 does not exist in current draft. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Relevant section has been updated in current draft.	No change
18	Figure 1.1	Source/reference?	Reference (Snæbjörnsdóttir et al., 2020) is mentioned in image caption.	No change
19		"hydrodynamic trapping" / "migration assisted trapping"	The term "migration assisted trapping" is indeed relevant here.	Changed the term of "hydrodynamic trapping" to "migration assisted trapping", and further added some minor detail to the description, and 2 references (Bump et al., 2023; Spencer et al., 2011).
Section 2: Point of creation of the CO_2 Removal Certificate (CORC)				
20	2.1.0	Suggest changing "can be verified" to "when measurement records are available"	The referenced rule 2.1.0 does not exist in the methodology. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. However, a corresponding rule has been included in the current draft as rule 2.2.1. In our opinion, the current wording is more appropriate than the suggested alternative. However, we acknowledge that the terminology of the rule is suboptimal, but a wider alignment across methodologies is necessary to address this point (see comment to rule 2.2.1 below).	No change
21	2.1.1	I would consider splitting the Methodology for CO_2 Removal into different sub-standards for example "Standard for Capture", "Standard for Geological Storage". There are very few companies, if any, that will be in charge of the whole value chain alone. If 100 CO_2 Removal Suppliers aims to use Northern Lights or CarbFix, all of these suppliers must go up the same path and documenting them as part of their value chain. A smarter and leaner approach would be that these storage providers was pre-approved by puro for the Removal suppliers to use them	The suggestion to split the methodology to different modules is not feasible to realize in the time allotted for completion of this draft. We take this suggestion under advisement for a potential update or addendum. Note that in practice, Puro.earth works closely with CO_2 Removal Suppliers to reduce redundant work.	No change
22	2.2.1	Suggest that point of creation is defined as "the moment that Puro generate a digital CORC certificate having received and verified all necessary information from the CO_2 Removal Supplier". The current definition seems to be very abstract and is not practical.	The point of creation refers to the point in the process when carbon is considered securely stored. That is the end point of the end-to-end process of carbon removal and storage after which the carbon will no longer return to the atmosphere. We acknowledge that the terminology could be improved, and we'll consider that in a later version, and align across all methodologies.	Rule was re-numbered to 2.3.1 (due to additions of other rules in this section). Definition of point of creation was added for further clarity.
Section 3: Eligibility Requirements				
23		Eligibility Requirements - Overall Principles - The usage of the term No Net Harm here is defined in the footnote as "benefits outweigh the disadvantages" in reference to land use change and biodiversity impacts, but it is not clearly stated here what methods and/or metrics should be used baseline and monitor these potential impacts. Suggest clarifying this.	This text is not a requirement for suppliers, but for general information (requirements correspond to numbered rules). The intention of the text is that this methodology is constructed in a manner that ensures 'no net harm' when the requirements of the methodology and the Puro Standard are followed.	No change
24		How should the 'no net harm' be measured? The production of machines necessary for DAC / BECCS will come at a (minor) environmental cost, how do you measure that the benefits outweigh the disadvantages?	This text is not a requirement for suppliers, but for general information (requirements correspond to numbered rules). The intention of the text is that this methodology is constructed in a manner that ensures 'no net harm' when the requirements of the methodology and the Puro Standard are followed.	No change

Comment no	Rule or part	Comment	Response	Action
25		We support Puro's eligibility requirements for geologically stored carbon projects, as expressed in Section 3.2 of the methodology. However, we believe that there may be a need for further clarification on the sections described below.	We thank the commenter for the support. Requests for clarification commented separately below.	No change
26	3.2.0	When third party power is procured, is average CO_2 intensity of supplier's power allowed?	The referenced rule 3.2.0 does not exist in the methodology. Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. For the quantification of project direct emissions (E_project, in CORC quantification), the CO_2 Removal Supplier can use specific emission factors based on the rules in section 5 (see also rule 5.2.19 relating to external energy inputs from the grid). For leakage emissions (E_leakage), quantification follows procedures and equations from section 6.3 (see e.g. rule 6.3.2, where the average emission factor of the grid is used).	No change
27	3.2.1	3.2.1 specifies eligible project activities must inject CO_2 into a suitable underground geological storage reservoir under conditions which ensure the safe and durable storage of CO_2, preventing its re-emission back to the atmosphere for at least 1000 years. We would like to clarify how Puro or the VVB will make this determination, i.e., does a project activity need to develop a reservoir model capable of predicting the behavior of the sequestered CO_2 1000 years post injection in order to be eligible? Or, is this durability assumed/granted if the project adheres to the pre-approved regulatory programs which enforce strict site selection and risk assessment criteria?	Puro.earth considers GSC in general a priori permanent for at least 1000 years when following the requirements of the methodology.	No change
28	3.2.1	How can the duration of 1000 years be substantiated or verified?	Puro.earth considers GSC in general a priori permanent for at least 1000 years when following the requirements of the methodology.	No change
29	3.2.1	How / why was the duration of 1000 years taken as a cutoff (based on IPCC I assume)? This is not a measurable time. When is there enough proof there is no risk of leakage? Please provide a workable timeline on this. Why is the eligibility of the storage activity determined during the production facility audit and not earlier?	1000 years is to align with the CORC1000 credit type. Puro.earth considers GSC in general a priori permanent for at least 1000 years when following the requirements of the methodology. For what constitutes "enough proof there is no risk of leakage", please refer to section 7.7 (site closure requirements). Eligibility is ultimately decided at the audit because the auditor has the final say in the matter. Puro.earth can and will advise and discuss with Suppliers on matters of eligibility.	No change
30	3.2.1	What is the production facility audit? There are no additional sections or references provided in the text to to explain this process. When does it occur?	Production facility audit is further described in Puro Standard General Rules.	No change
31	3.2.2	Suggestion to rephrase the sentence on eligibility of CO_2 stream. The sentence reads that a stream needs to consist at least 95% of an eligible source of biomass - where in rule 3.2.3, an ineligible source is fossil CO_2. Thus this could lead to the interpretation a CO_2 stream has to consist of above 95% biogenic CO_2. This would therefore disallow many BECCS + WtE projects with a higher % of fossil CO_2 in the stream.	The current wording is a mistake. The intention was to require that the stream consists of >95% CO_2, but not necessarily >95% biogenic CO_2. However, only the biogenic fraction can be credited.	Changed first sentence of rule 3.2.2 to "An eligible CO_2 Stream shall consist overwhelmingly (at least 95% by volume) of carbon dioxide that has been captured from an eligible source of CO_2..." Further added a note to the end of the rule: "Note that the CO_2 Stream may contain carbon dioxide from both eligible and ineligible sources (see rule 3.2.3), but only the eligible fraction can be credited as CORCs (see rule 3.2.5)."

Comment no	Rule or part	Comment	Response	Action
32	3.2.2	"An eligible CO_2 Stream shall consist overwhelmingly (at least 95% by volume) of carbon dioxide that has been captured from an eligible source of CO_2 (see rule 3.2.3)." The threshold cut off appears restrictive, when the eligible sources themselves already factor out fossil/ineligible sources. Is this to address, e.g. sustainability requirements?	The current wording is a mistake. The intention was to require that the stream consists of >95% CO_2, but not necessarily >95% biogenic CO_2. However, only the biogenic fraction can be credited.	Changed first sentence of rule 3.2.2 to "An eligible CO_2 Stream shall consist overwhelmingly (at least 95% by volume) of carbon dioxide that has been captured from an eligible source of CO_2..." Further added a note to the end of the rule: "Note that the CO_2 Stream may contain carbon dioxide from both eligible and ineligible sources (see rule 3.2.3), but only the eligible fraction can be credited as CORCs (see rule 3.2.5)."
33	3.2.2	Disagree with the necessity of the CO_2 stream being >95% purity. As long as the amount of CO_2 is reliably quantified; the purity of the stream should not be of importance to calculate the amount of CORCS. Yes, most storage sites will require a minimum CO_2 purity, but that should be irrelevant to the amount of CORCS produced.	The amount of CORCs can of course be easily accounted for no matter what the purity, but the composition of the stream is important for matters of safety and chemical and physical behavior of the substance (which in turn are relevant for e.g. storage security and permanence). These are also within the scope of the methodology, besides the mere quantification of CORCs. See also responses to other comments regarding this rule.	No change
34	3.2.2	>95% is a useful mimimum requirement, although we think that this is mostly covered by the requirements of the storage operators that usually have >99% CO_2 as a mimimum requirement. Our suggestion is to refer to these requirements as well, next to legislative documents (like the CCS directive)	We consider the suggestion as a useful clarification to add.	Changed rule 3.2.2 to clarify that the chemical composition of the CO_2 Stream shall also comply with applicable local regulations as well as requirements imposed by relevant external operators (e.g. the storage site or pipeline operator).
35	3.2.2	3.2.2 specifies that an eligible CO_2 stream shall consist of minimum 95% CO_2 by volume. CO_2 specification for geological storage is driven by requirements of transport infrastructure, and the requirements of the sequestration operator. Dry CO_2 is not corrosive to carbon steel, and contamination limits are based on potentially corrosion inducing constituents such as free water, O_2 and H_2S, and non-condensable components that affect the decompression behavior of the CO_2 stream [3]. ISO 27914 for geological CO_2 storage does not set a specification on minimum CO_2 composition. [4] We suggest changing the "shall" to a "should" in this section, simply removing this requirement all together as it may be redundant with the existing regulatory requirements (i.e., the London Convention and Protocol which requires the stream be "overwhelmingly CO_2") , or adding some language that clarifies the intent of this requirement is to ensure that the CO_2 injected can be injected and sequestered in the dense phase. This would allow the CO_2 pipeline and sequestration operators the ability to determine the CO_2 purity requirements based on sound engineering judgement in conjunction with any regulatory requirements for the site jurisdiction. [3] ISO 27913:2016. Carbon dioxide capture, transportation and geological storage — Pipeline transportation systems [4] ISO 27914:2017. Carbon dioxide capture, transportation and geological storage — Geological storage	This requirement is to align with the EU CCS directive, which states that "A CO_2 stream shall consist overwhelmingly of carbon dioxide". While the directive does not include a percentage value, ISO/TR 27921 states that "Capture and purification processes are evolving and generally purity levels have increased. Several regulatory regimes require the CO_2 stream to consist "overwhelmingly" of CO_2 . This is often approximated as a purity of at least 95 % (cf. ISO 27913:2016 on pipeline transportation systems)." [1] The feedback on this topic is mixed, with comments for and against a specific percentage value. Based on the overall feedback and discussions surrounding this topic, we consider it appropriate to conservatively retain the 95% purity requirement. In our view, this should not be an overly restrictive clause given that e.g. storage site and pipeline operators usually also impose requirements for CO_2 purity, which are in line with (or beyond) this requirement. [1] ISO/TR 27921:2020. Technical report. Carbon dioxide capture, transportation, and geological storage - cross cutting issues - CO_2 stream composition. https://www.iso.org/standard/67273.html	No change

Comment no	Rule or part	Comment	Response	Action
36	3.2.3	"In section 3.2.3, regarding eligible project it is mentioned that "" The CO_2 injected into the geological storage reservoir shall be captured directly from the atmosphere or from a sustainable biogenic source"". Furthermore, the eligible sources of CO_2 has been mentioned as - CO_2 from DAC - Biogenic CO_2 from thermochemical treatment, Biological Treatment, industrial process etc. However, no standalone point source capture of CO_2 has been made eligible under this methodology. We would like to submit that globally CO_2 emissions from hard to abate sectors are rising, for example in a developing economy like India, CO_2 emissions in India from the hard to abate sectors like steel, cement, coal-based power, chemical, etc. is estimated to reach around 2,300 mtpa by the year 2030. Even for a base case scenario of 20 mtpa CO_2 capture at point source, $ 3.6 Billion of investment is estimated(Source : https://www.niti.gov.in/sites/default/files/2023-02/CCUS-Report.pdf). Incentivizing such investments can scale up and facilitate usage of common CCUS infrastructure. Hence, we request inclusion of standalone point source CO_2 emission capture as one of the eligibility criterias which would enable access to the much needed carbon finance to scale up the CCUS activities. We welcome the differentiation of CO_2 source in terms of direct air and point source capture while seeking carbon finance."	The Puro Standard only credits carbon removals from the atmosphere and not emissions reductions or avoidance. Puro.earth methodologies do not credit storage of fossil CO_2.	No change
37	3.2.3	why exclude co-fired coal and biomass? Surely the benefits of reduction of coal can be quantified and supported. Many of this project type do plan on a co-fire leading to 100% biomass. Consider allowing a transition	The ICVCM guidelines don't allow mitigation activities relating to coal-fired electricity generation. Without this rule, it could be possible for a BECCS project to capture CO_2 from a plant that co-fires biomass with coal, which could violate the ICVCM criteria and potentially extend the lifetime of the plant, even when Puro.earth would not award credits for the fossil CO_2.	No change
38	3.2.3.b	Second point here states facilities cofiring coal and biomass for electricity are ineligilble, would that include cement production plants using fossil and biomass fuel and also waste to energy plants where some part of the fuel is fossil origin? Waste to energy and other industrial plants are considerd eligilble in the first clause here.It would be helpful to clarify this.	This point relates to the ICVCM guidelines, which don't allow mitigation activities relating to coal-fired electricity generation specifically. The prohibition does not implicitly extend to other types of activities than what is mentioned. A cement production plant does therefore not fall under this requirement, although it would be very difficult for a cement production facility to satisfy the net-negativity requirements of the Puro Standard.	No change
39	3.2.3b	This could be interpreted to rule out CO_2 from systems that use some kind of fossil fuel in start-up, like using diesel to start a dryer or boiler. Suggest a clarification to allow this so long as it is a negligible amount. It is similarly unclear whether CO_2 from biomass-and-fossil sources (i.e. co-firing coal and wood pellets for BECCS) could be mass-balanced to only generate CORCs for the proportion of CO_2 from wood, or if the presence of coal in the system disqualifies the stream entirely. Suggest clarification.	According to rule 3.2.5, it is possible to inject streams from mixed sources (e.g. containing fossil CO_2 from start-up fuels). However, added a footnote to reference this rule as a clarification. In the case of CO_2 from mixed source (i.e. containing both biogenic and fossil CO_2), mass balancing is in general possible as per rule 3.2.5. However, in the special case of co-firing biomass and coal for electricity generation, mass balancing to generate CORCs from the biomass is not possible as no part of the stream is eligible (neither the CO_2 from the coal itself nor the biogenic CO_2 from the biomass incinerated with it). In rule 3.2.3 b, it is already clarified that "Any CO_2 (even biogenic) captured from activities relating to coal-fired electricity generation..." is not eligible.	Added a footnote to 1st bullet point of rule 3.2.3 b to clarify the accounting for mixed sources.
40	3.2.5 4.4.5	Mixed CO_2 (biogenic + fossil) is eligible provided that the non-eligible fraction of injected CO_2 is reliably quantified and deducted from the reported Output volume --> We see a problem with the current definitions used in 4.4.5. The current way of reporting fossil CO_2 for waste to energy plants in the Netherlands is via weighbridge quantification and using national CO_2 emission factors for every type of waste. From 2028 the waste to energy plants will become part of EU ETS and it is possible that the current way of measuring/reporting becomes the standard for EU ETS reporting as well. Rule 4.4.5b however requires to measure at the stack. This will be a problem for an auditor as the total of biogenic and fossil CO_2 will not add up to a 100% when measured in two ways. Our suggestion is to add a rule 4.4.5.c, see details in comment on section 4.4.5.	This comment is addressed below in response to the commenter's feedback to rule 4.4.5.	No change.
41	3.2.5	"reliably quantified and deducted" needs a definition. Clarification is provided in 3.2.13; suggest a reference to that indicator within this one.	Rule 3.2.13 relates to use of shared infrastructure. A better cross reference would be rule 4.4.5 on quantifying eligible CO_2 in the stream.	Added cross reference to rule 4.4.5
42	3.2.5	Add after the last sentence: Or, that the eligible fraction of injected CO_2 is reliably quantified?	Rule text already includes a cross reference to rule 4.4.5 describing the calculation of the eligible fraction	No change

Comment no	Rule or part	Comment	Response	Action
43	3.2.6	The following general types of geological storage are eligible under this methodology: Add: -Flooding and storage of algae biomass on the seabed. The largest natural CO_2 sequestrator and oxygen producer on the planet is microalgae, which, after a short life cycle, settles to the bottom. This is a natural process that must be used.	Storage of biomass on the seabed is out of scope for the present methodology.	No change
44	3.2.6	The first sentence in this section is "It is important that the storage reservoir is located deep enough underground to ensure efficient and secure storage.", which suggests safe storage is more important than storing in supercritical state, but this needs to be clearer. We believe the state of the CO_2 should be managed by the regulator in each jurisdiction. There may be situations where the CO_2 can be safely stored in gaseous form. Focusing on supercritical or liquid phase may sterilize the use of perfectly safe and suitable pore space.	<Note that "this section" at the beginning of the commenter's feedback refers to section 1.1> While the main reason for CO_2 storage at depths >800 m is the significantly increased storage efficiency due to the dense state, there are additional storage security related considerations with shallow storage that need to be addressed as well (e.g. due to increased buoyancy in the gaseous state). However, we recognize that CO_2 storage in shallow reservoirs does not inherently preclude the safe and permanent storage of CO_2 (as also demonstrated by examples such as the Ketzin pilot project [1]). Further, the EU guidance documents related to the CCS directive state that "It is assumed that CO_2 will usually be injected and stored in dense phase at depths greater than 800m. Note that storage is also possible at shallower depths and the CCS Directive is not prescriptive about the depth of storage. Shallower storage should not be excluded, as long as phase related considerations are addressed." [2, p. 21] We therefore consider it reasonable to allow storage to shallower reservoirs provided that the additional phase related considerations are properly addressed. [1] https://www.sciencedirect.com/science/article/pii/S1876610214017330 [2] https://climate.ec.europa.eu/document/download/951d14ea-ceof-4753-92dd-35ba88920888_en?filename=gd1_en.pdf	Section 1.1: added a footnote to state that storage in shallower depths is also possible as long as phase related considerations are properly addressed. Rule 3.2.6: changed the requirement for a storage reservoir to maintain injected CO_2 in the liquid or supercritical phase into a recommendation. Rule 8.5.3 a: added requirement to explicitly consider and assess additional risks related to storing CO_2 in the gaseous phase.
45	3.2.6	it should perhaps not be a requirement that co2 should be injected in liquid/sc phase to be eligible (even though this is recommended practice since such conditions do make for more efficient storage for a given pore volume) . For example, when injecting into heavily depleted reservoirs then a large fraction of the co2 may be in the gas phase in the region around the well (will this make it non-eligible?). Also there may be some cases with potential candidate stores where P&T/Depth means that storage will be in gas phase (if these stores can be shown to be safe) -do we really want to exclude these in the future if they are otherwise safe storage ?	While the main reason for CO_2 storage at depths >800 m is the significantly increased storage efficiency due to the dense state, there are additional storage security related considerations with shallow storage that need to be addressed as well (e.g. due to increased buoyancy in the gaseous state). However, we recognize that CO_2 storage in shallow reservoirs does not inherently preclude the safe and permanent storage of CO_2 (as also demonstrated by examples such as the Ketzin pilot project [1]). Further, the EU guidance documents related to the CCS directive state that "It is assumed that CO_2 will usually be injected and stored in dense phase at depths greater than 800m. Note that storage is also possible at shallower depths and the CCS Directive is not prescriptive about the depth of storage. Shallower storage should not be excluded, as long as phase related considerations are addressed." [2, p. 21] We therefore consider it reasonable to allow storage to shallower reservoirs provided that the additional phase related considerations are properly addressed. [1] https://www.sciencedirect.com/science/article/pii/S1876610214017330 [2] https://climate.ec.europa.eu/document/download/951d14ea-ceof-4753-92dd-35ba88920888_en?filename=gd1_en.pdf	Section 1.1: added a footnote to state that storage in shallower depths is also possible as long as phase related considerations are properly addressed. Rule 3.2.6: changed the requirement for a storage reservoir to maintain injected CO_2 in the liquid or supercritical phase into a recommendation. Rule 8.5.3 a: added requirement to explicitly consider and assess additional risks related to storing CO_2 in the gaseous phase.
46	3.2.6	Replace phrasing of "pure (undissolved) CO_2" used on pg 9, 17 with "overwhelmingly CO_2 phase" (consistent with >95% referenced on page 15)	Although not utilizing exactly the same words as in rule 3.2.2., we feel that the current wording brings the meaning across more clearly. However, added cross reference to rule 3.2.2 to provide more clarity on the CO_2 stream definition.	Added cross reference to rule 3.2.2 to provide more clarity on the CO_2 stream definition.
47	3.2.6	Please clearify: what is meant with 'pure CO_2'? A purity of >95%?	Yes, the CO_2 stream must conform to the requirements of rule 3.2.2	Added cross reference to rule 3.2.2 to provide more clarity on the CO_2 stream definition.

Comment no	Rule or part	Comment	Response	Action
48	3.2.7	Suggest removing unnecessary constraint of "reservoir pressure shall not exceed the original pressure of the reservoir except locally around injectors during injection and well stimulation (p 17). Defer to jurisdiction's regulation.	We consider it a reasonable adjustment to align with local regulatory requirements in this matter, provided that such exist in the applicable jurisdiction. (see also below response)	Modified rule 3.2.7 b remove limitation to original reservoir pressure in cases where otherwise defined in local regulation.
49	3.2.7	This section appears to ignore the possibility that incidental hydrocarbon production will most likely occur as a byproduct of CO_2 storage in depleted hydrocarbon reservoirs and does not provide much flexibility for what is most likely an unavoidable occurrence in practice. We would recommend an alternate approach which allows and attempts to accurately account for the production and safe disposal of the hydrocarbon byproducts if only for the explicit purpose of managing the depleted hydrocarbon reservoir's operation. The current language is too excusatory and may inadvertently result in a significant amount of potential storage reservoirs being deemed ineligible. This section also limits the potential reservoir pressuring during CO_2 injection operations to the, "original pressure of the reservoir". This requirement may be unnecessary at the methodology level and would probably be best left to the local regulatory authority and storage site operators which do require an understanding of the fracture pressure of the reservoir and often limit operations to within this limit.	This methodology strictly excludes extraction of fossil fuels (e.g. EOR), as per the ICVCM Core Carbon Principles. Based on further research and discussions with a subject matter expert in the working group, we do not share the commenter's view of incidental hydrocarbon recovery being likely/unavoidable during a CCS operation in a depleted field. In such a case, the existing hydrocarbon wells will either be plugged and abandoned, or converted into CO_2 injection wells and so will be disconnected from any production systems. If any wells are left attached to oil or gas separators, it is likely that they are still producing (and the field would not, in fact, be depleted). Therefore, no hydrocarbon recovery should occur under normal circumstances (barring e.g. accidental release from a poorly plugged legacy well or similar). To better address any accidental release of hydrocarbons, we modified rule 4.7.1. to specifically cover any accidental release of hydrocarbons from the reservoir. Finally, concerning the comment on the original reservoir pressure, we consider it a reasonable adjustment to align with local regulatory requirements in this matter, provided that such exist in the applicable jurisdiction.	Split rule 3.2.7 to subrules for clarity, addressing a) prohibition of hydrocarbon extraction and b) reservoir pressure. Modified rule 3.2.7. a to include examples of evidence of no hydrocarbon recovery. Modified rule 3.2.7 b remove limitation to original reservoir pressure in cases where otherwise defined in local regulation. Modified rule 4.7.1. to explicitly classify accidental release of hydrocarbons as a reversal (and hence subject to requirements about reversal monitoring and accounting). Slightly modified rule 7.7.2 (related to post-injection monitoring of release events) to include other types of reversal besides release of CO_2, in alignment with rule 7.6.1: "The CO_2 Removal Supplier shall continue to monitor the storage site and its surroundings for release of CO_2 or other reversal events..."
50	3.2.7 3.2.12	Consider allowing EOR to be acceptable storage to allow for a period of time given the time delays associated with permitting for deep saline aquifers.	EOR was included in the previous version for this purpose, but is now excluded as the ICVCM guidelines do not allow EOR operations.	No change
51	3.2.11	The only countries that currently meet this rule may be the European Union and the United States, and if low-cost CDR projects are needed in the future, more countries can participate, so please consider relaxing this requirement If a country does not have a framework specifically for permanent carbon storage, are BECCS/DACCS projects in that country unable to be registered in the PURO Registry? Could Puro consider relaxing the relevant provisions under Rule 3.2.11 to support these countries that do not have a specific framework to develop geological storage CO_2 projects	The permanence and storage security has been linked to robust regulatory environment in several studies (see section 8.2 in the methodology). Therefore, Puro.earth considers it vital that a robust regulatory environment is already in place for projects eligible under this methodology. Puro.earth considers the provisions in rule 3.2.11 as important minimum requirements considering that several details in the methodology are implicitly or explicitly deferred to the local regulations.	No change
52	3.2.11	The methodology's eligibility criteria for projects in countries with an established regulatory framework, as outlined in Table 1.1, creates a high barrier for projects in nations that are currently developing such frameworks. In Brazil, for instance, the regulatory framework is still under development by the parliament with involvement from various stakeholders. It is difficult to predict whether the final text to be approved will meet all the requirements stipulated in Table 1.1. Therefore, it is important that the methodology allows the project proponent to ensure these safeguards even if the national framework does not specify such a requirement. It is essential for methodologies like this to be adaptable across various jurisdictions and tailored to fit the regulatory landscapes of individual countries, rather than serving as additional hurdles.	The permanence and storage security has been linked to robust regulatory environment in several studies (see section 8.2 in the methodology). Therefore, Puro.earth considers it vital that a robust regulatory environment is already in place for projects eligible under this methodology. Puro.earth considers the provisions in rule 3.2.11 as important minimum requirements considering that several details in the methodology are implicitly or explicitly deferred to the local regulations.	No change
53	3.2.11	A priori jurisdictions should include Alberta, British Columbia, and Saskatchewan. These are three jurisdictions in Canada that have robust regulations that the Canadian Federal government recognizes. Information on which jurisdictions are outlined in Canada's Federal CCUS Investment Tax Credit legislation. The three provincal jurisdictions are Alberta, Saskachewan, and British Columbia, and we recommend that their frameworks should be considered robust enough. In fact, the oil and gas and CCS regulations in these juristictions are world class, if not world leading regulatory jurisdictions. Carbon Alpha would be happy to steer Puro Earth to the regulations for each jurisdiction that support this claim.	After revision, Puro.earth is satisfied that the provinces of Alberta, Saskatchewan and British Columbia satisfy the requirements mentioned in 3.2.11 c, and are therefore classified as robust jurisdictions	Changed rule 3.2.11 b to include Canada, provided that the injection operations fall under the jurisdiction of Alberta, Saskatchewan, or British Columbia.

Comment no	Rule or part	Comment	Response	Action
54	3.2.11 b	3.2.11.b specifies that the United States, member states of the European Economic Area Agreement, and the United Kingdom are recognized as having a priori recognition for robust legal framework for CCS. We recommend that Canada is included in this list for reasons stated below. Canada has one of the most enabling policy and regulatory environments in the world for carbon management adoption thanks to both federal and provincial policy and regulatory frameworks. Based on the jurisdictional authorities, provinces own their subsurface resources and hold primary responsibility for regulating CCUS activities, with Alberta, Saskatchewan, and British Columbia having regulations in place to support safe and permanent geological CO_2 storage. [5] These regulations cover pore space tenure acquisition, project permitting, management of long-term liability for CO_2 storage, as well as measurement, monitoring, and verification requirements. Other provinces, such as Manitoba, Ontario, and Nova Scotia, are taking steps towards developing enabling frameworks for CO_2 storage. Canada has a decades-long history of successful CCS implementation and has ascertained its intention to advance policies and regulations that enable the safe deployment of carbon management solutions. Notably, Saskatchewan served as a site for the international research program at the Weyburn-Midale CO_2 Monitoring and Storage Project. After over 20 years of operation, its sites are still being used and have successfully stored over 40 million tonnes of CO_2. [5] Natural Resources Canada (2023). Canada's Carbon Management Strategy. https://natural-resources.canada.ca/climate-change/canadas-green-future/capturing-the-opportunity-carbon-management-strategy-for-canada/canadas-carbon-management-strategy/	After revision, Puro.earth is satisfied that the provinces of Alberta, Saskatchewan and British Columbia satisfy the requirements mentioned in 3.2.11 c, and are therefore classified as robust jurisdictions	Changed rule 3.2.11 b to include Canada, provided that the injection operations fall under the jurisdiction of Alberta, Saskatchewan, or British Columbia.
55	3.2.	Clarify the meaning of "production facility" in a case the project has e.g. mutiple capture sites. Example: a project has 6 biogas plants in different locations, 1 storage sites, 2 capture techs. Is each biogas plant considered a production facility, or they all considered one together, under which conditions, etc ?	A definition of the Production Facility was added in section 2.2 of the methodology.	See new rule 2.2.1.
56	3.3.2 3.3.5 4th bullet	According to Norwegian law, <Company name> will own the CO_2 after they take delivery of it and when it is in the reservoir. <Company name> must be the owner of the CO_2 in the reservoir since they bear the liability for the CO_2 under the license. <Company name> Strongly requests to change this rule	Puro.earth considers the suggestion reasonable in cases where transfer of ownership is required by local regulations	Modified rule 3.3.2 to allow an exception to sole CO_2 ownership in cases where the transfer of ownership is required by local regulations (however, the right to the carbon removal aspect must always be retained to prevent double counting, as per rule 3.6.1). Further modified 4th bullet of rule 3.3.5. to require "proof of ownership" instead of "proof of sole ownership" and added a cross reference back to rule 3.3.2.
57	3.3.2	"the co2 removal supplier shall prove .. its sole ownership of the permanently stored carbon". Why does the CO_2 removal supplier need to be the sole owner of the stored carbon?	In general, Puro.earth considers it necessary to limit transfer of ownership because of e.g. liability reasons. However, the CO_2 Removal Supplier need indeed not be the sole owner in all situations (see above)	Modified rule 3.3.2 to allow an exception to sole CO_2 ownership in cases where the transfer of ownership is required by local regulations (however, the right to the carbon removal aspect must always be retained to prevent double counting, as per rule 3.6.1). Further modified 4th bullet of rule 3.3.5. to require "proof of ownership" instead of "proof of sole ownership" and added a cross reference back to rule 3.3.2.

Comment no	Rule or part	Comment	Response	Action
58	3.3.5	Please specify what is meant with "contractual agreement" (in the second bullet point), and when this contract needs to be provided as evidence; at the audit before issuance of the CORCS or in the pre-certification stage? As both the CO_2 removal supplier and CO_2 transport and storage providers have not taken FID yet, contractual agreements will be limited to non-binding heads of terms before FID. The CO_2 removal supplier needs to be pre-certified before being ablet to take its FID, so if more than non-binding contractual agreements are required for pre-certification of the CORCS, we see a potential chicken and egg situation.	"Contractual agreement" here refers to contracts or similar binding documents which show that the captured CO_2 is not destined to any other use than the permanent storage eligible under this methodology. Such documents are required at the audit stage, not necessarily in the pre-certification stage.	No change
59	3.4.2	What if the DAC facility is newly built, but the storage site is not? Similar question for when other infrastructure is re-used.	The primary determinant of the baseline scenario and project type is indeed the capture facility, and whether it is newly built or a retrofit, hence the initial naming and definition of scenarios. This remains as is in the updated text. However, the re-purposing of existing assets for either CO_2 transport or CO_2 storage should indeed allow for different accounting rules of supply-chain emissions (in particular embodied emissions and land use change emissions) and some ecological leakage considerations. Although this was the initial intention in terms of emission accounting, the text has now been clarified also in the baseline scenario description to allow for specification of sub-scenarios for the transport and storage infrastructure (distinguishing primarily between newly built for CO_2 or re-purposing for CO_2). It should be noted that in practice, when GSC activities scales, most new capture sites will be connected to shared networks of CO_2 transport and storage. Further rules in chapter 5 and 6 will be clarified to specify how the related accounting shall be done, in particular regarding the embodied emission amortization rules.	Section 3.4, clarification text was a added. Rules 3.4.2, 3.4.3 were amended to leave room for definition of sub-scenarios in the baseline, with respect to transport and storage infrastructure.
60	3.4.3	The options provided don't encompass all scenarios, which may make completing an audit difficult for some. For example, an operator building a biomass-to-CO_2 process onto existing feedstock processing and CO_2 storage infrastructure would not fit into A or B as the CO_2 storage sites are already built.	The primary determinant of the baseline scenario and project type is indeed the capture facility, and whether it is newly built or a retrofit, hence the initial naming and definition of scenarios. This remains as is in the updated text. However, the re-purposing of existing assets for either CO_2 transport or CO_2 storage should indeed allow for different accounting rules of supply-chain emissions (in particular embodied emissions and land use change emissions) and some ecological leakage considerations. Although this was the initial intention in terms of emission accounting, the text has now been clarified also in the baseline scenario description to allow for specification of sub-scenarios for the transport and storage infrastructure (distinguishing primarily between newly built for CO_2 or re-purposing for CO_2). It should be noted that in practice, when GSC activities scales, most new capture sites will be connected to shared networks of CO_2 transport and storage. Further rules in chapter 5 and 6 will be clarified to specify how the related accounting shall be done, in particular regarding the embodied emission amortization rules.	Section 3.4, clarification text was a added. Rules 3.4.2, 3.4.3 were amended to leave room for definition of sub-scenarios in the baseline, with respect to transport and storage infrastructure.

Comment no	Rule or part	Comment	Response	Action
61	3.4.3	Shouldn't a new built capture facility plus existing transport and/or storage infrastructure also eligible?	The primary determinant of the baseline scenario and project type is indeed the capture facility, and whether it is newly built or a retrofit, hence the initial naming and definition of scenarios. This remains as is in the updated text. However, the re-purposing of existing assets for either CO_2 transport or CO_2 storage should indeed allow for different accounting rules of supply-chain emissions (in particular embodied emissions and land use change emissions) and some ecological leakage considerations. Although this was the initial intention in terms of emission accounting, the text has now been clarified also in the baseline scenario description to allow for specification of sub-scenarios for the transport and storage infrastructure (distinguishing primarily between newly built for CO_2 or re-purposing for CO_2). It should be noted that in practice, when GSC activities scales, most new capture sites will be connected to shared networks of CO_2 transport and storage. Further rules in chapter 5 and 6 will be clarified to specify how the related accounting shall be done, in particular regarding the embodied emission amortization rules.	Section 3.4, clarification text was a added. Rules 3.4.2, 3.4.3 were amended to leave room for definition of sub-scenarios in the baseline, with respect to transport and storage infrastructure.
62	3.4.3 a	"Retrofitting of an existing biomass conversion facility: in this baseline, called bio-CCS Retrofit, it is assumed that the biomass conversion facility already exists (and generates useful bioproducts, while CO_2 is emitted to the atmosphere), but it is not yet equipped with a carbon dioxide capture unit" The retrofit baseline should allow for different operating conditions of the underlying bioenergy plant. For instance, in the <Company name> Power Station Development consent order for BECCS it was estimated that without CCS, the plant would operate on a merchant basis for 4,000 hours per year. With BECCS the plant would operate at baseload. In some situations, it may be that an existing bioenergy plant may otherwise close without CCS, particularly in regions such as the EU/UK where support mechanisms for unabated bioenergy are to finish over the coming years.	At this stage, we believe that the examples given would all be classified as "bio-CCS Retrofit". The different situations being described in the comment (e.g. 4000 operating hours becoming 7000 operating hours after retrofit, plant marginally operated and foreseen to shutdown now operating as baseload) would affect, under this baseline scenario, how market and activity-shifting leakage is addressed (possibly, leading to the conclusion that the retrofit does not entail negative energy leakage due to the increased output, but some feedstock land use leakage to consider).	No change
63	3.4.3 b	"Construction of a new biomass conversion facility: in this baseline, called bio-CCS New built, it is assumed that neither the biomass conversion facility, the carbon capture facility, the infrastructure for carbon dioxide transport, nor the carbon storage site are built." There may be instances where a transport and storage network are already in place, despite the plant and capture equipment being newly constructed.	The primary determinant of the baseline scenario and project type is indeed the capture facility, and whether it is newly built or a retrofit, hence the initial naming and definition of scenarios. This remains as is in the updated text. However, the re-purposing of existing assets for either CO_2 transport or CO_2 storage should indeed allow for different accounting rules of supply-chain emissions (in particular embodied emissions and land use change emissions) and some ecological leakage considerations. Although this was the initial intention in terms of emission accounting, the text has now been clarified also in the baseline scenario description to allow for specification of sub-scenarios for the transport and storage infrastructure (distinguishing primarily between newly built for CO_2 or re-purposing for CO_2). It should be noted that in practice, when GSC activities scales, most new capture sites will be connected to shared networks of CO_2 transport and storage. Further rules in chapter 5 and 6 will be clarified to specify how the related accounting shall be done, in particular regarding the embodied emission amortization rules.	Section 3.4, clarification text was a added. Rules 3.4.2, 3.4.3 were amended to leave room for definition of sub-scenarios in the baseline, with respect to transport and storage infrastructure.
64	3.4.4 a	"in the special case of energy facilities that have recently been converted from fossil fuel to biomass (100% conversion), the operational start of the facility is defined as the time when the conversion to biomass is completed." Further define operational start. This could be initial commissioning, or achievement of rated power output.	Comment was incorporated, using the notion of initial commissioning.	In rule 3.4.4 (normal case), the definition was added: "The operational start is defined as the initial commissioning date of the facility." In subrule 3.4.4a, a similar definition was added: "... the operational start of the facility is defined as the initial commissioning date of the converted facility."

Comment no	Rule or part	Comment	Response	Action
65	3.4.4 b	Very vague term. What kind of case by case analysis shall be performed? We must determine the eligibility and potential credits in advance before get issuing body involved.	To date, it is difficult to foresee how such situations of combined expansion and CCS installation shall be tackled without project-level information. Hence, the option left to discuss this between Puro.Earth and project proponents. Whenever, capacity expansion is "significant", the project could be allowed/required to use the New-built baseline scenario. Defining what significant is remains a challenge without concrete examples. Dialogue with Puro.Earth to inform on project specificities is welcome and common. In the future, we foresee that this rule will be refined (minor change).	No change (but future refinements foreseen in due time).
66	3.5.1	Please clarify "other binding obligations". Are these additional obligations related to public law regulations in the country of residence of the CO_2 removal supplier? Does this include or exclude private agreements?	This excludes private agreements. It is meant as a comprehensive inclusion of any mandatory requirements set by the host country that would mandate the activity.	No change
67	3.5.1	"To demonstrate additionality, the CO_2 Removal Supplier shall demonstrate that the geological storage activity is not required by existing laws, regulations, or other binding obligations." There are important considerations where existing bioenergy facilities are present in a jurisdiction that may in the future require CCS for e.g. access to state aid, but where an existing bioenergy facility has the option to close. e.g. Where a regulation requires BECCS plants accessing state aid to have CCS adopted (and where state aid is necessary for financial viability) the plant may fail the regulatory additionality test and therefore the underlying bioenergy facility would be decommissioned. In this situation, the removal activity does not otherwise materialise in the absence of certification, highlighting a fallacy in the additionality testing. There may be other instances where the underlying bioenergy generation is subject to binding requirements that CCS be implemented (e.g. government contracts), but where the BECCS would be economically unfeasible without VCM support for the removal. Suggest alternative text: "To demonstrate additionality, the CO_2 Removal Supplier shall demonstrate that the geological storage activity [and any co-located underlying activity e.g. bioenergy generation] is not required by existing laws, regulations, or other binding obligations."	We recognize this future scenario as possible. In general, it is recognized that with the increasing climate ambitions, some activities are likely to be mandated and they will become non-additional in the regulatory aspect over time. Adjustments of additionality rules may be required in the future, but an industry-wide discussion is needed to reach an international consensus on those adaptations. Puro.earth is willing to contribute to that discussion.	No change
68	3.6.1 4.4	For projects that have sent some volumes to LCFS markets and are reciveing RECS and Fuel credits for low CI fuels, why are the CORCS generated for all the volumes produced and then a corresponding amount of credits retired to account for the volumes that are not VCM eligible? Only generating/serializing the CORCs that can be traded (related to the non LCFS volumes) seems like a more fulsome risk mitigation against double counting than double issuing and making a corresponding retirement.	The monitoring reports for CORCs include the total injected volume regardless of which market the injection is intended for (intentions do not always materialize). From the total injected volume the projects then deducts the project emissions to get to net carbon removal and storage i.e. CORCs. The carbon removal markets, including Puro Registry, are transparent, and the verified gross and net removals are publicly available in the monitoring reports in the registry, as are also the retirements. Since LCFS does not have the same transparency for the wider public, we see that it is better to declare all volumes (injected and removed) here and then make the corresponding retirement for other purposes like LCFS in the carbon removal registry, so that it is visible to all parties.	No change
69	3.6.1 a	Will there be a possibility to share the CORCS generated between, for example, the DAC facility operator and the storage site operator? (even though one of them would be the CO_2 Removal Supplier)	Yes, you are free to move the CORCs to another account after they have been issued. The CORCs will be issued to one Puro account registered for the Production Facility.	No change

Comment no	Rule or part	Comment	Response	Action
70	3.6.1 b	Please explain what type of renewable energy certificates are meant and if CORCs can be issued for the additional removal of biogenic CO_2 compared to the baseline situation. In the case of our waste to energy plant, we currently receive renewable energy certificates (Guarantees of origin) because part of the electricity produced is considered renewable, based on the incineration of waste originating from biomass (baseline scenario). As we will install CCS in the future scenario, we will capture and store part of the (both biogenic and fossil) CO_2 that is currently emitted. So an additional carbon removal of biogenic CO_2 (or "negative emissions") takes place. As this is additional to the baseline scenario, we assume that CORCs can be issued (under the assumption that the renewable energy certificates remain unchanged compared to the current situation).	Yes, CORCs can be issued even when renewable energy certificates are also issued by the same facility. However, if CORCs are issued and sold on the VCM, the supplier is not allowed to double-count its CO_2 removal by issuing both CORCs and counting the CO_2 removal in e.g. the carbon footprint of the renewable energy or to sell the renewable energy certificates with associated CO_2 removal claims (unless the CORCs have explicitly been retired for this purpose). This is to avoid double-counting/claiming of the CO_2 Removal.	No change
71	3.6.1. b	How can this be proved?	For more details on prevention of double counting, please see Puro Standard General Rules. Specifically, rule 3.5.6.1 of the General Rules v. 4.0 state that "The CO_2 Removal Supplier is responsible for ensuring that double use or double reporting of the CO_2 Removal within the supply chain is prevented by contracts, statements, or other measures. ..."	No change
72	3.6.1 c	I Understand the need to cover the double counting topic. however, this is getting into allowable use of credits and claims. Other standards are meant to govern that activity. The clause seems out of place an potentially in conflict with some other corporate reporting standards. Possibly replace with commentary such as parallell or dual accounting is acceptable but double claiming by two private entities is not accpetable	Rule 3.6.1 c does not limit allowable use of credits, it merely require disclosure of CORC issuance.	No change
73	3.7.1	We support the intent behind this indicator. Allowing mass balancing will help operators adopt this guideline by bringing feedstock suppliers online gradually. We also support the creation of a separate central document for sourcing criteria, as this makes it clear what is required for each feedstock regardless of downstream processes (see specific comments on this document later).	We thank the commenter for the support. Mass-balancing is allowed according to the separate document.	No change
74	3.7.3	catogrizartion of biomass waste feedstock may be challenging for projects in that the composition may change regularly and may be hard to track to the level of detail being asked. What si the objective here and is there anoither way to achieve it? i.e regular lab testing for biogenic content, monthly?	In practice, we foresee that most facilities processing biomass would process primarily one of the categories, with the exception of solid waste incinerators which may process various kinds of waste. The category A was revised (as per comment #209) and now includes more waste feedstocks commonly processed by solid waste incinerators. The purpose of those categories is not per see the determination of the biogenic content (tackled elsewhere) but rather the traceability and sustainability of the biomass sourcing. For waste categories, where no to little sustainability criteria need to be demonstrated, and where traceability information is very similar, projects will simply need to maintain records of the biomass deliveries with sufficient traceability information (as defined in the separate document).	No change (except for naming of the categories, as per comments received on the Puro Biomass Sourcing Criteria).
75	3.7.3	Biomass sourcing criteria. We assume this list of categories are not extensive and that more cathegories will be added in the future. Therefore we would suggest to add a new category "ID Q" Other sustainable biomass feedstocks. Defined: Other sustainable biomass sources, not purposly developed/produced to generate CORCs, whick is approved by Puro on a case to case basis. Idea behind: There are most likely many more feedstock categories, than the ones defined A-O, that could be sustainable and should be eligible, therefore Puro should have a general category that opens up for these sources, for a case-to-case evaluation, until next revision of Puro Biomass Sourcing Criteria	The categories (A-O) were designed to encompass most if not all types of biomass feedstocks usable for CDR, with a focus on whether their traceability and sustainability criteria are subject to certain specifics, as opposed to making a detailed classification (e.g. Eural codes, NTA8003). Note that category A was revised (as per comment #209) and now includes explicitly more waste feedstocks commonly processed by solid waste incinerators. The separate Biomass Sourcing Criteria are meant to be possible to revise as needed in a swift manner, and clarifications will be provided on how certain feedstocks shall be classified. Hence, the need for a category Q is not needed at this stage.	No change (except for naming of the categories, as per comments received on the Puro Biomass Sourcing Criteria).
76	3.7.3 o	Change to: O. Cultivated algae or shellfish or harvested aquatic plants and related derivatives.	At the moment, no methodology in the Puro Standard relies on CO_2 sequestration via mollusks/shellfish. Hence, the addition suggested to the Puro Biomass Sourcing Criteria is not relevant. It may be considered in the future, if such methodologies are developed.	No change

Comment no	Rule or part	Comment	Response	Action
77	3.7.3 m	"Any biomass from palm tree plantations (which are not considered forests but agricultural plantations), e.g. palm oil and its fractions, empty fruit bunches..." <Company name> is concerned about inclusion of palm oil without sufficient protections to prevent ILUC. E.g. if a BECCS facility used palm oil that displaced a pre-existing energy use, the palm oil can be expected to meet the sustainability and leakage requirements (due to the new environmental fate being better than the prior use), but there is a significant risk of ILUC materialising due to the increased market demand imposed.	The comments received in chapter 6 now address the concerns raised here.	See changes to section 6, regarding leakage in the land sector, and specific rules for feedstocks with high iLUC risks.
78	3.8	We support this section as written. It is comprehensive, fair, and clear. This section will help operators ensure they are considering and mitigating the environmental and social impacts of their project, just as they should and as this guideline intends.	We thank the commenter for the support	No change
79	3.8.3	We read that this assessment is to be performed for the geological storage activities. Then we would suggest to have a dedicated standard for storage providers, so they can be pre-approved by Puro, to aviod that all the Removal Suppliers needs to be repeating the same job over again	The suggestion to implement a dedicated standard for storage providers is not feasible to realize in the time allotted for completion of this draft. Note that rule 3.8.3 also allows the utilization of other (pre-existing) documents to fulfil the requirements of the rule, which could be utilized to prevent repeated work.	No change
80	3.?.?	Add: requirements for Positive Sustainable Development Goals (SDG) impacts description	The addition of these requirements is mandated by Puro Standard General Rules section 1.3.5.2 ix	Added subsection 3.9 (containing the sole rule 3.9.1) to align the SDG impacts requirements with those of the Puro Standard General Rules.
Section 4: Quantification of CO_2 Removal Certificates (CORCs)				
81		We support Puro's general principles for quantifying CORCs from projects, as expressed in Section 4 of the methodology. However, we believe that there may be a need for further clarification on the sections described below.	We thank the commenter for the support, and address the further comments separately below	No change
82		Consider hold back or discount factor or buffer pool contemplated to be set aside for reversal events or revocation.	The CO2 Removal Supplier that has registered the removal activity i.e. the Production Facility, is responsible for all obligations related to that facility, including liability for any reversals. Puro Standard rules and methodologies are rigid and only lead to issuance of CORCs that are securely stored for long-term. In the methodology rules, all reversal pathways are eliminated by site selection or accounted for and deducted before the issuance of CORCs. Should, after all these precautions, a reversal happen there is a tiered mechanism for the CO2 Removal Supplier to fully compensate for the reversal with CORCs from the same facility same year, next years or from the market with the same durability. The CO2 Removal Supplier is free to manage this with hold backs of buffers or through agreements with third parties like insurers, but it does not remove the liability from the CO2 Removal Supplier. Puro.earth is expecting international approaches to develop in this area in the future, and our rules would be adapted to the best practices.	No change
83	4.2.1	So, the amount of CO2 stored / injected can be measured over a maximum of one year to generate a certain amount of CORCs from that period. Should the associated emissions (Eproject; etc) also be calculated over that year? Please clarify which indicator is monitored over what period.	Details on calculation and accounting for associated emissions are given at length in section 5 and 6.	No change
84	4.2.2	How frequently would these samples need to be taken? Recommend setting a baseline and remeasuring at regular intervals (annually? Every 5 years?) with ASTM D6866 and then reporting based on mass of inputs from biogenic and non-biogenic sources.	Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Requirement to monitor at least semi-annually has been added in the current draft (see rule 7.4.2).	No change

Comment no	Rule or part	Comment	Response	Action
85	4.2.3	Utilizing synergies through co-location should be recognized. For example, utilization of previously unutilized heat from a facility should be recognized as a credit for the DAC or BECCS facility. Please confirm if this is outlined in the referenced ISO 14040/44 standards.	The rule 4.2.3 simply requires the supplier to conduct an LCA for determination of the supply-chain emissions (E_project), first following the scope defined in Section 5, and then the general LCA principles of the stated ISO. The stated ISO does not specifically refer to how co-location should be handled in the context of GSC activities. The use of previously un-utilized heat is in general possible; however, how it is tackled in the project emissions shall be specified in the methodology. In any case, the use of a "previously un-utilized" energy source never results in a "credit" i.e. avoided emissions, but can result in a climate footprint of said energy source that is lower than the one of a comparable non-waste energy source; hence, creating an incentive for so-called synergies and process integration. This said, as per Puro's interpretation of the ICVCM requirements to not incentivize fossil-fuel related activities (which is also reflected elsewhere in the methodology, cf. no EOR, no coal-biomass power plants), it seems relevant to clarify how the climate footprint of any "waste" or "previously un-utilized" fossil energy/material product used in the CCS process shall be quantified.	A related rule was added in Section 5.2, specifying the accounting rules for any energy product derived from fossil fuel, whether it is heat or electricity, whether previously used or not (so called waste heat). This rule specify that the footprint of such energy source can never be set to zero.
86	4.2.4	At what point in time wrt the monitoring period is the amount of CORCs determined? After, during, or before?	After, as data from the monitoring period is required to quantify CORCs	No change
87	4.2.5	In the event of CO_2 storage reversal, from which batch of CORCs should these be subtracted? Please clarify.	Please refer to Puro Standard General Rules rule 6.7.6 for more details on relevant procedures	No change
88	4.2.7	"The data records shall be kept in a reliable data system." Can you provide more detail on what you consider to be a reliable data system.	There are no detailed requirements on technical specifications of the data system. Basically, this refers to a modern digital data storage and management solution suitable for similar industrial settings (ensuring e.g. adequate data protection, back-ups, etc.)	No change
89	4.2.?	New rule: Define the crediting period as per Production Facility Audit for a 10-15-year period, renewable.	Puro.earth considers extending the default crediting period (in line with Puro Standard General Rules 2.4.1) in this methodology reasonable given the long operating timescales associated with typical CCS facilities	Added rule 2.2.2 to change the crediting period to 15 years, renewable twice (for a total of 45 years)
90	4.2.?	Taken from paragraph 2.4.1 of v4.0 of the Puro Standard: "The first date of the first Monitoring Period marks the beginning of a Crediting Period. The Crediting Period lasts 5 years unless otherwise stated in the applicable Methodology. The Crediting Period can be renewed twice by successfully undergoing a new Production Facility Audit. The Crediting Period shall not overlap with another Crediting Period." The crediting period contained in the Puro Standard is too short to give certainty to high capex projects, and is restrictive for removals which often begin at a baseline of no removals and have almost infinite climatic benefit. That being said, it is noted the Standard allows for the "applicable methodology" to contain unique crediting period provisions. This does not appear to be the case in the consultation text. The suggestion is for the methodology to adopt one of either: (i) a 15 year crediting period renewable twice, consistent with Article 6.4 rules, or (ii) no limited crediting period at all, consistent with the direction of travel for methodologies under the EU CRCF.	Puro.earth considers extending the default crediting period (in line with Puro Standard General Rules 2.4.1) in this methodology reasonable given the long operating timescales associated with typical CCS facilities	Added rule 2.2.2 to change the crediting period to 15 years, renewable twice (for a total of 45 years)
91	4.3.1	Is the unit of the CORC in tCO_2e or in tCO_2? Or perhaps it does not have a unit?	The unit would be tCO_2e, since factors such as Eproject can include other GHGs than CO_2, and hence are converted to tCO_2e for quantification	No change

Comment no	Rule or part	Comment	Response	Action
92	4.4.1	Some comments on this formula: - C injected should include a timeframe. Without time this parameter has no meaning. - E released. Be aware of potential double counting due to ambiguous phrasing. Accindental leaks might also be included under E leakage from formula 4.1. - F eligible and F supplier might be simplified.	According to Puro Standard General Rules, CORCs are issued based on an output review for a given monitoring period, and hence the timeframe of quantification is said monitoring period. We do not share the commenters views on ambiguous definition of Ereleased. In rule 4.4.1, Ereleased specifically mentions "prior to final geological storage". Rule 4.4.4 further specifies "from equipment on the surface", and that the term shall not include emissions from the storage reservoir, which are quantified under Ereversal. We further see no obvious ways to significantly simplify the terms in the equation.	No change
93	4.4.4 b 4.4.6 b	"Injection site operator" is not defined previously in the standard - what is this role in relation to the CO_2 Removal Supplier and the other roles defined?	This is a misprint. "Injection site" should rather be "storage site" for consistency.	Replaced "injection site" with "storage site" in section 1.3, rules 4.4.4 b and 4.4.6 b, Table 4.1, rules 7.2.4 and 7.6.3, and section 8.2
94	4.4.4	In the case where F(supplier) is not 100% (CO_2 stream is mixed with other CO_2 streams), shouldn't E(released) be: E(released) x F(supplier). The supplier of the CO_2 Stream should only be responsible for their fraction of any release.	We consider the suggestions a reasonable adjustment to make.	Changed rule 4.4.4 according to include the scaling factor Fsupplier according to suggestion.
95	4.4.5	Where does the amount of atmospheric CO_2 need to be measured? At the injection site?	Atmospheric CO_2 does not usually need to be measured as per rule 4.4.5 a. For biogenic CO_2 in general, as per rule 7.4.2, monitoring must be done from the captured stream (at the capture site).	No change
96	4.4.5 4.4.6	Can this be simplified towards having a single parameter that tracks the amount of CO_2 for the specific removal supplier that is stored?	Assuming this refers to combining Feligible and Fsupplier. Both of these parameters are necessary for quantification, and while it might be possible to combine them into one, we consider it to be clearer to have separate variables for separate effects for increased data granularity.	No change
97	4.4.5	We believe it should be possible to allocate biogenic and fossil carbon in mixed streams. If we capture from a CO_2 stream being 50% biogenic/50% fossil, we get a CO_2 Stream being 50/50 also. Then we should be able to tag one portion of the stream as 100% biogenic and another portion as 100% fossil. Looking at chapter 4.4 Carbon Dioxide Stored (Cstored), we would argue it should be allowed to define the eligible fraction (Feligible) to be 100% in this case, if we can document we store less than the available biogenic volume. The fossil fraction can either be emitted or it could be put into a fossil based product. See illstration to the right --> An equivalent to this: if a plant with mixed emission is under ETS, they invests in CCS capacity corresponding to 100% of their fossil emission (for example 50%). They capture and store this into a geological storage. Should they then need need to pay ETS if they have stored a volume corresponding to all their fossil. Under the Renewable energy directive (RED II/RFNBO delegated act) - which is relevant for production of e-fuels with biogenic CO_2 as a raw material - the EU Commission has confirmed it is possible to do allocation when we do partial capture from a mixed CO_2 stream. The commission argue by using the principle of mass balancing, one can have a pure biogenic stream coming from a mixed source. See details below. We hope that Puro could align with the EU Commission on this matter. Source: https://energy.ec.europa.eu/document/download/21fb4725-7b32-4264-9f36-96cd54cff148_en?filename=2024%2003%2014%20Document%20on%20Certification.pdf Why is this important? For waste incineration, if we have an eligibility factor of 50%, we will need to double our CORC price to achieve the same income. This would be difficult. In worst case scenario, this would incentivise projects to go for 100% utilization, in stead of routing a portion towards storage.	In most situations, Puro usually develops its methodologies to be in-line or at least compatible with other regulations, e.g. the RED II/III. The management of mixed CO_2 streams is indeed of crucial importance for waste-CCS project (due to the usually high share of fossil-CO_2, typically 50%), but it should be noted that this topic applies in fact to all types of bio-CCS projects (which can have few % of fossil-CO_2 mixed in the biogenic stream). Introducing the accounting rule described by the commenter would ultimately allow waste-CCS operators to either invest in smaller capture module than their operational capacity ("capturing only the biogenic fraction"), and let operators decide freely on how to allocate the captured biogenic and fossil CO_2 between storage and utilization; mutually affecting the generation of CORCs or renewable product from CCU (e.g. e-fuels). Ultimately, operators would have the option to financially optimize their operations, depending on variable prices, also affecting additionality assessments, beside carbon accounting rules. While this is an important matter for waste-CCS, Puro believes that at this stage, the rules shall remain as originally written and not allow for such accounting fractionating of biogenic/fossil CO_2, as this is since as most conservative and most straightforward. In the future, revisions might be considered.	No change

Comment no	Rule or part	Comment	Response	Action
98	4.4.5	<Copied from the commenter's feedback to rule 3.2.5>: Mixed CO_2 (biogenic + fossil) is eligible provided that the non-eligible fraction of injected CO_2 is reliably quantified and deducted from the reported Output volume --> We see a problem with the current definitions used in 4.4.5. The current way of reporting fossil CO_2 for waste to energy plants in the Netherlands is via weighbridge quantification and using national CO_2 emission factors for every type of waste. From 2028 the waste to energy plants will become part of EU ETS and it is possible that the current way of measuring/reporting becomes the standard for EU ETS reporting as well. Rule 4.4.5b however requires to measure at the stack. This will be a problem for an auditor as the total of biogenic and fossil CO_2 will not add up to a 100% when measured in two ways. Our suggestion is to add a rule 4.4.5.c, see details in comment on section 4.4.5. Add: (see comment above about section 3.2.5): "4.4.5 c. If the mixture has been determined for EU ETS and this mixture has been audited and accepted by the CO_2 Removal Supplier National ETS authorities, then this mixture may be used for eligible CO_2 (F eligible) instead of additional measurements as per subrule b."	We appreciate the feedback from the commenter, and the forward looking inputs regarding the EU ETS. As the EU ETS regulation specific to waste incineration is not yet official, it is difficult for Puro.Earth to align with this regulation at this stage. It is not a problem if the method currently used in the Netherlands (weighbridge quantification and default factors) is not yielding the same results as stack quantification (currently required by Puro). Auditor would understand that stack quantification is more accurate for CORC quantification. The rule 4.4.5 might be changed in the future, whenever the EU ETS regulation is implemented for waste-CCS.	No change
99	4.4.5	Each of our biomethane facilities maintains ISCC EU certification, ensuring compliance with the sustainability criteria set forth in Directive (EU) 2018/2001 (REDII) and its successors. This certification guarantees that the entire supply chain, from the initial sourcing of organic biomass to the final application of biomethane, undergoes annual third-party audits to affirm its sustainability credentials. See ISCC EU – ISCC System (iscc-system.org) Our query pertains to the co-digestion processes of various biomasses of organic origin, such as animal manure, straw, glycerine, molasses, industrial organic waste fractions, and energy crops, resulting in the production of biomethane. These processes can potentially and depending on feedstock availability integrate both certified (sustainable) and non-certified (non-sustainable) biomasses. While sustainable biomasses and the resulting end-products are traceable and verified for sustainability through Proofs of Sustainability (PoS) at each stage of the supply chain, we seek to understand the implications of incorporating non-certified feedstocks in terms of the issuance of CORCs. Since the methodology does not clearly defines mass-balancing principles that guide the determination of CO_2 fractions from co-digestion per feedstock in puro.earth methodology, we propose to refer to ISCC EU (or similar) mass balancing to be applicable to calculate fractions of CO_2 from different feedstocks in co-digestion for projects within the legislation of the EU.	Rules 3.7.1 and 3.7.2 already state that only the share of CO_2 from eligible biomass feedstock shall be included in the CORC quantification, while the share of CO_2 from non-eligible biomass feedstock shall be excluded (via the parameter F_eligible) and is treated as other non-eligible CO_2 sources. Rules 3.7.1 and 3.7.2 were already referencing to rule 4.4.5, but rule 4.4.5 did not explicitly mention the share of eligible / non-eligible biomass. Note that in the content of the commenter, non-certified biomass does not necessarily mean non-eligible. Certification is only one option of demonstrating eligibility of the feedstock as per the Biomass Sourcing Criteria. Mass balancing is thereby allowed, for determination of eligibility of the biomass used. Clarification on this was added in the biomass sourcing criteria as per reply to comment #233 (below).	Rule 4.4.5 was edited to reflect the need to account for the share of eligible biomass feedstock, for bio-CCS projects. Further edited rule 7.4.2 (requirement to monitor the share of eligible CO_2 in the stream) to accommodate the changes made to rule 4.4.5.

Comment no	Rule or part	Comment	Response	Action
100	4.4.5	According to 4.4.5.b, and 7.4.2, some CO_2 sources are subjected to radiocarbon analysis through ISO 13833 or ASTM D6866 methods at least bi-annually. It is worth noting that the test is most applicable to materials containing short-lived renewable carbon which recently ceased to be within an active respiratory or metabolic system in equilibrium with percent moder carbon (pMC) CO_2 in the air (unless the test is on CO_2 from DAC). [6] Indeterminate errors from past living components such as forestry products can be dramatic and cannot be accurately quantified, unless the results are qualitatively assessed based on the magnitude of the product's pMC value and factual knowledge of the source components; test results, especially such as those from projects using woody biomass, should apply the accurate atmospheric correction factor [7]. [6] ASTM Standard D6866-24, 2024, " Standard Test Methods for Determining the Biobased Content of Solid, Liquid, and Gaseous Samples Using Radiocarbon Analysis," ASTM International, West Conshohocken, PA, 2024, DOI: 10.1520/C0033-03, www.astm.org [7] For example, the biobased carbon content of the core part of 80-year-old cedar wood was measured to be 142%. (Funabashi, M.; Ohara, K.; Kunioka, M. Accuracy of Biobased Carbon Content of Determination of Plastic Products and Related Materials by Accelerator Mass Spectrometry. Polymer Degradation and Stability 2014, 109, 385–392. https://doi.org/10.1016/j.polymdegradstab.2014.05.018.)	It is well known that older samples can show pMC values of > 100 % due to the increase of 14C concentration in the atmosphere as a result of thermonuclear weapons testing (mainly between 1952 and 1963). Standards such as the ASTM D6866 already contain procedures for the application of an atmospheric correction factor. The ASTM D6866 further requires the final report to contain a justification of the selected correction option (where applicable). In some specific cases, the bomb carbon effect from past living components can be pronounced, as demonstrated by the commenter's example. However, the bomb carbon effect has since radically diminished. In the case of the 80-year-old cedar, the sample for analysis was taken by sanding the core section of a wood block. However, in a typical case, the forestry products utilized in the context of this methodology would not consist of predominantly of core wood, but of much younger material (e.g. branches, clippings, residues), where the effect of bomb carbon is not nearly as pronounced in the first place. In summary, while the overall point raised by the commenter is valid, Puro.earth believes that the current procedures are sufficient to account for this effect, especially in the foreseen use cases in the context of this methodology. However, added a note for awareness, explaining the effect in the relevant rule.	Added a note to rule 4.4.5 about the bomb carbon effect and its relevance to measurement accuracy.
101	4.4.6	Fsupplier is something that is very important, but can be hard to track. Consider the following: 5 capture projects deliver CO_2 to a onshore export terminal, the same is happening at 5 other locations, having 6 export terminals in a joint system. One ship is collecting this CO_2 from the export terminals and then delivers this to a storage site (e.g. Northen Lights). The storage site received 2 ships that day and is continusly injecting a certain volume to storage. How to calculate Fsupplier for all of the different capture projects?	The calculation of Fsupplier would indeed be convoluted in the example described, but not impossible given that quantities of CO_2 delivered to the various sites can be measured & documented. Puro.earth agrees that the determination of Fsupplier can in some instances be complicated, but sees no readily applicable simpler alternatives.	No change
102		Project Emissions , then it states that Eproject is the total life cycle emissions arising from the whole supply chain of the activity (capture + transport + injection) – but how is this actually to be performed ? Should one calculate the projected entire LC emission of the entire project from "cradle to grave" (all way into future including closure and post closure emissions) and then distribute these total LC emissions evenly on the prognosed total injection volumes ? or should this only be accumulated LC emissions up to current period (and where only include difference of these emissions from previous monitoring period ? (in which case the Eproject will be much higher during early part of injection operations and will drop away very quickly...) ?? Seems to be this last alternative given the wording in 4.5.3 ?? If it is the former, then need better description of how to distribute these volumes over the injection period of the project (and how updates from actual emissions are factored into updates). Perhaps this should be explained better in the document ?	The questions raised in the comment are addressed in section 5 of the methodology. In practice, the embodied emissions are determined at start of the crediting period (using adequate project data and/or assumptions), and these emissions are then amortized annually accordingly as per the rules in section 5.2. In turn, the operational emissions are calculated annually based on actual data from project operations.	No change.
103	4.5.1	Please define more detailed system boundaries. 'the whole supply chain': what is included?	As stated in the following rule (4.5.2), further details are provided in section 5.	No change
104	4.5.1	General comment: please list system boundaries etc. within the same section as the formulas. Going back and forth is confusing.	Avoiding cross references in a document as complicated as this is not feasible. While the goal is to avoid confusion as much as possible, including all necessary background information in each formula separately, would lead to a huge amount of redundant text and make the methodology much longer.	No change
105	4.5.1	What are the timelines for these emissions? For the largest part, material (embodied) emissions will result from the construction of building / machinery. At what point in time do these need to be taken into account? A suggestion is to relate the embodied emissions to the total lifetime of the machinery and the total amount of CO_2 that it can capture.	Amortization of embodied emissions are addressed in detail in section 5.2 (see esp. rule 5.2.15)	No change
106	4.5.1	What emissions need to be taken into account for E injection? Please clarify to avoid potential double counting.	Emissions included in Einjection are detailed in rule 5.2.6 c	No change
107	4.5.1	"Total life cycle emissions arising from the whole supply chain of the geological storage activity" Geological storage does not necessarily equate to carbon removal. This should rather be "Total life cycle emissions arising from the whole supply chain of the carbon removal activity"	The term "geological storage activity" refers back to the eligible activity certified in this methodology (end-to-end, from capture to storage). The suggested formulation "carbon removal activity" is correct, but not specific to this methodology.	No change

Comment no	Rule or part	Comment	Response	Action
108	4.6.1	In the description you mention 'negative economic leakage', in the variable description it's 'negative ecological leakage'. Please clarify.	This is a mistake. Text should instead read "negative ecological, market, and activity-shifting leakage"	Changed "negative economic leakage" to "negative ecological, market, and activity-shifting leakage"
109		should there be a clause for cases of large leakage to effect that large leakages (need to be defined in document) would require independent third-party review/QC/verification to ensure quality of the estimates?	The quantify of CORCs received is always independently verified by a 3rd party auditor as part of the Output audit (see Puro Standard General Rules for details)	No change
110	4.7.3	[note. The quotes in italic are not quotes from the methodology, but from the commentor] "The GHG emission reductions or removals from the mitigation activity shall be permanent, or if they have a risk of reversal, any reversals shall be fully compensated." "The CO_2 Removal Supplier shall quantify the total amount of CO_2 released during each reversal event in which the atmospheric re-emission has occurred." It would be useful to grant scope in the methodology for the liability for compensation of reversals to be transferred to another party, i.e. for the liability not to simply sit with the "removal supplier". This could be achieved through contractual obligations. The effect would be to retain the obligation for compensation of removals but to recognise the distinction between parties such as the "removal supplier" and the transport and storage operator.	The CO_2 Removal Supplier that has registered the removal activity i.e. the Production Facility, is responsible for all obligations related to that facility, including liability for any reversals. Puro Standard rules and methodologies are rigid and only lead to issuance of CORCs that are securely stored for long-term. In the methodology rules, all reversal pathways are eliminated by site selection or accounted for and deducted before the issuance of CORCs. Should, after all these precautions, a reversal happen there is a tiered mechanism for the CO_2 Removal Supplier to fully compensate for the reversal with CORCs from the same facility same year, next years or from the market with the same durability. The CO_2 Removal Supplier is free to manage this with hold backs of buffers or through agreements with third parties like insurers, but it does not remove the liability from the CO_2 Removal Supplier. Puro.earth is expecting international approaches to develop in this area in the future, and our rules would be adapted to the best practices.	No change
111	4.8.3	I'd suggest clarifying what constitutes official sources. We would advocate for including sources from government sponsored research, such as papers from national labs that reflect latest science. An example would be this paper on biomass emissions factors in the US: https://pubs.acs.org/doi/full/10.1021/acs.est.1c04301	Official sources are primarily governmental agencies or international agencies that public LCA datasets. Note however that even factors from such sources do not necessarily include upstream and downstream emissions (if they are meant for inventory purposes, they then only include direct activity emissions in most cases). Hence, such factors often need to be completed by factors from other sources to include upstream/downstream emissions. Data from research papers, although peer-reviewed and government sponsored, are not automatically suited for use in CORC quantification: one shall verify that the scope is complete, applicable to the local project, and performed using adequate modelling (e.g. in research publications, LCAs can be consequential, attributional, prospective, etc.). This section is primarily on uncertainty quantification relating to the LCA. It was also clarified that for emission factors from other sources, the uncertainty is 20% unless an uncertainty has been determined by the publisher of the emission factor.	Clarification on official sources. Added: (e.g. governmental, intergovernmental). Added option to determine uncertainty of an emission factor: "a flat uncertainty of 20% of the value of the emission factor shall be assumed, unless an uncertainty has been determined by the publisher of the emission factor."
Section 5: Assessment of life cycle greenhouse gas emissions				
112		We support Puro's approach in utilizing a Life Cycle Assessment framework to determine the net amount of CORCS generated for a geologically stored project. However, we do not agree with the embodied emissions accounting method.	Please see our answer to #124. In case this does not address your concerns, please reach out to us to better understand what in the embodied emissions accounting you do not agree with.	No change

Comment no	Rule or part	Comment	Response	Action
113		We support the use of LCA for determining the overall net removal benefit. However, we disagree with the boundaries chosen and approach to attribution. - LCA should include critical components (land impacts, supply chain emissions) upstream of the CO_2 capture, regardless of circumstance. Even retrofit projects should consider such impacts in making a credible claim of a carbon removal to avoid situations where enduring emissions (often Scope 3) in the biomass supply chain/land sector outweigh the amount of carbon captured and stored i.e. situations where the full value chain does not deliver an overall removal of atmospheric carbon. Alternatively, the methodology should allow for means to distinguish between removal units which have fully counter-balanced those upstream emissions allocated to BECCS co-products and those which have not. Such removal units could have specific labelling to ensure that these credits are distinct from those where upstream emissions have not been fully compensated. This could either be done through 100% allocation to the net carbon removal or a flexible allocation approach combined with a connected retirement or buffer system. The latter may be more desirable to allow allocation rules to follow existing regulatory or voluntary standards that may apply to the project proponent. Embedding such an approach would further ensure conservative estimation, appropriate product differentiation and labelling for customers, GHG inventory alignment (i.e. allows for neutralisation of asset-associated Scope 3 emissions) and would maximise the chance of delivering claims aligned to the EU CRCF. Such an approach is all the more pertinent with the announcement that SBTi is considering use of credit claims for Scope 3 abatement. i.e. it is an integrity risk if credits are purchased by a business to neutralise its Scope 3 emissions, but where the asset generating credits does not already have its Scope 3 emissions neutralised.	The calculation of CORCs (section 4) follows a life cycle approach (section 5, Table 5.1) that includes both upstream and downstream impacts. As such, the CORCs by definition represent net removals that have already accounted for the emissions of processes and infrastructure needed to capture, transport, and store carbon from the atmosphere. When it comes to multi-functional processes, attributing emissions to co-products is a common procedure in LCA. For increase transparency, we agreed that is necessary to disclose the supply-chain emissions of the biomass even if they are not attributed to the CO_2 removal but to the primary co-products.	Rule 5.2.8 on biomass supply-chain emission attribution was edited to require disclose on those emission calculations and their explicit attribution in the LCA model provided.
114	5.1.1	"The CO_2 Removal Supplier must conduct a life cycle assessment (LCA) for the geological storage activity" Geological storage does not necessarily equate to carbon removal. This should rather be "The CO_2 Removal Supplier must conduct a life cycle assessment (LCA) for the carbon removal activity"	The term "geological storage activity" refers back to the eligible activity certified in this methodology (end-to-end, from capture to storage). The suggested formulation "carbon removal activity" is correct, but not specific to this methodology.	No change
115	5.1.3	European Standards should not apply to US projects	Comment seems to refer to the current version of the GSC methodology instead of the public consultation draft. Relevant sections (on biomass sustainability) have been significantly updated in the current draft	No change
116	5.1.3	This is semantics; but: only reporting on carbon footprint does in fact not qualify as an LCA. It is then simply carbon footprint accounting / analysis.	Carbon foot printing may be done following within an LCA approach.	No change
117	5.1.4	Am I reading this right -so emission facyors used in Alberta for complinace reporting set by the government of Alberta are not accpetable? Seems like there should be room for this kind of emission factor	It is possible to use such emissions factors. If necessary, they may need to be completed with other emission factors for upstream/downstream emissions. More precise answer depends on the specific factors used.	No change.
118	5.1.5	It is unfeasible to present disaggregated GHG emission calculations for the different life cycle stages.	Puro provides a LCA inventory checklist and other templates to assist in this process. Please contact our team to learn more on how we facilitate this process.	No change.
119	5.1.7	Agree! Be aware that this is a term used in the ecoinvent database. This is just one example of a database that can be used. Not all databases work in the same way (ie with the same terminology).	None.	No change
120	5.1.8	"Determination of an appropriate allocation rule shall follow principles from ISO 14040/44" The methodology should specifically exclude any system boundary expansion approach that would result in crediting of avoided emissions (e.g. crediting of fossil fuel/power displacement). We also recommend the methodology be more prescriptive on allocation to avoid bias (e.g. selecting an approach that diverts emissions away from the carbon removal towards the coproducts.)	Comment was incorporated.	Rule 5.1.8 was made more specific, focusing on the partitioning rules (and not on avoided-burden approach).

Comment no	Rule or part	Comment	Response	Action
121	5.2.2	"The spatial boundaries of the LCA must be defined. This includes: the areas from which biomass is sourced (for any biomass-based capture activity), the location of the capture site(s), the main transport routes, as well as the location of the storage site(s)." There is a conflict here with the diagram laid out in 5.2.4., which ignores the areas from which the biomass is sourced. We would suggest the following boundaries. The spatial boundaries of the LCA must be defined. This includes: the areas from which biomass is sourced (for any biomass-based capture activity), locations in the upstream supply chain (e.g. biomass processing sites and transport routes), the location of the capture site(s), the main CO_2 transport routes, as well as the location of the storage site(s).	Thank you for the clarification suggestion. It is incorporated.	Rule 5.2.2 now also explicitly refers to "locations in the upstream supply chain (e.g. biomass processing sites and transport routes)".
122	5.2.5	Not sure if the distinction between embedded and operational emissions is necessary. Simply relate everything you need and the lifetime it has back to the total amount of CO_2 that can be produced and the time it takes to produce one tonne of CO_2 (the functional unit defined earlier).	Thank you for your comment. The differentiation between embedded and operational emissions is relevant for the accounting of the net carbon removals that results in CORCs. The embedded emissions are amortized across the first crediting period; this is a conservative approach to account for this type of emissions and provide a way to subtract the amortized portion from the gross carbon stored per monitoring period. On the other hand, the operational emissions are subtracted from the gross carbon stored during the monitoring period where they have taken place. By differentiating between both, we aim at ensuring that the impacts of the carbon removal activity are properly accounted for.	No change
123	5.2.5	Is there a cutoff point for embodied emission accounting from carbon crediting perspective? LCA normally would apply a cutoff of e.g., 1%.	In order to setup a cut-off criteria, the goal of the LCI is to approximate 100% of the project emissions, and aim at achieving 95% completeness with significant impacts. This means that the activities within the 5% cut-off can only be considered negligible and excluded from the final calculation if they represent individually less than 0.5% of the total approximated project emissions. we have expanded this in greater detailed under 5.2.20	New rule regarding cut-off was introduced, see 5.2.20. See also 5.2.21.
124	5.2.6	Regarding items 5.2.6, the main stages within the activity boundaries of LCA, are to include 5.2.6.b. transport of carbon stream, and 5.2.6.c. injection of carbon stream, with embodied emissions from both stages proposed to being included. We recommend that the embodied emissions from these stages be excluded, as the quantity is immaterial, is difficult to accurately determine and validate by a qualified third party expert, and often times have drastically different lifetimes compared to capture facilities (e.g., A 30 year capture projects vs. 50 year CO_2 Pipelines and CO_2 Injection Wells. <Company name> has successfully operated CO_2 infrastructure since the 1970s and expect these assets to continue operating for another 50 years if well maintained).	Thank you for your comment. These rules are developed to cover all possible cases of infrastructure used for the carbon removal activity. It is not possible to defined a priori whether the project infrastructure would be new-built or a retrofit of an existing facility to use for the project. In addition, while it is possible to have infrastructures with different lifetimes, the rule on amortizing the embodied emissions of these infrastructures aim at ensuring that they are covered by the project during the first crediting period. In case of retrofit of existing infrastructure, it is only requested to account for the embodied emissions of the retrofit and maintenance incurred during the crediting period. Further, embodied emissions are not always immaterial.	No change
125	5.2.6	Per our feedback, this should include upstream activities as well.	Text already includes "upstream activities".	No change
126	5.2.6	"Embodied emissions: This includes emissions related to construction, maintenance, and disposal of any infrastructure and equipment (i.e., buildings, machines, vehicles, pipelines)." Embodied emissions should not include pre-existing and/or shared CO_2 infrastructure, but rather the infrastructure dedicated to the facilities. "Embodied emissions: This includes emissions related to construction, maintenance, and disposal of any dedicated infrastructure and equipment (i.e., buildings, machines, vehicles, pipelines)."	Thank you for your comment. We amended 5.2.5 to better define how to account for pre-existing facilities and shared infrastructure.	Rule 5.2.5 and following rules 5.2.14 and 5.2.15 were amended to explicitly include the case of retrofitted assets.
127	5.2.6 b	How to deal with sharing pipelines? Eg when using existing CCS infrastructure. Please clarify.	Thank you for your comment. We amended 5.2.5 to better define how to account for pre-existing facilities and shared infrastructure.	Rule 5.2.5 and following rules 5.2.14 and 5.2.15 were amended to explicitly include the case of retrofitted assets.

Comment no	Rule or part	Comment	Response	Action
128	5.2.7	The data table in section 5.2.7 indicates that several parameters be publicly disclosed for audit. We recommend data that is publicly disclosed should be agreed upon by the CORC supplier, prior to publication.	Puro as a Standard has to require a common minimum of data made public for all suppliers operating under the same methodology. Here, we refer to calculated emissions in broad categories to be disclosed (but not the underlying parameters). Indeed, it is common practice to get confirmation that numbers are correct and valid prior to publication; but the same disclosure granularity requirements shall apply to all projects.	No change
129	5.2.7	CO_2 contributions organized by main stages Per our feedback, this should include upstream activities as well.	See reply to comment #113.	See reply to comment #113.
130	5.2.7	*Ecapture Ecapture contains terms relevant upstream of capture (*Biomass production, supply and conversion). These should be separated into a new term reflecting the upstream supply chain, and should be applicable in all circumstances.	Thank you for your comment. The terms are described as Level 3 contributions in table 5.1 and are mandatory requirement as per rule 5.2.7. See also reply to comment #113, and edits made to attribution rules.	See reply to comment #113.
131	5.2.7	"Either fully attributed to CORCs or partly allocated to CORCs via share of internally use bioenergy" While we support the use of this approach for power BECCS, it does not apply to other forms of BECCS and so other approaches to allocation would be required. Equally, being prescriptive here contradicts the flexible allocation approach outlined in 5.1.8	Thank you for your comment. We provided further clarification under 5.1.8 and 5.2.8.	See reply to comment #113.
132	Table 5.1	dLUC should be defined next to this table (not mentioned / explained until 5.2.16)	Thank you for your comment. We clarified the term in the table.	dLUC defined in table.
133	5.2.8	Biomass Supply Chain Attribution"If the activity is associated with the production of one or several biomaterial or bioenergy products, then the emissions associated with the production and supply of the biomass feedstock are in the general case fully attributed to those products." There is a risk that this provision might detract from the stated aim of achieving a lifecycle assessment of greenhouse gas emissions. Attributing large portions of CO_2 to associated products but leveraging the full volume of injected CO_2 to calculate net removals could lead to an artificial increase in the quantification of the removals impact of the project. This issue was notably discussed in a recent article "Ethanol carbon capture and storage isn't carbon removal – CarbonPlan." [1] <Company name> further notes that in the recent technical assessment paper on methodologies under the EU CRCR the following recommendation for quantification was made: "The second step for quantifying the net benefit should consist of subtracting any associated GHG emissions occurring during the lifecycle of the activity and related to the implementation of the activity. Relevant GHG emissions that should be taken into consideration include direct emissions, such as those resulting from the use of fertilisers, chemicals, fuel or energy, other material inputs and transportation". Importantly, referencing to fertilisers makes it clear that activities back to the land sector should be considered. Therefore, there should be an explicit recognition that upstream supply chain emissions are an important component of a carbon removal unit/claim, and necessarily need to be considered and at least in part allocated without exception. However, we do agree that for some upstream activities it does make for full attribution away from the biomass value chain, where it is clear that impact of the biomass value chain is immaterial to those processes. This may be for activities upstream of post-consumer waste collection or residue collection where the collection of biomass is immaterial to the process operation (e.g. <10% of overall process revenues). Again, it should be made clear this is not the case for attribution at the BECCS plant, on the basis that it is highly likely that removal revenue streams are material for overall process operation. [1] https://carbonplan.org/research/ethanol-cdr-claims	The calculation of CORCs (section 4) follows a life cycle approach (section 5, Table 5.1) that includes both upstream and downstream impacts. As such, the CORCs by definition represent net removals that have already accounted for the emissions of processes and infrastructure needed to capture, transport, and store carbon from the atmosphere. When it comes to multi-functional processes, attributing emissions to co-products is a common procedure in LCA. For increase transparency, we agreed that is necessary to disclose the supply-chain emissions of the biomass even if they are not attributed to the CO_2 removal but to the primary co-products.	Rule 5.2.8 on biomass supply-chain emission attribution was edited to require disclose on those emission calculations and their explicit attribution in the LCA model provided.
134	5.2.8	This clause allows the supplier to exclude all the biomass feedstock supply and production emissions if there are biomaterial or bioproducts produced in the process. This is the case for almost all bioCCS facilities where there is always a bioproduct or biomaterial like heat, power, fuel. Thus, this clause should be rephrased to clarify how to allocate biomass feedstock emissions on the producst or the LCA.	Thank you for your comment. The emission partitioning rules that guide the allocation are defined at the end of 5.2.8.a allowing for jurisdictional, industry best-practices, and general allocation procedures as defined under ISO 14044:2006. Whichever procedure is chosen, it shall be applied consistently for the whole project.	No change
135	5.2.8	Does the quantification all for projects that may import and export heat, steam , electricty and/ have cogeneration onsite or offsite?	We would need more information to be able to respond to your query.	No change

Comment no	Rule or part	Comment	Response	Action
136	5.2.9	Inclusion of soil emissions for purpose grown biomass may be challenging to estimate/quantify. Suggest more guidance is rewuired on aceptable methods to quantify. Also record keeping on fuel use for culivation and harvesting may not be available. More guidance is needed on accpetable estimates and or record kjeeping reuired. Consider a conservative default? Also what quantificaiton is acceptable to estimate biomass decay during storage?	Thank you for your comment. We will provide supporting information, separately. In short, soil emissions are typically estimated with IPCC factors for fertilizer use. For cultivation operations, either primary data or data from database are both acceptable. For biomass decay during storage, supplier should resort to industry best practice.	Rule 5.2.9.a expanded to include guidance on data sources for biomass production.
137	5.2.9 c Table 5.2	When capturing CO_2, the NOx emissions from the waste to energy plant through the stack will be reduced compared to the baseline scenario as processes in the capture plant will scrub the flue gases and certain components will dissolve in water, which will then be treated in a wastewater treatment plant. We assume it will be possible to attribute this reduction in NOx emissions to the Capture plant, is this assumption correct?	Reduction in N_2O (different from NO and NO_2) will not be counted as a GHG reduction (avoided burden). Instead project specific value is possible to use for residual N_2O emission, instead of the default values. This is also technology dependent (not all flue gas CO_2 scrubbing systems will affect N_2O in same way). Note also that any cooling effect of NO / NO_2 is not considered.	No change
138	5.2.9	Is it allowed to use emissions measurements obtained with CEMS (Continuous Emission Monitoring System) instead of the default factors in Table 5.2 for a waste to energy plant? The waste to energy plant we operate complies with the most stringent emission requirements in the world. See also previous comment.	Yes, it possible to use project specific data provided that it is properly documented as stated in the rules.	No change
139	5.2.9	The methodology seems unclear on how to quantify biomass supply chain emissions in practice, i.e. do all biomass suppliers (and sub-suppliers) need to account for their GHG emissions or can project proponents use purchasing records and regional biomass GHG emissions factors as per the latest science available? For US, this could for example be done with ANL's biomass emission factors research: https://pubs.acs.org/doi/full/10.1021/acs.est.1c04301	It is possible to use national or regional average emission factors from peer-reviewed databases and literature for biomass production as long as the reported sourced volume is supported by records of purchase. These average emissions factors shall be cradle-to-gate and include all relevant upstream and downstream emissions.	Rule 5.2.9.a expanded to include guidance on data sources for biomass production.
140	5.2.10	Consider adding some default emission facotr for carbon capture material streams such as amine	No default factors are provided for such chemicals at the moment; however, it is possible to rely on existing factors in databases, provided that they are representative of the project and include all relevant upstream and downstream emissions.	No change.
141	5.2.10	According to 5.2.10, the climate footprint of the chemicals for carbon capture may be performed in a "separate LCA study". We suggest including a clarification that performing a separate LCA study may be unnecessary and add unnecessary administrative burden in cases where commodity chemicals are used, (examples: NaOH, KOH), and have climate footprint data already availability in LCA databases.	In some cases, LCA databases can be used more readily. The text offers a possibility ("may") for more complex supply-chains of other types of sorbents.	No change
142	5.2.10	Due to the proprietary nature of the solvent we intend to use, it is hard to come by LCA data; either because an LCA has not been performed for the specific solvent or we cannot obtain / make public the data from the LCA. May default/available data from an LCA for MEA (most widely solvent for capture of CO_2) be used in this case? We consider this data as conservative as MEA is considered to perform less from a life cycle perspective.	In some cases, LCA databases can be used more readily, but this is not applicable to all types of sorbents. For newer types of sorbents, early estimates of their carbon footprint may not be sufficiently conservative or be outdated. It is important to work on compiling accurate data for sorbents. In any case , the data used for sorbent will need to be evaluated, both for completeness of the scope, representativeness, and conservativeness.	No change
143	5.2.11	If the functional unit is 1 ton of CO_2 captured and stored; the carbon footprint of all processes associated are included for just that one tonne, which by definition is stored. This makes point 5.2.11 unneccessary. Please remove.	The rule covers the carbon capture process before the carbon stream is directed for storage. It is possible that at this point part of the captured carbon could be used in CCU applications and not only for CCS. Therefore, we find necessary to keep this rule to cover that possible scenario.	No change
144	5.2.12	If this rule is applied, this will over-estimate the emissions attributed to the biogenic CO_2 during the capture stage with a factor up to 2 (50-65% of the waste incinerated is from biogenic origin). Suggestion is to modify the rule and make the content similar to rule 5.2.11, i.e. attribute the emissions and energy use for the eligible carbon fraction.	This is the intended function of this rule at the moment. See reply to comment #97, for more details.	No change

Comment no	Rule or part	Comment	Response	Action
145	5.2.12 5.2.13	Repeat of the comment from 5.2.11. Please reconsider this section.	This rule has a different purpose than 5.2.11. Rule 5.2.11 addresses the possibility that a captured carbon stream could have different end-uses. So, it ensures that only the portion that will be destined for CCS is accounted for. On the other hand, rules 5.2.12 and 5.2.13 deal with capture, transport, and storage of carbon from mixed sources, including both fossil and biogenic carbon in defined proportions. Therefore, these rules have the purpose to ensure that only the portion of biogenic carbon is accounted for in the final storage calculation while including in a conservative manner all operational emissions associated with the capture, transport, and storage of the undifferentiated volume of mixed carbon from the same capture process.	No change
146	5.2.13 a	See previous comment 5.2.12. It seems that again, emissions attributed are overestimated. See previous comment at 5.2.12.	We take a conservative approach to all operational emissions associated with the processed carbon regardless of their eligibility.	No change
147	5.2.14	The guidelines listed here are for 'environmental product declarations'. This is a specific methodology, which is not necessarily preferred for all calculations by LCA practitioners. Please reconsider.	The referenced standards for processed-based LCA calculations for buildings and infrastructure are industry standards for environmental product declarations. These are provided as guidance. There is a large body of verified data and tools in the market that can assist in the calculation of embodied emissions associated with building materials and processes according to industry best practice included in those guiding standards.	No change
148	5.2.15	A concrete building (for example) will have a longer lifetime than 10 years. Please reconsider this maximum lifetime assumption.	The rule is meant to ensure the amortization of the embodied carbon during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. In addition, we revised the crediting period to extend to 15 years.	Rules changed to amortized embodied emissions over the first crediting period.
149	5.2.15	According to 5.2.15.a, the amortization period of embodied emissions for the project is to not exceed 10 years or the lifetime assumption of the asset, whichever is shorter. We propose that the amortization period should reflect the project lifetime assumption, which can often exceed 10 years [8]. Matching the amortization period to the expected project lifetime is also aligned with the US Department of Energy's Best Practices for LCA, and GHG Protocol's technical guidance for calculation emissions [9,10]. [8] 30-40 year capital asset lifetimes are typical in heavy industries. International Energy Agency. (2020). The challenge of reaching zero emissions in heavy industry https://www.iea.org/articles/the-challenge-of-reaching-zero-emissions-in-heavy-industry [9] U.S. DOE. (2022). Best Practices for Life Cycle Assessment (LCA) of Direct Air Capture with Storage (DACS). U.S. Department of Energy, Office of Fossil Energy and Carbon Management. https://www.energy.gov/fecm/best-practices-LCA-DACS [10] Greenhouse Gas Protocol (2011). Corporate Value Chain (Scope 3) Standard. https://ghgprotocol.org/corporate-value-chain-scope-3-standard	The rule is meant to ensure the amortization of the embodied carbon takes place during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. Nonetheless, we revised the crediting period to extend to 15 years (see new rule 2.2.2). Also, the carbon removal supplier has the flexibility to choose how to breakdown the emissions to amortized: on equal annual installments or a custom breakdown during the established period.	Rules changed to amortized embodied emissions over the first crediting period.
150	5.2.15	A 10 year amortization period seems very conservative. We understand that embodied emissions are frontloaded, but compared to other standards (Verra, no embodied emissions; Isometric, over the reasonable lifespan), this could have a significant negative impact on the financials of a project. In finance, depreciation can also be over longer timelines. We suggest a more pragmatic standard, allowing for longer timelines of amortization, in line with financial standards.	The rule is meant to ensure the amortization of the embodied carbon takes place during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. Nonetheless, we revised the crediting period to extend to 15 years (see rule 2.2.2). Also, the carbon removal supplier has the flexibility to choose how to breakdown the emissions to amortized: on equal annual installments or a custom breakdown during the established period.	Rules changed to amortized embodied emissions over the first crediting period.

Comment no	Rule or part	Comment	Response	Action
151	5.2.15 a	amoritization period over 10 years - what if the project only ever serializes once for one year worth of credits? How will the embodied emissions be recouped?	The rule is meant to ensure the amortization of the embodied carbon takes place during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. Nonetheless, we revised the crediting period to extend to 15 years (see rule 2.2.2). Also, the carbon removal supplier has the flexibility to choose how to breakdown the emissions to amortized: on equal annual installments or a custom breakdown during the established period.	Rules changed to amortized embodied emissions over the first crediting period.
152	5.2.15 a	Why 10 years amortization period? The lifetime of the assets will typically be 25 years and contracting of storage of CO_2 for our project based on 15 years. The project type to which this method applies (CCS) typically has a very long financial amortization horizon because of the high (infrastructure) costs.	The rule is meant to ensure the amortization of the embodied carbon takes place during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. Nonetheless, we revised the crediting period to extend to 15 years (see rule 2.2.2). Also, the carbon removal supplier has the flexibility to choose how to breakdown the emissions to amortized: on equal annual installments or a custom breakdown during the established period.	Rules changed to amortized embodied emissions over the first crediting period.
153	5.2.16	There are different emission factors described in IPCC for dLUC. Which ones should be used? Can this not more effectively be included in the total LCA?	The dLUC emission factor depends on the original land use.	no change.
154	5.2.17	more is needed on materiality	More on materiality was added in new rules.	New rules 5.2.20 tackling cut-off criteria.
155	5.2.17 b	Similarly, for maintenance related emissions as described under 5.2.17.b., embodied emissions should be amortized over the lifetime of the relevant equipment to help simplify the overall carbon accounting.	We understand your reasoning to align amortization with lifetime of the asset. However, the rule is meant to ensure the amortization of the embodied carbon takes place during the first crediting period of the project or carbon removal activity. This ensures that there will not be over-crediting in case the project does not continue operations beyond that first crediting period. Nonetheless, we revised the crediting period to extend to 15 years (see rule 2.2.2). Also, the carbon removal supplier has the flexibility to choose how to breakdown the emissions to amortized: on equal annual installments or a custom breakdown during the established period.	No change
156	5.2.18	Not clear why "To" (number of years the storage site will be in operation) is capped at 10 years. What is reasoning here ? Most injection projects will typically inject for 15-25 years before injection cessation and then will have a period of post injection monitoring Tm (can be 20 years in EU and even 50 years in some legislative regions elsewhere) before store is handed back to CA	Our intention is to define at least a minimum operation time (To) equal to the crediting period. We have clarified the language to this purpose in the rule.	Change to incorporate.
157	5.2.18	Please clarify that the To, operating time, that is capped at 10 years is for the purposes of accounting (similar to embodied emissions on pg 52) not a limit on the project life (Pg 55)	Our intention is to define at least a minimum operation time (To) equal to the crediting period. We have clarified the language to this purpose in the rule.	Change to incorporate.
158	5.2.18	transfer of long term liability is not always the case and could vary from jurisdiction	We agree. Rule changed to include min-max post closure monitoring and financial obligation of storage site operator.	Change to Tm incorporated.
159	5.2.19	We have the opportunity to purchase "emissions offsets" which will be registered on CSA Group's GHG CleanProjects Registry, as this allows for use of: •Alberta's Energy Generation from the Combustion of Biomass protocol (one of very few published protocols that allow for bioenergy in a developed country and from waste wood) •The specific name they use for offsets is "verified emission reduction and removals" Would these qualify as similar to the listed schemes (REC, GOO, DPA)?	At the moment, we could not find enough information to make a decision on this point. Please contact us to discuss this in greater detail.	No change

Comment no	Rule or part	Comment	Response	Action
160	5.2.19	We commend the practical and balanced approach for allowing CO_2 Removal Suppliers to utilize low carbon energy in the Method. By allowing suppliers to utilize flexible acquisition mechanisms such as renewable energy certificates (RECs), Guarantees of origin (GOO), and direct purchase agreements (DPA) for projects, low carbon energy supplies will be able to expand in optimal generation conditions without facing prohibitive barriers. It is refreshing for a carbon standard to acknowledge the practical issues associated with developing large-scale climate projects, such as needing access to high-density energy storage that does not yet exist at the scale needed for projects like <Company name> is developing. We believe these issues can indeed be partially mitigated by simply requiring that the low carbon energy originate from the same physical grid or network and are issued within the same calendar year they are consumed; thus, ensuring a realistic and environmentally accountable approach to calculating the emissions factors used in life cycle assessments (LCAs). We appreciate the vision for a future shift towards hourly matching of energy use and production, recognizing the challenges and technological advances needed to make this feasible.	Thank you for your comment. We share your vision on future hourly matching of energy use/production as part of our efforts to achieve ongoing issuance through digital monitoring, reporting and verification as presented in Appendix A of the General Rules v.4.0. We will work with CO_2 removal suppliers to make this vision a reality by developing future implementation guidance.	No change.
161	5.3.2	Actively monitoring for life cycle assessment calculations - Please clarify where Measurement Error comes from. Assuming it's quantifying constraints on the ability to accurately measure the various components needed for the calculation (?) i.e., how accurate is the instrument measuring the various fuel and emission volumes.	As stated under 4.8.2. "The CO_2 Removal Supplier shall identify and report all material sources of uncertainty in the Output volume, considering at least the following common sources of material uncertainty: … Measurement errors (e.g. the measurement/calibration error of the flow meter utilized for quantification of the injected CO_2)". while the rule is not exhaustive, the purpose is for the CO_2 Removal Supplier to identify the potential types of measurement errors depending on the parameter being measured and the measuring protocol being used.	No change.

Comment no	Rule or part	Comment	Response	Action
Section 6: Determination of leakage				
162		We support the approach of leakage mitigation before quantification. However, we disagree some of the approaches and justifications and believe greater rigour is needed. Importantly, we do not believe some of the approaches adopted will align to the EU CRCF. For leakage to be adequately mitigated, we believe there needs to be at the very minimum both a supply level AND a system level mitigation in place. For energy leakage, this could be: - Direct supply of renewable power, AND, - Existence with a cap-and-trade system, OR, Existence within a low carbon bidding zone For land sector leakage, this could be: - Biomass supply is derived from a product that is not the main output of the system (i.e. the driver of land use/management changes), AND - Carbon stocks are monitored at the system level and are not declining This is not an exhaustive list of all possible mitigations, but demonstrates possible complementary provisions that when combined provide appropriate protections against leakage. Moreover, mitigations need to be targeted to the leakage risk present. This is not the case in numerous circumstances, in particular where there is deferral of land sector leakage to energy sector leakage where it cannot be adequately mitigated Finally, power drawn from the grid should align to EU CRCF recommendations, relying on mechanisms for qualification of renewable power used in renewable fuels of non-biological origin. In particular, this needs to rely on mechanisms that bring additional renewable power capacity online.	We thank the commenter for the valuable, pragmatic and precise feedback on the topic of leakage. 1. The notion of supply and system level mitigation of leakage: this notion was added in the explanation text of section 6.2, and it was reflected when necessary in the mitigation options. In particular, whenever the "cap and trade" option was mentioned, it is not required to combined this with direct supply / purchase of renewable/low-carbon energy; thus, combining system and supply measures. However, in the case where the grid/network is already dominated by renewables (i.e. >90%); it was considered that being located in this grid/network already ensures that system and supply level mitigation are achieved. 2. Land sector leakage: feedback was incorporated, and land sector leakage now applies regardless of the baseline scenario, and is independent from the energy/material sector leakage. Rules now distinguish different cases with different risk profiles for iLUC. Some mitigation options were also removed or made stricter. 3. Alignment with EU RFNBO and additionality of renewable energy capacity: the options to mitigate energy leakage via only purchase of energy certificates alone were removed. When such certificates are used for E_project (as opposed to E_leakage), it is not also required to disclose the year of establishment of the energy asset (with a recommendation to have <3 years old assets, see section 5). The other mitigation options that refer to 90% renewable grids or specific footprints are derived and adapted from the EU RFNBO, although simpler in nature. This was deemed sufficient at this stage. 4. Carbon stocks monitored at the system level and are not declining: here, system-level was interpreted as referring to the jurisdiction or country of sourcing. Requiring that carbon stocks are stable or increasing in the country where forest biomass is sourced, and	Multiple edits across sections 6.2 and 6.3, including editing of existing rules, deleting of certain mitigation options, addition of new rules. Edition of the Biomass Sourcing Criteria to add disclosure requirement on whether forest carbon stocks are increasing or decreasing in the country of sourcing (for categories G, H, M).
163		Only the increase in GHG emissions or decreases in carbon stocks are quantified and the removal activity is penalized if those effects are not avoided or mitigated. Per our previous comments, upstream emissions that would effectively be considered within the Scope 3 boundary of the asset should require inclusion regardless of whether such emissions are assumed to be increased or not. However, we would consider such emissions part of the cradle-to-grave LCA, not leakage.	Comment is not applicable to leakage, but tackles the project emissions, and in particular upstream emissions (e.g. biomass cultivation) which are part of the project boundary. The classification as scope 1/2/3 relative to the (capture) asset, is a notion of organizational LCA, but is not relevant in the context of product LCA.	No change in section 6. See other changes in section 5 as per other comments.
164		Overall approach. As noted in our summary we recommend that mitigation includes both a direct supply mitigation AND an overall system mitigation.	See reply to comment #162	Multiple edits across sections 6.2 and 6.3, including editing of existing rules, deleting of certain mitigation options, addition of new rules. Edition of the Biomass Sourcing Criteria to add disclosure requirement on whether forest carbon stocks are increasing or decreasing in the country of sourcing (for categories G, H, M).

Comment no	Rule or part	Comment	Response	Action
165		Overall approach. Power drawn from the grid should meet requirements of the RFNBO/Hydrogen directives, per the EU CRCF technical recommendations for consideration of an emission factor of zero (e.g. leakage is mitigated). We do not believe renewable energy certificates (RECS/REGOs/GOOs etc.) are sufficient on the basis that there is little evidence to indicate that the purchase of such certificates brings additional renewable power on to the grid.	The mitigation option was implying that the supplier would need to purchase such certificates both for its project emissions (E_project) and additional certificates for leakage mitigation. Additional provisions were discussed, such as requiring that the purchased certificates would need to be from newly installed power generation capacity (<3 years), Ultimately, it was decided to remove this mitigation option, leading to a more conservative methodology. The use of certificates for the term E_project is still possible, and a disclosure on the year of establishment of the energy asset has been added. See also reply to #162.	Multiple edits across sections 6.2 and 6.3, including editing of existing rules, deleting of certain mitigation options, addition of new rules. Edition of the Biomass Sourcing Criteria to add disclosure requirement on whether forest carbon stocks are increasing or decreasing in the country of sourcing (for categories G, H, M).
166		In Puro.earth's methodology, the Net CO_2 removal impact is calculated as the net carbon balance of GHG emissions and carbon storages over the lifetime of the activity, which includes emissions from biomass cultivation, harvesting, and transportation if biomass is grown for CO_2 removal purposes. ISCC EU also involves GHG calculations that consider emissions across the entire supply chain. We would like to point out that it is not clear whether those emission accounted for within the scope of ISCC EU and allocated to the end-product biomethane also count into the Given that these emissions are already accounted for in the biomethane profile through ISCC EU certification and monthly LCA assessments, we would like to point out that this would result in a potential double-counting of emissions.	The comment is about LCA and supply-chain emissions, but not indirect leakage. We refer back to section 5.2 where those matters are tackled. There is no double-counting of emissions and the rules are compatible with reporting of the footprint of the co-products (e.g. biomethane, digestate). However, for transparency and ensuring non-double counting and ensuring non-reporting of emissions, the LCA performed for CORCs must also explicitly show how the rest of the supply-chain emissions that are attributed to the co-products are calculated and attributed (ideally in the same LCA tool as for determination of the co-products).	No change in section 6. See other changes in section 5.2 as per other comments.
167	6.1.2	6.1.2 identifies sources of market & activity leakage for DACCS pathways. We support the proposed treatment of market and activity shifting leakage of renewable electricity, as it ensures the environmental benefits of DACCS projects.	We appreciate the positive feedback from the commenter.	No change
168	6.1.2	The leakage criteria assume a shortage or competition over low-carbon energy. What happens if this is not the case? eg when there is net congestion due to solar electricity generation or in future scenario's, when there is ample renewable energy available?	As far as Puro is aware off, over-supply of low-carbon energy is not yet a common issue; at best, it is an extremely local feature. In this case, the mitigation option rules defined in section 6.2 allow to consider leakage to be mitigated and null in the quantification.	No change

Comment no	Rule or part	Comment	Response	Action
169	6.2.2	"The following high-level guidance is provided for conducting such an assessment: the assessment shall i) for each biomass origin, define the areas of land and ecosystems potentially affected (e.g. spatial extent, locations, soil types, hydrology, land cover, cultural and biodiversity values), ii) determine whether the sourcing of the biomass will affect the local hydrology, iii)determine whetherthe sourcing ofthe biomass will significantly affect the landcover, and finally, iv)conclude on whether the nearby land and ecosystems will suffer from loss of carbon stocks or from emissions of other greenhouse gases." This type of assessment appears overly burdensome. I think better to simply rely on the sustainable biomass criteria as sufficiently mitigating this risk, including additional provisions if deemed necessary.	Indeed, the rules on ecological leakage here are partly redundant with the biomass sourcing criteria. The comment is incorporated with some adjustments as well to the Puro Biomass Sourcing Criteria (categories G, H, I, J, and M).	Change to rule 6.2.2, the text cited by the commenter was replaced by "It is considered that the Puro Biomass Sourcing Criteria are sufficient to ensure that the sourcing of the biomass will not significantly affect the local hydrology nor the land cover of the nearby land and ecosystems surrounding the areas of sourcing. This is ensured via the sustainability criteria defined in particular for biomass feedstocks sourced on forest and agricultural land (as opposed for instance to end-of-life feedstocks such as municipal and industrial waste, for which this leakage source is not relevant)." Other changes to rule 6.2.2 were made for consistency with the change above (in paragraphs a and c). In the biomass sourcing criteria, refinements added to categories G, H, I, J, and M, to include the notions of surrounding areas: "- Surrounding areas: the areas surrounding the forestry/cultivation operations are not significantly affected, in terms of ecological leakage, e.g. via change in local hydrology or land cover change that would result in loss of carbon stocks or emissions of other greenhouse gases. "
170	6.2.2	Is the "ecological leakage" analysis required if the biomass is waste biomass, sourced sustainably as proven in previous sections?	No it is not required for waste categories. See also reply to #169	See reply to #169
171	6.2.3	Disagree strongly with excluding nuclear power in the 90% rule. It is a low-carbon energy source.	Indeed, nuclear power is a low-carbon energy source but it is usually not classified as a renewable energy source. Hence, the second part of the sentence ("or in which emission intensity of electricity is lower than 18.0 gCO_2e/MJ (64.8 gCO_2e/kWh) as determined by national statistics"), which thereby allows grids with a large share of nuclear power.	No change
172	6.2.3 b	"The CO_2Removal Supplier purchases annually low-carbon or renewable electricity production certificates (e.g. Renewable Energy Certificates, Guarantees of Origin) in an amount corresponding to the amount of electricity consumed for the capture process..." We do not feel this is an adequate mitigation measure without additional supporting provisions, on the basis that the purchase of such certificates do little to guarantee the additional supply of renewable power to the grid.	The mitigation option was implying that the supplier would need to purchase such certificates both for its project emissions (E_project) and additional certificates for leakage mitigation. Additional provisions were discussed, such as requiring that the purchased certificates would need to be from newly installed power generation capacity (<3 years), Ultimately, it was decided to remove this mitigation option, leading to a more conservative methodology.	Mitigation option was deleted.
173	6.2.3 b	"The capture facility is consuming electricity that used to be sold to specific end-users (i.e. not as part of a grid, but rather direct supply), and the CO_2 Removal Supplier can demonstrate that previous end-users of the electricity have deployed or are planning to deploy other low-carbon means of meeting their energy demand (e.g. via energy efficiency measures or deployment of new energy systems)" We do not feel this is an adequate mitigation measure without additional supporting provisions, on the basis that there is a significant risk that such activities are unrelated to the carbon removal project (e.g. they may be part of a climate transition plan of the customer). There may be a more legitimate case where such activities are directly financed by the project proponent.	The mitigation option cited by the commenter only applies in the specific case of off-grid power supply. For example, an energy provider delivering directly electricity to customer A and now switching deliveries to customer B (e.g. a DAC operator) by establishing a new connection. Under the current rule, this would lead to no leakage quantification only if customer A has deployed measures in order to no longer need said renewable power (new capacity installed, process change). By nature, this shift is unrelated to the carbon removal project and can be financed by other means than the intervention of the project proponent.	No change

Comment no	Rule or part	Comment	Response	Action
174	6.2.4	See comments above for power leakage and overall concerns about leakage in general	Mitigation option regarding "cap and trade" system for thermal energy was extended to also require a supply-level measure (similar to electricity leakage).	Change to mitigation option.
175	6.2.5	Overall approach As noted in our summary we recommend that mitigation includes both a direct supply mitigation AND an overall system mitigation. These mitigations should be specific to the land sector and individual biomass source, and should not be deferred to energy leakage provisions.	Land sector leakage is now treated separately. Feedstock diversion may still lead to market/energy leakage and the deference still apply in those cases (in addition to land sector leakage).	New rules regarding leakage in the land sector incorporated, now applicable to all baseline scenarios and distinguish between feedstock types based on associated risks.
176	6.2.5	Overall approach The leakage provisions do not address co/by products from forestry such as pulpwood sources, unless it is assumed such feedstock should be treated as 'residues' (which they should not). It is also somewhat disingenuous to cause any material that had a previous use 'residues' on the basis there is an existing market for the material.	Land sector leakage is now treated separately. Pulpwood sources are treated in the same way as forestry products.	No change, besides changes in response to other comments
177	6.2.5	Overall approach Any feedstock that is considered to have market impacts should not be addressed solely through the typical 'activity shifting' approach, which only typically accounts for first order affects i.e. a one for one displacement of existing use, as this ignores market effects, effectively assuming an increase in demand results in a reduction in supply and inventory (which is contrary to economic theory). Any appropriate mitigation therefore needs to consider system wide effects (e.g. assessment of carbon stocks across the jurisdiction or supply base), while avoiding those feedstock most likely to have beneficial impacts.	Land sector leakage is now treated separately. The biomass sourcing also incorporate criteria regarding carbon stocks in the supply base.	New rules regarding leakage in the land sector incorporated, now applicable to all baseline scenarios and distinguish between feedstock types based on associated risks.
178	6.2.5 a	* The food crop or energy crop is produced on agricultural land as part of a crop rotation that includes food or feed production * The food crop or energy crop is produced on agricultural land as an intermediary or cover crop These are not sufficient mitigations against ILUC – for instance, see ILUC modelling results for oil seed rape e.g. Final Report_GLOBIOM_publication_0.pdf (europa.eu) [1] [1] https://energy.ec.europa.eu/system/files/2016-03/Final%2520Report_GLOBIOM_publication_0.pdf	The mitigation option regarding crop rotations may not be sufficiently strict for the case of oil seed rape or other fuels currently cultivated as part of crop rotations, in its current form. However, the production of cover crops or intermediary crops was deemed sufficient.	Mitigation options for 6.2.5a were edited (one deleted). Rules on land sector leakage mitigation edited as a whole, now including iLUC factors for said crops if not cultivated on specific land defined in the mitigation options.
179	6.2.5 c	* Previous use is less efficient, and thereby produces less valuable material and/or energy products While we agree in the direction of travel for the 'direct supply' mitigation, it is very difficult to establish what 'less efficient' and 'less valuable' mean, especially if not elaborating whether this refers to economic value, environmental value or societal value. We recommend clearer criteria that identify the more valuable alternative uses e.g. sawtimber.	The mitigation option was revised to clarify that efficiency is here meant in technical terms. The rule 6.2.5.c (now numbered 6.2.5b) is primarily applicable to situations where e.g. a boiler is replaced by another more efficient boiler, and where the previous use is known and identified. The case of sawtimber mentioned by the commenter would not be applicable here, as timber that can be used as a construction material is not meant to be eligible for bio-CCS pathways in the normal case (as per the Biomass Sourcing Criteria).	Mitigation option revised. New wording: "Previous use and new use are of the same type (i.e. producing similar material and energy products) but the previous use is technically less efficient, and thereby produces less material and/or energy products".
180	6.2.5 c	If none of the conditions above can be demonstrated, the non-mitigated leakage source shall be further assessed as in rule 6.2.6 Deferring to energy leakage avoids addressing the leakage risk. We would recommend that if leakage cannot be adequately mitigated, then regional-specific ILUC factors are used as defined in relevant regulation/legislation (e.g. EU RED). This would align to the EU CRCF approach.	Land sector leakage is now treated separately. Feedstock diversion may still lead to market/energy leakage and the deference still apply in those cases (in addition to land sector leakage).	Rule 6.2.5c was edited to reflect the changes relating to separate considerations for the land sector leakage. Rule is now numbered 6.2.5b and allows to assess energy/material leakage in specific situations of feedstock diversion.

Comment no	Rule or part	Comment	Response	Action
181	6.2.6	If our plant will have both reduced energy output and expansion retrofit, how should the baseline and leakage emissiosn be determined?	The question is project specific and more specific information would be required. The question is also related to comment #65. If the facility is significantly expanded, the entire facility may be considered to fall under the New built baseline, in which case this rule would not apply. In case it is still considered a Retrofit (due to minor capacity expansion), the mass and energy balance would then possibly result in a no net reduction in bioenergy output, leading to no situation of energy leakage. In some cases, capacity expansion might also be seen as two separate facilities (one retrofit, and one new built), if they concern different boilers with different capture systems. The jurisprudence and practice on those matter will be established with actual projects going through certification, and clarifications and/or rule changes will be published accordingly.	No change. Rule clarifications or rule changes possible in the future, in relation to baseline scenario for hybrid projects.
182	6.2.6 c	Overall approach As noted in our summary we recommend that mitigation includes both a direct supply mitigation AND an overall system mitigation. For energy system leakage we recommend a direct supply of renewable power AND being present within a low carbon bidding zone OR a cap-and-trade system	As for previous comments (for DACCS), we have re-considered the mitigation options for bio-CCS Retrofits. - mitigation option related to the location of the project in an area with already decarbonized energy is considered to cover both system and supply level mitigation - the cap-and-trade system-level mitigation option should be revised to include a supply-level measure, but since this situation deals with a reduction in energy supply, it is unclear how project should address this energy reduction at the supply-level. Here, it was added the supplier should at least procure renewable energy for the energy it consumes from the grid. In the future, we may consider other supply-level options (e.g. increasing energy production capacity with separate units). - purchase of certificates as a standalone mitigation option was deleted	Changes made to the mitigation options.
183	6.2.6 c	With regard to thermal energy output: what if the thermal energy output shifts from steam to hot water? In our project we will use steam that previously went to a customer but will produce hot water for another customer due to heat integration. We assume that the energy balance may also include the energy produced by the capture plant in order to calculate net change in thermal energy output?	Indeed, the mass and energy balance described in 6.2.6a shall identify each outputs separately, including different qualities of heat products. Thereby, it is very valuable to mitigate leakage by implementing heat integration schemes.	No change
184	6.2.6 c	Please clarify the note at the end stating "Note: This situation typically materializes when retrofitting power plants or combined heat and power plants fuelled by either solid biomass (e.g. forest residues) or municipal solid waste, where a large share of the energy would be used in the carbon capture process, diminishing the amount of electricity supplied to the local grid (and often increasing the amount of heat supplied)." --> It is not understood why municipal solid waste is mentioned here, as the text directly above it relates to reduced biomaterial output. This does not apply to incinerating municipal solid waste.	The Note was meant to refer to the entire paragraph 6.2.6c (and 6.2.6 overall) not simply to the case of "biomaterial output".	The note was moved below 6.2.6d to reduce confusion and text was changed to: "The situation described in rule 6.2.6 typically..."
185	6.3.4	Now the leakage emissions are required to be calculated for losses of both power and thermal energy. But what if the project plant is a CHP and the loss is also subsituted by a CHP plant? Can the leakage emission be calcualted only once based on electricity grid emission factor? And what if we know the reduced energy is compensated by a decidated on-site plant? Which emission factor shall be used, the grid or the decicated plant's?	Puro believe that the case suggested by the commenter is covered under rule 6.2.6a, where certain system effects can be captured in demonstration of leakage mitigation. Thus, here, the quantification in rule 6.3.4 is only for cases where leakage could not be mitigated.	No change
186	6.3.4c	Please clarify why average values from the (local) grid are used in the equations. Can calculated project-specific emission factors be used when own steam and electricity are used?	The section 6 is about indirect effects, also known as leakage, corresponding to the term E_leakage in CORC quantification. For quantification of unmitigated leakage, the rules set out in this section must be used. This said, for the quantification of project direct emissions (E_project, in CORC quantification), yes, the supplier can use specific emission factors based on the rules in section 5.	No change

Comment no	Rule or part	Comment	Response	Action
Section 7: Data collection and monitoring				
187		The CO_2 Removal Supplier is several times mentioned as the one to monitor the storage site. However, the CO_2 storage operator will perform such monitoring. The CO_2 removal supplier is responsible for collecting the monitoring reports that the storage operator will create from the measurements.	This indeed the likely scenario (although the CO_2 Removal Supplier might itself be the storage site operator). This is understood by Puro.earth, and it is not the intention to limit such division of responsibilities. Rule 3.3.4. also references the division of monitoring responsibilities between the CO_2 Removal Supplier and an external operator (such as the storage site operator). See also opening paragraph of section 3.3.	
188		The proposed methodology requires a large amount of measurement on the whole value chain. This makes attaining CORCs very complex and will require a lot of resources. We fear that this could hinder some suppliers of achieving the CORCs permits.	Puro.earth believes that frequent and comprehensive in-field measurements are vital to ensure secure and permanent sequestration of CO_2, and robust quantification of the resulting carbon removal. The current measurement requirements are largely in line with e.g. EU & US regulations, and are not considered excessive.	No change
189		Will there be specific requirements set out for data formats and data storage?	There are currently no specific technical requirements on data formats or data storage solutions in relation to this methodology. In general, modern digital data storage and management solution suitable for similar industrial settings (ensuring e.g. adequate data protection, back-ups, etc.) is considered sufficient. Ultimately, the data should be in a format that is readily available to the auditor for verification and validation purposes.	No change
190		How will measurement/data errors be handled/accounted for?	According to the uncertainty assessment process outlined in section 4.8 (e.g. rule 4.8.2 specifically mentions measurement errors).	No change
191		During operation measurement instruments will need to revised. How should revisions be handled?	Instrument maintenance and eventual replacements should be conducted according to e.g. device manufacturer recommendations and industry best practices.	No change
192		<Company name> already has a lot a measurement equpitment. Will there be sent out specifik standards/requirmentes for the measurement equipment or is it expected, that companies can continue using what is already in place?	For the most parts, it is expected that companies can continue to utilize the measurement equipment already in place. Rather than to require a specific make & model, the requirements of this methodology aim to describe the type of measurement & accuracy required to ensure flexibility (where feasible).	No change
193		How should it be handled if datapoints aren´t possible to collect from third party handlers? E.g. Puro set out an expectations of collection CO_2-emission data of the sorbent used in a capturing facility. This would probably be a patented solution and owner might now be willing to deliever data?	According to rule 3.3.6 the CO_2 Removal Supplier is responsible for ensuring that sufficient data is available for verification purposes. If such data is not available, the project is not eligible. In the case described, it would not be possible to issue credits to the project without access to the necessary supply chain emission data.	No change
194		General comment on this section: please provide an overview (eg in a table) how often and at what points monitoring should be done.	Thank you for your comment. This section contains a lot of monitoring requirements which are not well suited for short tabular form without a lot of unnecessary repetition of text (e.g. document & planning requirements). Puro.earth will provide more guidance to the CO_2 Removal Suppliers throughout their certification journey, including detailed information on the monitoring requirements prior to the Audit stage.	No change
195		This list should probably have Canadian Standards Association (CSA) standard listed (CSA-Z741-12), considering it was the source document for ISO. Furthermore, if Alberta, BC and Saskatchewan become included as approved regulations, there a numerous Provincial regs/guidance documents we could share links to.	Puro.earth agrees that the CSA standard can be added to the list in section 7.1.	Added CSA-Z741-12 to the list of guidance documents in section 7.1. Changed relevant bullet point from "ISO standards" to "ISO and national standards".
196		Add: "Optimization of injection and storage operations" in the list of objectives of monitoring	Puro.earth considers this a valid suggestion.	Added "Optimize injection and storage operations" to list of monitoring objectives in section 7.2.

Comment no	Rule or part	Comment	Response	Action
197	7.3.2	wording is a little poor perhaps. It is possible to continuously monitor downhole pressure and temperature in injection wells (through gauges) but the same is not necessarily true for the average pressure in the store. This will either require dedicated monitoring wells with such gauges (this is not required in EU storage directive ++) or by periodic shut-in of injection wells and performing fall-off analysis to determine average reservoir pressure and temperature (together with reservoir modelling). Suggest to change wording / make meaning clearer. Also what would happen if require measurement of downhole P&T from gauges but where these stop working after a while ? – would this require shutting in well whilst waiting for intervention or is it acceptable (as most operators would argue) that can use well hydraulic models and measured rates and P&T data at wellhead to estimate downhole conditions ?	We acknowledge the unclarity in wording. The intention for this rule is to monitor the conditions in the wells.	Changed "The CO_2 Removal Supplier shall continuously monitor the temperature and pressure of the storage reservoir in the injection wells..." Further added the sentence "Where the direct measurement of downhole temperature and pressure is not possible (e.g. due to device maintenance or calibration), the CO_2 Removal Supplier may estimate downhole conditions based on relevant operational data (e.g. well hydraulic models combined with measured flow rates as well as temperature and pressure at the wellhead)."
198	7.3.3	If no significant changes have been done to the CO_2 capturing process, why should the CO_2 composition change? Yes, the chemical composition of the CO_2 should be measured but quarterly measurements seem excessive and might potentially result in quite some downtime. Also, how will this be handled in the case of multiple CO_2 suppliers?	Without measurements, there is no direct evidence that composition hasn't changed. The measurement frequency was discussed in the working group. The frequency was initially semi-annually, but increased to quarterly due to comments from the working group, who also pointed out that quarterly is in line with e.g. US regulation. In the case of multiple suppliers, all CO_2 Removal Suppliers seeking crediting under this methodology will be subject to the same measurement requirements.	No change
199	7.3.3 b	For direct injection/storage operators it will not be practically feasible to monitor the chemical composition of the injected CO_2 close to the well-head or on the platform, as these sites are unmanned. Therefore, it would be more logical to measure chemical composition when the barges are loaded. For pipeline operators, the CO_2 will be mixed and hence measurements will also take place upstream, closer to the Capture operator.	These considerations are already addressed in rule 7.3.3 b. The rule explicitly mentions "composition analysis shall be performed as close to the injection wellhead as feasible"	No change
200	7.5.3	"...shall periodically monitor well construction materials eg cement and casing for signs of corrosion ..." This paragraph needs to be reworded/changed. Some well barriers can only be checked and tested during the initial well construction process (e.g cement on outside of production casing, production testing integrity) and it is generally not possible (no existing technology) to log and test for such things through 2 tubulars/strings. Better to focus on "regular integrity testing to verify well barriers" as stipulated by local legislation .	This requirement is modeled after the corrosion testing requirements in US regulation 40 CFR 146.90(c) [1]. The requirement already states "The monitoring shall be conducted with a method in accordance with applicable local regulations or, if no such regulations exist, in accordance with industry standard practices", which would cover cases where there is no existing technology. However, to clarify this point, a note on accessibility of certain well barriers was added. [1] https://www.ecfr.gov/current/title-40/part-146/subpart-H#p-146.90(c)	Added 'accessible' to "The CO_2 Removal Supplier shall periodically monitor the accessible well construction materials" with a footnote noting that certain well barriers are only accessible for testing during initial well construction.
201	7.7.1	Can you provide more clarity on how this rule applies in the following scenario: DAC company is the CO_2 Removal Supplier and partners with CO_2 storage company (separate entity) for a project with a 10yr lifetime. CO_2 injection well lifetime is 20 years. Thus, CO_2 Removal Supplier may not have access to the storage site throughout the post-closure period.	The methodology speaks of the CO_2 Removal Supplier, as they are the party authorized to represent all the other parties involved in the operations (as per rule 2.1.1). The intention of the methodology is that the various parts of the process (such as operational monitoring of the storage site) can be contracted to external operators (as per requirements in section 3.3).	Changed to read "The CO_2 Removal Supplier shall ensure that access to the storage site for monitoring purposes is retained throughout the post-closure period."
202	7.7.1	"The CO_2 Removal Supplier shall retain access to the storage site for monitoring purposes throughout the post-closure period." It should be possible to allow post injection monitoring to be contractually fulfilled by a party other than the "removal supplier" e.g. the storage operator. Reference could be made to the legal frameworks already cited in 4.2.11	The methodology speaks of the CO_2 Removal Supplier, as they are the party authorized to represent all the other parties involved in the operations (as per rule 2.1.1). The intention of the methodology is that the various parts of the process (such as operational monitoring of the storage site) can be contracted to external operators (as per requirements in section 3.3).	Changed to read "The CO_2 Removal Supplier shall ensure that access to the storage site is retained for monitoring purposes throughout the post-closure period."

Comment no	Rule or part	Comment	Response	Action
203	7.7.2	What if a Jurisdiction does not have liability transfer regulations? Does a trust/insurer, etc meet this requirement?	Changed rule to refer to local requirements in case no transfer of responsibility requirements exits. Further, added minor clarifications to rule text (cross reference to rule 7.6.1 on CO_2 release monitoring, and changed sentence structure to make text more readable.)	Changed beginning of rule to read (changes in bold): "The CO_2 Removal Supplier shall continue to monitor the storage site and its surroundings for release of CO_2 (see rule 7.6.1) to verify the storage permanence during and after site closure (post-injection period) as stated in the applicable legal framework (see rule 3.2.11). The monitoring shall continue until the transfer of responsibility or, if no regulations on the transfer of responsibility exist in the applicable legal framework, as long as required by the local requirements for storage site closure and post-closure site management…"
204	7.7	No standardization of post-closure duration?	This topic was discussed during the writing of the draft, and it was decided that the precise length of the monitoring period is best left to the local regulator, as it may depend on site-specific factors and the selected approach (e.g. injection of dissolved CO_2 vs undissolved CO_2 can have significantly different mineralization timescales).	No change
Section 8: Risk and uncertainty management				
205	8.2	a more recent work giving numbers and analysis of storage permanence and risk of reversal is BEIS 2023: https://www.gov.uk/government/publications/deep-geological-storage-of-carbon-dioxide-co2-offshore-uk-containment-certainty	We thank the commenter for pointing this out.	Added suggested reference (Daniels et al., 2023) to section 8.2.
Biomass sourcing criteria				
206	Origin and type evidence (Traceability)	Removals vs Reductions: Why does the methodology only allow for the issuance of removal credits? The established conditions should not limit the global mitigation potential of BECCS. Recognized by the IPCC as a vital decarbonization strategy to limit global warming to 1.5°C, BECCS could have its scope significantly restricted by such limitations, thereby diminishing the positive impact these projects could potentially have on climate change mitigation. This issue is particularly concerning given that the project's capital expenditure (CAPEX) relies on full injection capacity. Scaling this technology economically will demand government subsidies, tax credits, and carbon pricing initiatives, even on a voluntary basis. Hence, it is crucial for methodologies to be flexible and adaptable across different jurisdictions, and to be tailored to suit the regulatory environments of each country. Therefore, we suggest that Puro.Earth consider the possibility of also issuing reduction credits for the portion of biomass that is not traceable. The non-traceable biomass also contributes to net emission reductions and holds essential value in the context of nature-based and technological solutions aimed at combating climate change.	Puro.earth methodologies focus only on durable carbon removals. Puro.earth methodologies do not credit avoided emissions or emission reductions.	No change

Comment no	Rule or part	Comment	Response	Action
207	Origin and type evidence (Traceability)	What type of evidence is required to prove traceability of feedstock? Will this be decided on a case by case basis? Could examples be provided? (Including for Waste).	Requirements of traceability of feedstock varies with the feedstock categories (A-O), with evidence being in general less detailed for waste feedstocks than for other feedstocks originating from agriculture or forestry activities. There is also variability on the level of evidence required depending on the project specifics, e.g. when demonstration of sustainability criteria requires specific traceability information. For example, for Mixed MSW and assimilated (category A), the information that should be compiled by the CO_2 Removal Supplier is limited the approximative geographical area of waste sourcing and the name of entity delivering the waste to the waste-CCS facility. In other words, the traceability information is limited to the previous step in the supply-chain. Examples will be provided in further documentation.	A section with short examples was added (section 4).
208	Categorization	How is the classification of the biomass into one of the 15 types of biomass proved? What type of evidence is required and who approves the classification?	During the certification journey, Puro will confirm to the CO_2 Removal Supplier that the proposed classification of the feedstock used is correct. The categories have been designed in a way that most feedstocks would fit only one primary category. If needed, clarifications to the Puro Biomass Sourcing Criteria will be issued.	No change
209	Feedstock description GSC 3.7.3 a	Please clarify the definition of category A "mixed municipal solid waste". This is a general term, which does not cover all the types of waste that a waste to energy plant incinerates according to definitions used in the Eural codes and/or NTA8003. Example 1: we miss a waste category "company waste"; or is this also considered part of mixed municipal solid waste? (note that the composition of waste from companies is similar to municipal solid waste, although this is waste collected from offices instead of households). Example 2: we miss a waste category "RDF - Refuse derived fuel". This is waste that has undergone some form of pre-processing, e.g. separation of plastics from the waste (post-sorted waste). Category C also does not cover this type of waste as only source-separated waste streams are defined here.	It was the intention to include "company waste" in the category A, which shall cover mixed MSW and assimilated waste. Waste generated by companies and offices, often collected via the same channels as household waste, is indeed often coined waste assimilated to household waste, thereby fitting in the MSW category. Category A is also foreseen to include other waste streams that would be processed in waste incinerators, e.g. hospital waste. The category A was also extended to include Refuse Derived Fuel and certain industrial waste streams, which are commonly incinerated. The use of Eural codes or other classification schemes was added, for further characterization of the waste streams incinerated, as part of the "Origin and type evidence". The text remains flexible to different classification schemes, in order to be globally applicable.	Category A was renamed as "Mixed MSW and assimilated waste". Its description was extended to include all types of mixed waste streams containing some organic/biogenic fraction and commonly treated by incineration: "The non-sorted organic fraction of mixed solid waste from normal municipal waste collection service, from collection of assimilated waste from e.g. offices, companies, hospitals, as well as refuse derived fuel and assimilated industrial waste. This feedstock category is typically processed in solid waste incinerators." Category A, Origin and type evidence, Basic information, was extended to include: ", type of waste (according to local classification)." An example is also provided in section 4.
210	Origin and type evidence: Basic information	Identification number: what kind of identification number is meant here? In the EU we use EURAL codes for waste types. Our preference is to use the NTA 8003 category 5 identification numbers, see next line of comment. Will both be accepted as evidence?	Identification numbers are meant to refer to deliveries of biomass feedstocks to the processing facility (e.g. waste incinerator), and does not refer to the type of feedstock.	A definition of "identification number" was added in section 3.1.
211	Origin and type evidence	In the Netherlands we make use of the NTA 8003 certification for waste which contains biomass. Our advice is to adhere to this classification (see attached pdf file). All waste incinerated in a waste to energy plant is classified as NTA 8003 category 5 (see page 21 in the attached pdf file). As our plant is NTA 8003 certified, we can prove the sustainability of the biomass sources. Can you confirm that proving being NTA 8003 certified will be accepted as evidence for the origin of the biomass waste?	The use of NTA 8003 codes will be possible to specify the type of waste stream belonging to category A (or other categories as needed).	No change, besides changes in response to comment #209 and #210.

Comment no	Rule or part	Comment	Response	Action
212	Origin and type evidence (Basic Information)	Comment 1: [[commenter]] does not believe it is necessary to specify the Basic Information for every delivery of feedstock to a biomethane plant in order to "exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR". This is because the main product from this pathway is biomethane, not CDR.	For traceability and verifications of the removal claims, the CO_2 Removal Supplier will need to be able to keep records of the deliveries of biomass feedstock. There is likely some flexibility on the level of details that will need to sent to Puro.Earth, but in any case such records must be available to auditors for the Output Audits. The purpose of the basic information is not solely to "exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR".	No change
213	Origin and type evidence (Basic Information)	Comment 2: biomethane plants receive many hundreds of deliveries each year. They have data available documenting each delivery, however, actually sending the raw data, and the cost and administrative burden of providing evidence to Puro for every delivery will be prohibitive. We suggest this, and all other reporting, is done on an annual basis, and that we are not required to provide the actual raw data but rather to show them to verifiers during site visits to document the aggregated numbers.	For traceability and verifications of the removal claims, the CO_2 Removal Supplier will need to be able to keep records of the deliveries of biomass feedstock. There is likely some flexibility on the level of details that will need to sent to Puro.Earth, but in any case such records must be available to auditors for the Output Audits. More precisely, the current text specifies that "In practice, CO_2 Removal Suppliers must keep records of the biomass processed, alongside all information needed to demonstrate type, origin and sustainability. This information shall then be synthesized as part of the Output Audit procedures. Puro will make templates available to suppliers, to facilitate the reporting of this information."	No change
214	Origin and type evidence (Basic Information)	Comment 3: In many cases, biomethane producers do not know the entity generating the waste. There can be several reasons for this: the entity generating the waste can be an individual household whose name they do not have or come from several municipalities, there may be a (known) intermediary aggregating waste from a number of entities generating the waste, where the intermediary will not disclose their suppliers of waste (this is the case in the fishery industry for instance). We propose that the name of entity generating the waste is not a requirement as it is not possible to provide this given the complex nature of the biomethane's supply chain	Indeed, it was not the intention to require collection of information on the primary generator of the waste in all situations (as it is impractical in many situations, e.g. when it refers to individual households). Thus, for all waste categories, the traceability is now limited to the entity delivering the waste as well as the geographical area of waste supply.	For categories A, B, C, D, E, and F, the traceability information was changed to be limited to: "geographical area of waste supply, name of entity delivering the waste", excluding "name of entity generating the waste if applicable", making the reporting for these categories uniform.
215	Origin and type evidence (Basic Information)	Comment 4: Geographical location of source: this may not be known other than at a very high level of granularity. The geographical location for fish waste may be "the coast of Norway". We propose to keep a high level of granularity.	The text is meant to be interpreted as providing geographical location with a high level of granularity, unless the location needs to be more precise to support adequate demonstration of sustainability criteria (e.g. Forest biomass, in certain cases).	A definition of "Geographical area of supply" was added in section 3.1, specifying the minimum level of granularity expected when no other rule requires more precise information.
216	Origin and type evidence (Basic Information)	Comment 5: biomethane plants at sewage treatment plants recieve a continous supply of sewage sludge from a defined geographical footprint. It is not possible to specify an ID number for such waste and we propose to drop this requirement for sewage.	The example given in the comment is specific to the case of biomethane plants collocated with sewage treatment plants, or connected with a pipe, ensuring continuous supply of sludge. In that case, the need for an information number can be relaxed or replaced by a generic identification number matching the frequency of reporting of the project for issuance of CORCs (e.g. monthly, annually), e.g. B2024-05 (representing the total amount of sludge received during the month of May 2024). However, in other cases where sludge is delivered to a methane plant by other means, delivery identification numbers may still be required.	No change.
217	Replanting Requirement	Replanting requirement: as written, this criterion rules out sourcing from forest harvests that are naturally regenerated. This technicality could omit a significant amount of forest residues and would steeply reduce the number of operators able to use this guideline, as it is nearly impossible in some contexts to ensure that one is sourcing only from forests that are replanted. We suggest that the requirement be changed from “replanting” to “regenerating”.	Indeed, both replanting and regeneration shall be accepted.	Text was changed to read as follow: "Regeneration: harvested areas are systematically replanted or regenerated, following local rules or forestry best-practice."

Comment no	Rule or part	Comment	Response	Action
218	Feedstock description	We suggest the following categories/text "Forest biomass, including any primary feedstock (low grade roundwood from final harvest and thinnings, forest residues) or secondary feedstocks (sawmill and wood industry residues)" Secondary feedstocks are sources like sawmill residues, not residues from forestry. Stumps and roots are typically undesirable feedstock due to forest carbon disturbance. Woodchips are not a type of feedstock as these could come from any other underlying source. Black liquor is a waste and probably not best considered under these conditions.	The feedstock description for the category "Forest biomass" is intended to refer to all primary and secondary forest biomass, without exclusion, in order to be widely applicable. It is then left to the sustainability criteria defined later to lead to the exclusion of certain fractions (e.g. high-quality roundwood for constructions; stumps and roots, as mentioned in the comment). The list provided in the text "such as ..." was meant to describe both primary and secondary and is now removed, as it is also repeated in section 2G (in the type). Black liquor was moved to category H, specific to pulp and paper industries, as it is indeed better suited there.	Text now reads: "Forest biomass, including any primary feedstock (harvested from forest land) or secondary feedstock (generated during processing of primary feedstock)". Specific reference to black liquor was moved to category H.
219	Origin and type evidence	We suggest aligning feedstock reporting requirements to SBP requirements for practicality of reporting – see table 3.3.3. for basis of reporting SBP_Instruction-Document-5E_v2.1_final.pdf (sbpcert.wpenginepowered.com) [1] [1] https://sbpcert.wpenginepowered.com/wp-content/uploads/2023/12/SBP_Instruction-Document-5E_v2.1_final.pdf	The table 3,3,3 in the referenced document is indeed useful to align reporting requirements. It was considered, and the text for category G was adjusted. Further clarity on reporting will be provided in the templates provided to suppliers for audit preparation.	Changes made in the table of section 2G, regarding Type and properties. The text now states: "physical description (e.g. roundwood, chips, sawdust, pellets, shavings, offcuts), feedstock type (e.g. high-grade stem wood, low-grade stem wood, forest residues, processing residues), forestry operation origin (e.g. final harvest, thinning, wood processing)" instead of "wood form (e.g. sawdust, pellets, chips, liquid), wood type (e.g. species, softwood, hardwood, mix to specify), wood fraction (e.g. branches and tops, needle, bark, stumps)"
220	Origin and type evidence (type and properties)	Careful consideration should be given for necessary information, especially if intended to be passed on throughout the entire chain of custody for wood pellets. For instance, 'wood type', particularly species, could be incredibly challenging unless a reasonable degree of aggregation and estimation across biomass sources is allowed.	Indeed, this complexity was not intended and aggregation and estimation are in practice allowed.	Changes made in the table of section 2G, regarding Type and properties, as per reply to comment #219.
221	Origin and type evidence (mix of sources)	"Segregation of biomass sources along the supply-chain shall be preferred over mixing, to facilitate traceability and sustainability demonstration." Segregation is not necessarily desirable for sources of biomass feedstock that meet the eligibility requirements as this creates supply chain efficiencies. Segregation should only be seen as desirable for keeping eligible and non-eligible sources of biomass apart.	The comment is incorporated.	Changes made in the table of section 2G, regarding Mix of sources. The text now states "Segregation of eligible and non-eligible biomass sources along the supply-chain shall be preferred over mixing".
222	Sustainability criteria (air quality)	We are unsure what 'uncontrolled burning' relates to. Some forms of onsite burning are desirable and/or necessary as part of sustainable forest management practices and should not be ruled out.	Indeed, some on-site burnings are not ruled out. Uncontrolled burning here refers to burning that would be e.g. performed without adequate surveillance of areas burnt, not following safety measures.	Changes made in the table of section 2G, regarding Air quality, to clarify that controlled burnings are allowed. Text now states: "forest operations shall not resort to uncontrolled wood burning as a means of management, as opposed to controlled, documented and safely planned burning events."
223	Sustainability criteria (high-value ecosystems)	"Sourcing of biomass may be allowed provided that the harvesting of the biomass does not interfere with those nature protection purposes, and this is validated in-writing by the relevant competent authority" Producers should also be allowed to cite research and/or management guidelines for ecosystems produced by credible sources and that verification of appropriateness and be provided through 3rd party audit of a forest certification standard. SBP, SFI, FSC all have criteria to which this can be benchmarked and reviewed.	The comment is incorporated.	Changes made in the table of section 2G, regarding High-value ecosystems, to allow for 2 mechanisms making harvesting eligible in highly biodiverse areas. Text now states: "and this is either validated in-writing by the relevant competent authority or is performed in-line with management guidelines applicable to such ecosystems alongside adequate 3rd party verification of implementation of those management guidelines."

Comment no	Rule or part	Comment	Response	Action
224	Traceability and Sustainability criteria and evidence	"Biomethane plants in Europe already meet a hierachy of traceability and sustainability requirements for most, if not all of their biomass feedstock. <Company name> proposes that feedstock which fulfills one of the following criteria shall automatically fulfill the Puro criteria for i) Traceability and ii) Sustainability: - all feedstock that is certified to be compliant with REDII/REDIII, for example by ISCC or REDCert - all feedstock that is verified according to a national regulation or programme that meets or exceeds the Puro criteria, for example ""Lagen om hållbarhetskriterier"" in Sweden and The Danish Energy Agency requirements on biomass sustainability. Note: the traceability data for biomass feedstock that does not meet any of these criteria may only be partial (e.g., not all names of intermederies in transport chain). Inherit requests that the following rule from (A) is also applied to these categories: ""the information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR""."	In reference to categories I, J, demonstration of eligibility of the biomass can already be performed by relying on regulatory schemes like the EU RED II/III and national regulation such as the one cited by the commenter. Still, reporting and availability of the information during the audits will be needed, and thereby automatic eligibility based solely on the location of the project (in the EU) will not written in the rules as such. In reference to category K (in field agricultural residues), evidence options for the criteria "Soil quality and carbon stocks" already allow for the use of regulation, provided the regulation includes some level of monitoring (not necessarily at the field level, but for instance at the region or country level). For the criteria "Working conditions", in addition to primary evidence from the biomass supplier, an another evidencing option was added based on existence and enforcement of laws. In reference to category L, same changes as for K, regarding "Working conditions". Those are particular importance in certain countries were processing agricultural residues is performed in informal contexts with significant negative effects on health of the workers. Addition of a rule similar to waste categories, stating that "information provided shall be sufficient to exclude situations where waste is deliberately produced for the purposes of providing biomass for CDR", does not seem to apply here in the general case, since the biomass is either in-field/non-field agricultural residues (residue/co-product diverted intentionally to CDR), or food/non-food agricultural crop (dedicated production for CDR).	Changes to evidencing options in categories K and L, regarding evidencing options of "Working conditions" in the biomass supply-chain, stating "Existence and enforcement of laws tackling working conditions in the agricultural sector, emanating from governmental authorities, for the criteria Working conditions".
225	Cut-off date Jan 2008	"Correctly referred to in 3.2, but incorrectly referred to in sctions 2I (Non-food agricultural crop) and 2J (Food agricultural crop). - Section 3.2: ""land that had one of the following statuses in or after January 2008"" is CORRECT with reference to RED II and III Directive. - Section 2I and 2J: The use of the word ""prior"" in the following sentences is INCORRECT: ""High-value ecosystems or high-carbon stock land areas: cultivation operations must not take place on land that is or used to be highly biodiverse areas, or highcarbon stock land areas, prior to 2008-01-01. Only land that was already agricultural land prior to this date may be used to source agricultural crops for CDR."" - Propose to use same wording as the Directive to avoid confusion."	We thank the commentor for the careful reading and identification of this mistake.	In sections 2G an 2I, terms "prior to" replaced by "after".
226	Sustainability criteria (carbon stocks)	"One of the sustainability criteria is that ""agricultural crop cultivation is planned to contribute to long-term maintenance or increase of carbon stocks in cultivated areas"" (2I, 2J) and ""harvesting of residues is performed in a manner that preserves soil quality and carbon stocks"" (2K). - Also one of the evidence options is ""Existence and enforcement of local agricultural plans, policies, programs, laws, or regulation"" - Propose that crop cultivation in Europe automatically fulfills this sustainability criteria because it is regulated by the EU Common Agricultural Policy: 2023-27."	Rather than provide automatic fulfillment of the criteria for a designated geographical area, the Puro Standard prefers to define a rule that is applicable globally and is able to tackle unforeseen cases of changes in regulation, by deferring the verification to the time of certification. During the certification process, the CO_2 Removal Supplier will have to reference e.g. the EU CAP 2023-27 and its specific sections, to demonstrate the criteria are met for the given project.	No change
227	Sustainability criteria (crops for CDR)	"- Multiple sustainability criteria are stated for crops that are cultivated for the purpose of CDR - [[commenter]] requests that CDR projects that make use of the CO_2 off-gas from biomethane production in Europe are not subject to these criteria. - Reason 1: in practice, crops are in the process of being eliminated from biomethane feedstock in Europe by the RED regulations and their use is already strictly limited (except in UK). Hence these criteria would be automatically fulfilled in EU, even if they did apply. "	In several instances, biomethane production from crop cultivated on agricultural land should be able to fit in the exceptions built-in this section (regarding Competition for food or feed, and Environmentally sound agriculture). Many of the criteria can be demonstrated via compliance with regulatory schemes, such as the RED II/III.	No change

Comment no	Rule or part	Comment	Response	Action
228	Origin and type evidence (Traceability)	Traceability Challenge for Food Agricultural Crops: Brazil faces significant local challenges regarding the assurance of biomass traceability, especially for primary agricultural sources such as corn. It is noted that few ethanol producers worldwide have the same level of grain traceability compatible with the detailed requirements of RenovaBio. The RenovaBio program is a Brazilian government initiative aimed at increasing the production and use of biofuels in the country's energy mix as part of Brazil's commitment to reducing greenhouse gas emissions in alignment with the Paris Agreement. While this has been a significant challenge in Brazil, the issue has evolved significantly, with some Brazilian corn ethanol production units achieving around 70-90% eligibility certification (ANP, 2023a). It is worth noting that Brazilian corn ethanol producers participating in RenovaBio are committed to zero deforestation, meaning there is traceable assurance that the corn used for ethanol production, which will generate Decarbonization Credits (CBIOs), was cultivated in an area where there has been no native vegetation suppression of any kind after 2018, including those that could have been regularly authorized (MME, 2021). This is not an exclusive condition of Brazil. In the United States, the vast majority of biofuel producers also source corn from major grain trading companies and face similar challenges on traceability. In a rather simplistic manner, the Environmental Protection Agency (EPA) established a baseline acreage for U.S. planted area in 2007 and determined that, as long as this baseline acreage is not exceeded, it is unlikely, based on historical trend assessments and economic considerations, that new lands outside the 2007 baseline are being dedicated to agricultural production. Thus, renewable fuel producers using crops or crop residues from the U.S. do not need to make individual records and reports to prove that their feedstocks come from qualified lands, unless the EPA determines through its annual assessment that the 2007 baseline acreage, set at 402 million acres, for agricultural lands has been exceeded (EPA, 2022). Therefore, they will not be able to prove traceability up to the farm level. It is due to this challenge that we request the methodology consider the possibility of generating reduction credits. The removal credits would be restricted only to traceable biomass, and the reduction credits to the non-traceable portion.	Puro.earth methodologies focus only on durable carbon removals. Puro.earth methodologies do not credit avoided emissions or emission reductions. Regarding corn ethanol facilities in which the CO_2 stream is then captured for geological storage, the implementation of the updated GSC methodology alongside the Biomass Sourcing Criteria, entails that only retrofitting of existing corn ethanol facilities will likely be eligible, provided they meet the rules defined in the methodology and the biomass sourcing criteria in section 2J/2I and its rules on avoiding Competition for food or feed. Regarding traceability challenges in the corn supply-chain, there is not necessarily a requirement to trace back corn up to the farm level. This will depend on project specifics and the areas of sourcing.	No change
229	Sustainability criteria	Sustainability Criteria (Food agricultural Crops): Requiring sustainability certifications or regulatory compliance for every sustainability criteria for the entire supply chain is impractical. Not all countries will have regulations capable of verifying compliance across the entire supply chain, nor will these regulations cover all principles. Additionally, the costs associated with certifying all producers in the supply chain are prohibitively high, rendering BECCS project certification economically unfeasible. Project Proponents should have the flexibility to demonstrate compliance with sustainability criteria to VVBs through a combination of methods or tools. In addition to these two methods for demonstrating compliance with sustainability principles, it should also be feasible to provide evidence through complementary studies and literature reviews.	For categories 2I and 2J, among others, the project proponents have the flexibility to demonstrate the sustainability criteria via a combination of methods (e.g. certification, compliance with regulatory schemes, other existence and enforcement of laws for agricultural practices, other primary evidence, etc.). The suggested "complementary studies" and "literature reviews" can be considered as part of "primary evidence", although literature reviews should be used only if recent and specific to the location studied supporting other primary evidence.	No change
230	Feedstock description GSC 3.7.3 0	Change to: Cultivated algae or molluscs or harvested aquatic plants and related derivatives. The largest natural CO_2 sequestrator and oxygen producer on the planet is microalgae, which, after a short life cycle, settles to the bottom. This is a natural process that must be used. The shell of a mollusk is usually a calcareous exoskeleton made of calcium carbonate and is a form of CO_2 fixation in seawater. Today, the world produces about 20 million tons of shellfish per year, which means about 15 million tons of calcium carbonate. Of course, only farmed shellfish should be accepted for evaluation. https://www.was.org/Magazine/2023/04/22/#zoom=true	At the moment, no methodology in the Puro Standard relies on CO_2 sequestration via mollusks. Hence, the addition suggested to the Puro Biomass Sourcing Criteria is not relevant. It may be considered in the future, if such methodologies are developed.	No change
231	Origin and type evidence: Mix of sources	Add: For microalgae cultivated for the purpose of CO_2 sequestration in open ponds or marine environments, the total amount of biomass in g/l and the typical carbon content must be determined.	Carbon content is already required. Amount of biomass in g/L is an unclear measure, likely referring to the amount of biomass in the pond, at harvest. It does not seem to be a relevant piece of information for ensuring the sustainability of the biomass sourcing at this stage.	No change

Comment no	Rule or part	Comment	Response	Action
232	High carbon stock areas	Remove 'natural forests'. This is not defined in the criteria and does not necessarily constitute high carbon stock areas. For instance, a young naturally-regenerated stand could be considered 'natural' forest but is not high carbon stock. Equally, the line between 'natural' forest and 'non-natural' is incredibly slim, especially where native species are planted - the distinction does not necessarily relate to healthier ecosystems.	The document initially intended to distinguish the requirement for categories G (forest biomass) and I/J (agricultural crop biomass), by relying on two separate definitions. The definition of "High carbon stock areas" was removed from section 3.1, and instead what remains is the text in respective sections 2G and 2I which itself refers directly to the other definitions in sections 3.1 (peatland, wetland, primary forest). Thereby, distinctions of requirements can be made for forest and agricultural biomass, regarding sourcing of biomass from areas that are natural forests (allowed in the case of forest biomass; not allowed conversion to agricultural land in the case of agricultural biomass).	Definition of High carbon stock areas, in section 3.1 was removed. Rules in section 2G and 2I regarding "High carbon stock previous land use" were edited. For 2G, the text states: "High carbon stock previous land use refers here to wetlands and peatlands". (noting that exclusion of primary forests is in a separate rule prior to this because the exclusion is irrespective of the cut-off date). For 2I, the text states: "High carbon stock previous areas refer here to wetlands, peatlands, primary forests and forests."
233	Traceability and Chain of custody (iv. Mass-balance CoC approach)	Reference to 'certified' and 'non-certified' is confusing in the context of the standard, as biomass does not necessarily have to be certified to comply with the requirements of the Standard. We recommend that site level mass balance is allowed, as is commonplace across certification systems. Also, it is commonplace for wood fibre supply chains that certified biomass-only be mixed with 'controlled' biomass (i.e. that is demonstrate to be legally harvested through risk assessment). We recommend similar requirements to be adopted to avoid risking mixing with illegally harvested material or material that would result in deforestation.	Comment was incorporated.	In section 3.1, on Mass-balance CoC approach was edited. Term "certified" was replaced by "eligible". Site-level mass balances were added. In section 2G, on Mix of sources, an exclusion was added regarding mixing with non-controlled sources of wood.
Miscellaneous				
234		Overall, we find the Methodology to be balanced in its approach on ensuring implement-ability and environmental integrity of carbon removal through geological storage. We also find the documents will need revisions before we believe they will be used in the DAC Industry and broader developing CDR markets. The governing principles are well chosen to specifically address the legacy issues present in the voluntary carbon market. We vehemently support these principles and are aligned with the spirit of what the Puro documents set out to achieve. Please allow us to provide a few questions and critiques which are meant to be targeted at the choice of implementation and not the underlying principles.	We thank the commenter for the support. The additional questions and critiques are addressed separately.	No change
235		In multiple places in the document you refer to both mafic and ultramafic rocks, but on page 8 you only exclusively say "basaltic rocks" which is a large minimisation of the scope from "mafic and ultramafic rocks", as basaltic rocks are only a small subset of mafic rocks. I would suggest making the definition consistent through the use of "mafic and ultramafic rocks" instead.	We thank the commenter for this observation. Indeed, the list should include the broader term Mafic and ultramafic rocks.	Modified the list of examples, replaced "Basaltic rocks" with "Mafic or ultramafic rocks, e.g. basaltic rocks". Unified the text overall.

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Webinar questions and responses

Public Webinar April 11th, 2024

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Question no.	Question	Answer
1	Does the methodology include embodied emissions for renewable energy (e.g., wind, solar), and are these emissions allocated over the project life or a 10 year period?	For wind, solar and other renewable energy, indeed, embodied emissions must be included in the emission factors used to represent those energy sources. The climate footprint of those energy source is not set to zero. This said, the embodied emissions are not spread over a 10-year period in the normal case but over lifetime of the renewable energy asset, whenever those energy sources are originating from the background system (i.e. not directly built and operated for the CDR activity). The lifetime of such renewable energy assets and thereby their climate footprint is part of common assumptions and such emission factors are available from various sources, including LCA databases. In the particular case where a renewable energy asset would be built as part of the CDR project, exclusively for it (direct power supply and no grid injection), the situation might be perceived differently. The asset is part of the project's foreground infrastructure and would then follow the amortization rules defined for the foreground infrastructure.
2	Were the Canadian Protocols/Regulations reviewed/considered for being approved under the method for CCS?	The Canadian regulations were not extensively reviewed as the EU and US regulations, but we are well aware that Canada has very good regulation in place for CCS. We included a question on this topic: should other countries be in this methodology as a priori approved regions, and we have all also discussed this amongst the working group. We are considering to add Canada to that list, but didn't include it [Canada] in this draft, as we wanted to collect more feedback from the general public on this topic first.
3	hi i am a CDR manneger in China I recently that Puro has updated geologically carbon storage methodology. Although it is still only a draft, it has many more details than the previous version,and what i focus on is rule 3.2.11, At present, China does not have a legal framework specifically designed for permanent storage of carbon dioxide, in this case, whether our project can be registered in Puro?	If there is no such regulation, the answer is no as they cannot fulfill the requirement. A more detailed answer would require a study on what type of regulations are in place that could fulfil the requirement. However, if there is no regulation in place, a project would not be eligible.
4	On pg 15 of guidelines, you elaborate on eligible CO_2 streams and mention that the stream shall consist overwhelmingly of CO_2 from an eligible source (95%). However in ineligible sources, co2 from fossil sources is described. Thus how can a WtE where a significant portion of CO_2 stream is fossil (e.g. 50%) be eligible under this methodology? Additionally, BECCS project could also have a higher proportion than 5% fossil. Thank you	You have to purify the flue gas to inject but it is not the intention of the rule to only allow for 5% non-eligible CO_2. This may need further clarification in the methodology.
5	a strategic question: why focus on removal of CO_2 from the ecosystem rather than on preventing additional fossil Co2 being introduced, by recycling and reuse of CO_2 already in the ecosystem	Thanks for the question. Preventing and reducing emissions is important, but the strategy of Puro.earth is to focus on the carbon removal. We are the leading engineered removals certification platform. There are others that focus on emission reductions.
6	whether the emissions factory of renewable electricity can be calculated as zero?	Whenever renewable energy such as wind power or solar photovoltaic electricity is used, no, it cannot be simplified as 0. The full supply chain emissions and thereby embodied emissions must be recorded or included in the LCA. In the normal case, this is done by using emission factors from already compiled sources.
7	when calculating C emissions for a transport system, are historical emissions to be included for example in building a gas pipeline 30 years ago which is now re-purposed for CO_2 transport	This ought to be added and clarified in the text. The revision will likely specify that for infrastructure that was already existing for another purpose than CO_2 transport for storage and for which there is a clear change of use (e.g. natural gas transport shifting to carbon dioxide transport), then those historical embodied emissions (construction & direct land use change, typically) would not need to be considered. This, thereby encourages the re-use of existing infrastructure (provided the infrastructure is no longer needed for its initial purpose). However, the re-purposing works and the emissions entailed would need to be included. The criteria here is based on "change of use" of the pipeline assuming that prior to current time there are no or very few pipelines that were historically built for CO_2 transport. Otherwise, we would also need a criteria that also considers the age of the pipeline (e.g. pipeline for CO_2 transport was already existing for more than 15 years, and keeps being used would not need to consider embodied emissions and direct land use change emissions).
8	Hi, project development manager from <Company name> here. I wanted to ask about the modelling for enhanced rock weathering. The methodology reccomends two papers (Kelland and Viene). Both of these models use PHREEQC to model. Does Puro accept or know of any other modelling platforms that work for enhanced rock weathering?	Questions does not tackle the GSC methodology, but the ERW methodology.
9	What are the sustainability criteria?	The document is an appendix because it is quite long and meant to be applicable, in the future to other methodologies. There are about 12 pages of criteria. The criteria are different for each feedstock category. As an example, for forest biomass, the criteria that needs to be provided tackles both social and environmental aspects, such as legal operation of the forest activities, good working conditions, systematic replanting of the forest stocks, maintenance or improvement of carbon stocks, adequate management of soil to preserve its quality, and similar criteria for water resources, air quality, biodiversity. There are also considerations of indigenous populations and local needs, as well as protection of high value ecosystems which includes non-harvesting from primary forests, high biodiversity areas, and high carbon stock land use. The sustainability criteria for other types of biomass is explained in similar detailed in the Appendix.
10	could you say more about the criteria for traceability of biomass such as residual waste?	Generally speaking for waste feedstocks as we defined them in the Appendix, the traceability and sustainability criteria are less strict than for a forest biomass or other cultivated biomass. In terms of traceability, let's say for food waste from an urban area, the minimum information we would require is the geographical area of supply and the name of the entities that have been delivering the waste to the processing factory. This is in contrast to other sources like Palm Oil where we require more details and go deeper in the traceability up to the field where the biomass was harvested to demonstrate sustainability criteria.

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Question no.	Question	Answer
11	What is the rationale behind the exclusion of carbon containing compounds as modes of geological sequestration? Is there evidence to suggest that this is less permanent than liquid CO_2 storage? Surely the oil and coal of today has been produced through a method such as this.	The main reason for the exclusion was not related to the permanence of the injected liquids but to the different types of requirements that would be needed to address the different characteristics of a carbon-containing liquid versus the injection of pure CO_2. There is evidence that even small impurities in the CO_2 stream can affect the physical and chemical behavior of CO_2 in the ground. So, we believe that the injection of the CO_2 containing liquids does not fit the same methodology as the injection of pure CO_2.
12	The amount of information that is expected to be publicly disclosed looks to be concerning in terms of commercial and technically sensitive information. Is it your view that all of these values are strictly necessary to disclose? The numbers could be further aggregated instead of providing detailed breakdown to the public.	There is a trade-off between complete transparency sometimes required by ICVCM and sensitive information from a commercial and technical perspective. We believe that what is suggested in the methodology has a sufficient level of transparency in the sense that we are asking to disclose operational and embodied emissions. however, for operational emissions, it is not required to make public the individual sources of energy use, material use, and so on. so, all of that is aggregated. of course, projects have the freedom to report more information if they wish but we think that this minimum aggregation and separation between operational versus embodied emissions should be feasible as we have found out through discussions during the working group sessions and other bilateral project discussions. But if you disagree, please provide your feedback with your reasoning and motivation via the public consultation process for our consideration.
13	In the case of CCS from biomethane production, sustainability characteristics including GHG-footprint in gCO_2e/MJ are already accounted for and attched to in the final product biomethane. How does puro's methodology take this into consideration? Correction to my question: i meant sustainability characteristics for biomass used in the biomethane production	Regarding calculation of project emissions, section 5.2 details how to deal with situations where the CO_2 is coming from a process with co-products. In short, there is an alignment with other reporting schemes. Regarding sustainability of the feedstock used for biogas production, the Puro criteria will be compatible in most situations with existing reporting/certification schemes, or in some cases require more data to be reported or made available to Puro auditor.
14	Should a facility, which uses it's own electricity and heat supply (WtE) for powering the capture technology, account for less electricity and heat provided to the grid? (e.g. replaced by fossil generated energy)	This depends on the baseline scenario, and is a matter of leakage (section 6). In case of a retrofit baseline for bio-CCS, leading to a reduced power/heat supply to the grid, the methodology defines mitigation options which would result in no leakage deduction. If no mitigation options can be demonstrated, the leakage term must be quantified as per the rule of section 6.3.
15	can you explain the future of biochar in this method? especially if used in deep geological storage	Storage of biochar (or other carbon-containing substances besides CO_2) is not eligible under this methodology.
16	Is the puro methdology compatible with being stacked with methdologies from other carbon standards?	This question does not pertain to the GSC methodology, but to the Puro Standard Requirements in general. Relevant information is found in the Puro Standard General Rules.
17	Biomass such as bamboo (perennial grass) shouldn't be included for carbon removal? as it grows better when it has a sustainable cutting plan. Is there any plan to update on such a thing including ease in certification?	Bamboo is possible to use. In the current Biomass Sourcing Criteria, bamboo plantations would either be categorized as forest biomass (G) or non-food agricultural crop (I), depending on the type of land it is cultivated on. In most cases, we foresee bamboo biomass to be treated as forest biomass, and subject to the same rules. In the future, if it appears relevant, a separate category could be added.
18	can you elaborate on embodied emissions for transport & storage in a case where this infrastructure is mostly shared with many co2 capture projects	Embodied emissions can be allocated to multiple users of shared infrastructure based on ISO 14044:2006 as described under rule 5.2.5.a. Moreover, we provide guidance in how embodied carbon can be amortized in the calculation of CORCs under rules5.2.14 to 5.2.17.
19	Does a waste+CCS project with a high split of fossil to biogenic CO_2 need to store the entire amount of CO_2 captured or only an amount corresponding to the eligible (biogenic) fraction?	At the moment, it was decided that the amount stored would bear the properties of the mixed CO_2 stream (fossil and biogenic shares) and not allow for accounting mechanisms to consider that captured amount is biogenic if not all is captured. We recognized the importance of such rules, which are conservative for now, and it may be revised or reconsidered in future updates.
20	Will there be a separate storage methodology for slurries and bio-oils?	It is unknown at present.
21	Relatedly, the Kelland and Vienne papers were not able to validate their model using physical findings and I have struggled to find any research that actually validates these models. How do we know they work and are there any requirements in terms of monitoring to confirm that the model is accurate?	Question does not tackle the GSC methodology, but the ERW methodology.
22	Why was 10 years selected for the max amortization period for embodied emissions of projects?	Answer provided live: We consider this timeframe to be a reasonable and conservative duration in line also with the crediting period. After the 10 year period is complete and the project is still eligible to issue credits, then for the subsequent years there will not be any embodied emissions to report except for the maintenance and repairs that may occur. Addition after revision of the document: the amortization period is now equal to the crediting period of the project, which was set to 15 years.
23	what are the sustainability criteria for biomass?	Sustainability criteria are provided in a separate document, also part of this public consultation. They are the basic criteria that determine whether a feedstock used for CDR is determined as eligible or not under the Puro Standard.
24	could you say a bit about the baselines for BECCS on exisiting facilities as opposed to new facilities.	The terminology was revised in the updated document. The primary determinant of the baseline scenario is whether the capture facility is New Built or Retrofitted (hence, a unique scenario for DACCS and two scenarios for bio-CCS). Then, projects will be allowed to further specify the nature of the baseline for the logistic transport chain and the storage site.
25	Will any supporting evidence (documentation) that supports the emissions figures in the CORC calculation be disclosed to the public on the registry?	The methodology requires at minimum public disclosure of the calculated emissions, with a breakdown per main groups, as detailed in the methodology, but not the full calculation with the explicit data inputs (due to confidentiality and IP issues). However, projects are free to disclose more information. Data submitted to Puro and auditors must include the full details.
26	Hi everyone, I am the Climate Change Program-Technical Manager from <Company name> and my question is related to Baseline demonstration defined in the methodology. For DACCS New built approach- it is assumed that the carbon capture facility is not built, the infrastructure for carbon dioxide transport is not built, and the carbon storage site is not built. Further, the land meant for construction remains in its historic state (pre-project land use). Would this default baseline also apply to storage sites that already exist such as- industrial wells or depleted hydrocarbon reservoirs?	The terminology was revised in the updated document. The primary determinant of the baseline scenario is whether the capture facility is New Built or Retrofitted (hence, a unique scenario for DACCS and two scenarios for bio-CCS). Then, projects will be allowed to further specify the nature of the baseline for the logistic transport chain and the storage site.

Question no.	Question	Answer
27	What do you think about GCS risks (leakage, reversal, micro-seismicity, etc) and their implications on the quality of carbon credits? Your system seems to be "binary"?	In general, the major risks discussed in the literature are: i) what if the storage reservoir leaks, ii) what if there is groundwater contamination following leaks, or iii) induced seismicity. Leaking of a deep geological storage is very rare. We have opinions from the IPCC saying that the CO_2 injected into a geologically storage reservoir is essentially permanently stored. This is in the case of a well managed site in a region where proper regulation is in place. Also, there have been numerical simulations and studies on the effect of e.g. different wells, looking at different leakage probabilities based on conditions of existing wells, or transmissibility faults or fractures. The overwhelming majority of evidence in the scientific literature suggests that leaking from the geological reservoirs into the atmosphere should be very small or negligible in the context of a well managed site and best regulations. That is why we added a requirement for regions with a robust legal framework surrounding the CCS activity. Induced seismic activities have been detected in CCS. But the overwhelming evidence shows that these have been micro seismic events that go undetected by humans but can be recorded accurately by seismic measuring devices. This has not been a major problem with CCS projects in the past. Nevertheless, there have been minor seismic events detected by local populations but they are quite rare and have not been large enough to cause major problems with the storage reservoir. So, yes it is indeed a risk, however there is a mature field in detecting seismic events that can help assess and manage seismic events.
28	how do factors like geological setup infleunce the viability of such project? in other words: the geological structure, porosity, permeability	The geological characteristics of a storage site have a significant effect on both the storage security and permanence, as well as the economic viability of the project. It is paramount that the geological characteristics of the storage site are investigated in detail during the course of the storage site characterization process.
29	In the case multiple business entities are involved to cover the entire value chain, it seems it may be difficult to get sufficient data from other entity due to confidentiality nature. Has Puro already saw such information sharing related challenges?	We acknowledge that there can be confidentiality and supply-chain challenges when compiling data for certification purposes; however, in Puro's experience to date, this has never led to the impossibility of certifying a project. We believe it is important to establish good cooperations with supply-chain partners to ensure transparency in the market. This is a broader issue in the field of sustainability transitions.
30	Does the biomass sourcing criteria advantage CDR solutions which work with feedstocks that they grow themselves, rather than sustainably managing a forest/taking away forest litter. With the upcoming supply side shortage in the supply of biomass, (and the emission-intensive transport of any biomass), does the growth of on-site biomass become more valuable?	We do not believe that Puro's Biomass Sourcing Criteria are affecting whether biomass should be grown by the supplier or from other parties.
31	Regarding biomass sources modelling in the LCA, do you include guidences on the allocation method at the source point? For example if they are classified as waste (i.e. burden free?), or if it's a byproduct where an economic allocation would be applicable, etc. Thanks	The allocation process of impacts between co-products/by-products and/or shared infrastructures follow the guidance of ISO 14044:2006 and are described under rule 5.2.5.a. Further details are provided for the attribution of biomass-based capture under rule 5.2.8.
32	My understanding is that also embodied emissions from transport of CO_2 (ie ships, trains, etc) have to be included. Will there be generic assumptions/emissions factors for this or will all players need to calculate this. Will be a huge complicated task.	In alignment with the GLEC Framework v3, we exclude the embodied/embedded emissions associated with the production of vehicles. However, we include in the transport calculations embodied emissions in infrastructure assets (e.g., pipelines, roadways, etc.). We will work with Suppliers to meet this requirement.
33	How will the project monitor for reversals of sequestered carbon to the atmosphere? Reversals as when carbon that is stored by a project is rereleased into the atmosphere by either avoidable (i.e., intentional) or unavoidable (i.e., extreme weather) events..	There are rules in the methodology that the supplier must monitor for these release events and in case they are detected the must be quantified and reported. Once leakage is detected, the supplier must take immediate action to limit the damage and notify the Issuing Body and quantify the amount that would be deducted from the carbon credits issued. In addition, there are events where releases may need to be undertaken for safety reasons (e.g. to lower pressure). These events must also be accounted for and deducted from the carbon credit issuance. All of these events must be properly recorded either through direct measurements or using conservative estimates based on the flux of CO_2 measured and estimated time that the leak has been ongoing. The obligation to compensate is with the CO_2 removal supplier.
34	Could you organize the answers to the questions of this webinar into a document and feedback to me	The answers will be published as part of the public consultation process.
35	Our interest is fermentation CCS in Europe. Red Trail in the USA is an interesting case study. 1) do Red Trail stored tonnes receive tax credits for US CCS and if so, how do they pass the additionality test? 2) does Red Trail biomass meet PURE biomass sustainability criteria (I'm not sure what these criteria are)? 3) do PURO biomass sustainability criteria align with EU Renewable Energy Directive? 4) will PURO align with the EU Certification Framework for Carbon Removals? thank you,	Questions 1 and 2. The questions relate to a certified project and are not directly related to the methodology. The questions are outside the scope of this consultation. Question 3. The Puro Biomass Sourcing Criteria are mostly aligned with the EU RED, and certification in accordance with the EU RED can be used in certain cases as a way to demonstrate eligibility of the feedstock for Puro. Question 4. In general, Puro.earth is ready to align and adapt to regulatory changes.
36	Why is EOR now excluded? Why the change from the previous version of the Methodology?	We want to align with ICVCM principles that prohibit removal methods that support EOR, i.e. lead to increased extraction of fossil fuels.
37	If the EU ETS starts to allow entry for certain types of CDR what types of CDR methodology is this likely to be for? Do you expect this to follow the classification system of the CRCF, allowing ""Permanent"" technologies to gain entry into the ETS, or do you expect only technologies involving geological sequestration to become integrated?	Puro.earth does not have visibility on what the EU ETS will ultimately include. However, Puro.earth is ready to align and adapt to regulatory changes.
38	to complement Richard reply a solid MMV program during and after injection towards transfer of liability to the Crown will be in place to ensure containment and leakage mitigation	Liability can indeed be transferred to a competent authority when possible in the applicable regulation.
39	Does the LCA study submitted to Puro.Earth require independent 3rd party review before auditing process? Can it also be developed by internal LCA team, if available? Previous version of the methodology makes explicit reference to professional LCA study and indepedent review, which is not the case of current draft.	No, this is not a requirement. The LCA project can be developed internally provided that it meets all the transparency and technical requirements defined in the methodology and that it follows the templates that are being provided by Puro.
40	What's the status of the methodology? More specifically, can it be freely used outside of commercial purposes for reporting in geographies where the regulations do not allow for carbon credits generation for example?	It is possible to use this methodology internally or for non-commercial purposes to advise your project design and project implementation and planning. But commercial use requires membership and contract with Puro.earth.

Question no.	Question	Answer
41	Many of the LCAs of large-scale DAC companies available in the literature exclude essential parts of the formula within your presentation (the embodied carbon costs most notably). These LCA are then used to model DAC cost curves used by these companies to show that they can reach sub $100/tCO2c. Do you believe large scale DAC companies would have been able to gain accreditation through Puro's framework?	It is difficult to provide an answer without closely reviewing the carbon calculations from these DAC projects.
42	For carbon storage in depleated hydrocarbon reserviors, can you share your thinking on what evidence that is required to show no further hydrocarbon recovery is taking place from that reservior?	If hydrocarbon extraction takes place in the future from that site, we would quickly run into problems with the IC-VCM criterion to not advance operations related to EOR, and also with additionality. For additionality, imagine that an oil reservoir is used as a storage site, and later on some 3rd party would start an EOR operation there. In that case, the 3rd party might have to pump less CO_2 into the reservoir because CO_2 had already been previously injected there (i.e. CCS operation might not be additional, as the 3rd party might have to anyway pump just as much CO_2 into the reservoir for EOR).
43	I am interested to learn more about the monitoring mechanisms in place that you are envisioning to quantify reversals? ... and in line with the previous question, what are the ways that puro.earth considers variability in performance in injection of CO_2? input biomass?	An important aspect of the monitoring the storage site is to check whether CO_2 actually stays underground. There are several different methods to monitor a CCS project. Most importantly, deep surface monitoring different kinds of gauges or other logs like pressure gauges in the actual wellbore, or other measurements like acoustic velocity or resistivity. Besides that, there are other types of measurements that can and should be done as well. Considering the large extent of a storage site, relying purely on direct sampling might not be that efficient to discover small sources of leakage not easily detected e.g. by pressure monitoring in the wellbore. This could instead be done through various types of remote sensing: for example, aerial or satellite data, hyperspectral imaging or publicly available spectral data. Other remote sensing options include detection of temperature anomalies, vegetative stress, changes in the shape or elevation of the ground, which can be use as indirect measurements to identify areas that could be candidates for further measurement, and identify previously unknown sources of leaks. What is important here is that projects choose a suite of measuring technologies that take into account the site specific characteristics. The methodology requires several types of measurements performed at regular intervals. Of course, there is also the requirement for compliance with local regulations on monitoring practices. The methodology gives a lot of guidance on what is good practice in the monitoring of CCS.
44	The recent projections by the IEA on the Net Zero 2050 outlook predicted that 102EJ. According to our calculations, this would amount to roughly 50Gt biomass. The use of this amount of biomass by bioenergy power plants would release something in the realm of 80GtCO_2. Therefore, there is 80GtCO_2 available for BECCS to sequester by 2050. Given this, and the fact that BECCS can do what DACCS does but cheaper, does DACCS become a redundant technology in your opinion? Can we reach our CDR requirements solely through BECCS-based systems?	This is an interesting question as it relates to the deployment of the CDR activities associated with this methodology. However, it is outside the scope of this consultation.
45	Good updates. Thanks for sharing. How much of these updates leverage efforts from Drax and CCS+ (Verra)'s draft methodologies for BECCS?	We have studied these and other similar methodologies as part of the background study for this draft. We have tried to align with common requirements from other methodologies, but overall this methodology is a synthesis from the best available scientific literature, regulatory guidelines and industry best practices rather than heavily leveraged from any single source. Further, some aspects of the methodology are unique to Puro.Earth's approach to CDR and Puro's General Rules.
46	with a choice between different types of certification schemes in the voluntary marked - wouldn't the CO_2 removal supplier choose a scheme that is not as honerous as the PURO scheme when it comes to emissions to include in the value chain in order to get a higher number of CORCs that can be sold?	Puro.earth considers it paramount to continue to maintain a high degree of rigor in matters of carbon accounting.
47	thank you, can you expand on then how would the "findings" of these measurements be integrated into the LCA analysis to quantify CORCS? ... e.g. we find a leakage, then what do we do? and if we fix it, then how we submit the leakage fix? ..interested in the timings and procedures	We refer to the equation for calculation of CORCs in section 4. Its different terms are calculated via different approaches. In particular: - E_project is determined by the LCA of the supply-chain of the removal activity, see section 5 - E_leakage correspond to indirect effects entailed by the activity, and is determined by following the rules in section 6 - E_reversals corresponds to releases from the storage, if any. Those reversals and their reporting is governed by the rules in section 4.7 as well as 7.6.
48	Given the length of the document, would it be possible to extend the PC period?	The length of the public consultation period is in line with other public consultations in the Puro Standard. Some late submissions were also accounted for.
49	insurer clients are looking to support carbon captuer projects to provide them with the necessary insurance cover. What problems could arise from the carbon captuer if the containment fails? Just to give me an idea of what I may be facing.	If the containment fails, there is the possibility that the CO_2 will move to a location where it is not wanted. A common direction could be towards the atmosphere. For example, if there is an improperly sealed legacy well connected with the storage reservoir. in that case, the CO_2 will go directly to the atmosphere. as this could result in small leakages and not in catastrophic levels like people dying. there are other types of leaks, if it leaks into underground drinking water, that might cause changes pH and dissolution of CO_2. making heavy metal leaks and brine contaminate the water source making it undrinkable.