



# Expectations for Prepurchase deliveries

Requirements to process and accept carbon removal deliveries through Frontier

Last updated May 30, 2023

## Delivery acceptance process overview

We are excited to process your delivery. Below is the process we will follow and the information we are looking for to confirm and accept carbon dioxide removal (CDR) as delivered:

- (1) **Supplier provides evidence of net carbon removal sequestered** to Buyers and Frontier
  - We can flexibly kick off this process as you deliver tons and have the substantiating data – we'll defer to you on whether to process interim and partial deliveries or, if applicable, wait until hitting final or renewal contract milestones.
  - See requested data below
- (2) **Frontier reviews delivery information**, follows up with any questions and sends a request for any missing data; Supplier provides any missing information.
- (3) **Buyer accepts or rejects delivery**
  - For the first delivered tons, Frontier will send the protocol and data (treated as confidential under NDA) to Frontier's external scientific team for review.
  - If some or all of a delivery is rejected, Frontier will flag any issues or additional data required before re-review.

Please note that this is interim guidance and subject to evolve as the CDR ecosystem does. Our delivery expectations for prepurchases also differ from those for offtakes (see Appendix).



## Data requested for tons delivered to Frontier buyers

We are looking for detailed information on the delivery of our purchase, as well as high-level data on your deliveries for our planned CDR Delivery Tracker.

To confidently accept delivery, we expect to receive:

Data	Description	When provided
Carbon removal delivery certificates	Certificate of delivery <sup>1</sup> which includes: <ul style="list-style-type: none"> <li>• Issuer</li> <li>• Issue date</li> <li>• Protocol issued against</li> <li>• Certificate #</li> <li>• Recipient</li> <li>• Net CO2 delivered</li> </ul>	With each delivery
Validation & verification report	A copy of the report detailing on-the-ground certification of the tons delivered per the protocol from an independent, third party validation and verification body (VVB) is preferred, though a review by an unaccredited VVB or self-produced report is also acceptable for prepurchases.  <i>Note: It may be strategic to look ahead to Frontier's expectations for offtakes when considering your early VVB partner.</i>	With each delivery
Approved protocol, Project Design Document (PDD), and creation summary	A copy of the protocol and PDD describing the approach to quantify net carbon removal for the project.  Should include: <ul style="list-style-type: none"> <li>• Name of the protocol developer</li> <li>• How the protocol was developed, reviewed and approved</li> <li>• The quantification methodology, inclusive of the <a href="#">relevant components for the pathway</a>, which details what data is measured versus modeled, LCA boundaries, monitoring frequency, key assumptions, and treatment of uncertainties</li> <li>• Accounting for the discount to net removal (when applicable) associated with the relevant pathway <a href="#">uncertainty components</a></li> <li>• Standard the protocol was validated against and name of VVB conducting the protocol validation, if applicable*</li> </ul>	Two months + prior to first delivery, and annual report thereafter of any protocol changes

<sup>1</sup>For prepurchases, we are explicitly **not** requiring use of an independent, Frontier-qualified third party registry, though we do require a 3P reviewed protocol. Note: these verification expectations differ for larger offtakes.



	<i>*Note: For prepurchases, this can be a proto-protocol, as long as details on the scientific review process are provided.</i>	
Life cycle assessment (LCA) for delivery	<p>A detailed LCA breakdown that specifies:</p> <ul style="list-style-type: none"> <li>● Gross removal for Frontier credits (per tCO<sub>2</sub>)</li> <li>● Emissions caused by delivering Frontier credits (per tCO<sub>2</sub>)</li> <li>● LCA boundary conditions</li> </ul> <p>Including, but not limited to:</p> <ul style="list-style-type: none"> <li>● Embodied emissions in materials used (equipment, sorbent, etc.) (tCO<sub>2</sub>)</li> <li>● Transport and electricity emissions with <ul style="list-style-type: none"> <li>○ Energy resource mix; power and/or liquid fuel (list)</li> <li>○ Carbon intensity of energy resource mix (unit of power/tCO<sub>2</sub>)</li> </ul> </li> </ul>	Upon first delivery, with a an updated LCA provided on an annual basis
Discussion of uncertainty discount	Quantification of net tons delivered which appropriately discounts volume to account for pathway uncertainties and points of leakage identified in CarbonPlan's CDR <a href="#">Verification Framework</a>	Upon first delivery, updated as uncertainties are reduced
Select operational data	<p>Relevant operational data to substantiate that you have done the activities necessary to remove carbon durably. These will vary by pathway, but may include:</p> <ul style="list-style-type: none"> <li>● Capture dates</li> <li>● Injection/application dates</li> <li>● Injection/application locations</li> <li>● Data demonstrating system's functional stability and durability</li> </ul>	With each delivery
Credit register maintained	<p>Details on how you are transparently, publicly reporting delivered tons. May be via:</p> <ul style="list-style-type: none"> <li>● A self-operated registry</li> <li>● An independent, third party registry or marketplace</li> </ul> <p><i>Note: We will list delivered tons on Frontier's CDR tracker. We do not require the use of an independent registry for prepurchases. However, if a supplier is broadly issuing credits, we assume the supplier is working with a legitimate VVB and has appropriate governance controls in place.</i></p>	Upon first delivery

Note: The information above will remain confidential under our NDA.

Note: Ongoing reporting against interim milestones and of other operational data will be requested/collected separately through quarterly meetings and via an annual portfolio survey.



If you have delivered all contracted tonnage and would like to kickoff assessment for future purchase eligibility (including unlocking renewal, if applicable), we will look for the following in addition to the above:

Data	Description
Summary report	A written report to Frontier outlining: <ul style="list-style-type: none"> <li>• How funds were used to contribute to the removal of carbon dioxide;</li> <li>• How many tons of carbon dioxide were removed and at what cost;</li> <li>• Proof of tons removed; and</li> <li>• A narrative description of Company's progress and challenges to completing the Project, and why this is the right time for a follow-on purchase.</li> </ul>
Research associated with the project delivery	Copies of any research or publications produced in connection with the Carbon Removal Purchase and Project.
Revised LCA	Updated LCA for future deployments that demonstrate declining future process emissions and improving net-negativity
Revised techno-economic analysis (TEA)	Updated TEA providing significant evidence that a sub-\$100/ton capture cost by the date projected in the application to Frontier is achievable and highlighting key cost sensitivities.  Differences between current experimental values and TEA assumptions for \$100/ton highlighted, including a plan to narrow the gap between actual and modeled performance presented
Proof of responsible community engagement	Evidence of ongoing responsible community engagement and efforts to achieve the highest standards of safety, compliance, and local environmental outcomes
Completed scorecard	Completed delivery and performance scorecard for the most recent calendar year
Project specific milestones	Evidence of achievement of any project specific milestones

*Note: This language is standard in contracts Spring 2022 and after. If you signed a contract prior to that date, the above may vary slightly.*



## Data requested for all tons delivered

For Frontier's public CDR ecosystem delivery tracker, we would like to highlight for the community all permanent carbon removal delivered to date, which includes deliveries you've made to other buyers beyond Frontier.

Please make a [copy of this template](#) and use it to provide the data for each delivery (orange fields are optional):

Data	Description	Example
net_tons	tons of CO2 delivered net of any lifecycle emissions	2,000 tons of CO2
supplier	supplier name	CO2 Inc.
supplier_link	supplier website	www.CO2inc.com
pathway	name of the CDR pathway associated with the tons	Direct Air Capture
delivery_date	date when the tons were delivered	December 15, 2022
protocol	link to a public copy of the protocol deliveries were verified against	<a href="#">DAC + Mineralization, 2022</a>
buyer	name of the organization purchasing the tons	Stripe Climate
details_link	a link to the supplier registry or tracker for the tons delivered (when available)	<a href="#">Charm Industrial's registry by delivery</a>
price_per_net_ton_delivered	dollars per ton delivered	\$500
gross_tons	gross tons captured for the delivery before lifecycle emissions are removed	2,300 tons of CO2



## Appendix

### Delivery expectations for Prepurchases vs Offtakes

Element	Prepurchase requirement	Offtake requirement
Standard	N / a	Credits must be issued against a program Standard with one of Frontier's qualified credit issuers
Protocol	A proto-protocol is acceptable	Approved protocol validated by a VVB & approved by Frontier is required
Project Design Document (PDD)	PDD required	PDD validated by a VVB is required
Validation & verification body (VVB)	Use an independent, third party verifier, ideally accredited (preferred)  Conduct internal review and reporting (acceptable)	Use an accredited, independent, third party validation and verification body confirmed by Frontier
Credit issuance & registry listing	Credits are publicly listed, but no independent registry required	Credits are issued by a third-party registry that meets Frontier buyers' needs and is confirmed by Frontier

#### Verifier & registry eligibility

*Note: this is draft guidance and subject to change*

To receive prepurchases, we may accept delivery that is reviewed by an unaccredited VVB and do not require an independent registry. However, to build relevant partnerships from the start, we suggest looking ahead to Frontier's delivery expectations for offtakes when considering your early VVB and registry partners.

#### Verifier expectations

We prefer to receive deliveries verified by entities that:

- Have strong processes for protocol validation that **account for project uncertainties** (e.g., open scientific questions, sensor tolerances, incentive conflicts, etc.)
- Have **relevant CDR experience and expertise**
  - Specific expertise in the domain of interest (DAC, oceans)
  - Field level technology experience (commissioning, instrumentation, etc.)
  - Analytical expertise (data management, modeling processes, etc.)



- **Are accredited** through an International Accreditation Forum member or by an accreditation system under the UNFCCC.
- **Provide a pricing model divorced from the quantity of tons successfully delivered** (i.e., payment may be based on expected tons, but should not be based on the % successfully delivered)
- **Avoid conflicts of interest.** The verifier is not financing the development of CDR or offset projects or generating revenue from credit sales.

#### Credit issuing program & registry expectations

We prefer to receive credits issued by entities that:

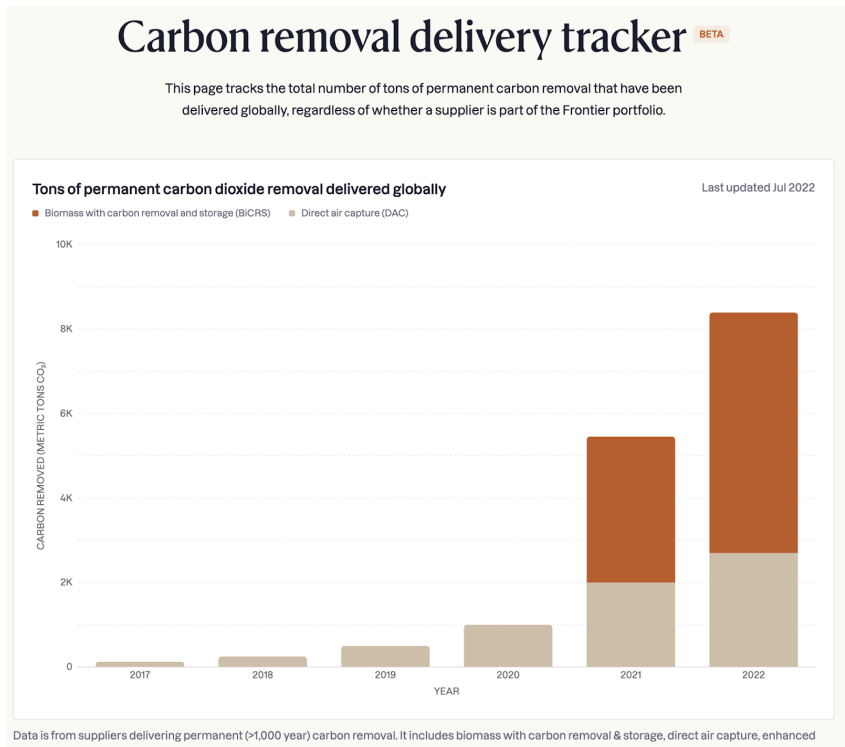
- **Are well-governed with transparent decision making**
  - Specifically, provide transparency around processes for credit issuing operations: a published Standard, open documentation of methodology review processes, overview of who holds decision making responsibilities, and processes for revising methodologies in accordance with the latest science
  - Follows IC-VCM's Assessment Framework guidance regarding credit program operations
- **Set a high standard across pathways for carbon removal**
- **Hold a high bar for verifier partners**
  - Specifically, provide clear requirements for independent third-party validation of CDR methodologies and verification of project deployments (e.g., clear process for selection, approval, reevaluation and rejection; conflict of interest policy, data reporting expectations for VVBs, etc.)
- **Publish a public, transparent, detailed ledger of tons**
  - Specifically, maintain a publicly transparent ledger of issued, traded and retired credits that includes greater transparency in reporting to increase field accountability (i.e., including methodology, buyer, lifecycle emissions, and chain of custody for any credit transfers)
  - Have processes in place to prevent double counting of projects across registries



Preview of Frontier CDR Delivery Tracker

Below are screenshots that illustrate the shape of the public delivery tracker Frontier is planning to launch in late 2023:

View 1 - Aggregation of deliveries by pathway and year



View 2 - An itemized list of delivered tons (purchased by credible buyers):

Recent deliveries Download .csv

Tons CO <sub>2</sub>	Supplier	Pathway	Delivery date	Delivery details
293	Test Supplier A	BICRS	Jul 2022	Details →
120	Test Supplier B	DAC	Jul 2022	Details →
153	Test Supplier A	BICRS	Jun 2022	
1,280	Test Supplier A	BICRS	Jun 2022	Details →
550	Test Supplier A	BICRS	Jun 2022	Details →
80	Test Supplier B	DAC	May 2022	
1,667	Test Supplier A	BICRS	May 2022	
1,280	Test Supplier A	BICRS	May 2022	
100	Test Supplier A	BICRS	May 2022	Details →
370.5	Test Supplier A	BICRS	May 2022	Details →





## Delivery expectation Q&A

### What level of measurement reporting and transparency is Frontier looking for?

Transparency around both what is known and where uncertainties remain could build broader community trust in CDR claims. For all purchases facilitated by Frontier, we expect transparent communication of protocols, data reflecting a company's execution against that protocol, and reporting to the market of tons delivered.

### What type of long-term durability monitoring does Frontier require?

We expect projects to actively monitor project deployments (storage systems, mineral amendment applications to land, etc.) until "functional stability," a concept from landfill management, is reached. This is the point at which the system no longer poses serious reversal risk and doesn't require any active control systems for continued storage.

For permanent carbon removal projects, we expect protocols to address durability by 1) developing monitoring processes and data requirements to track reversals or storage leakage, and 2) identify an appropriate threshold and what must be observed in order to confidently assess that "functional stability" has been reached and monitoring can be discontinued. This point will vary based on the nature of the deployment (i.e., the stability timeline for basalt mineralization vs geologic storage of supercritical CO<sub>2</sub> vs biomass burial looks different).

### How should protocols evolve as new information comes out? Will Frontier revise past vintages?

We ask that projects adopt conservative protocols that appropriately discount delivered volume based on uncertainties. In the case that significant learnings come to light that imply less carbon removal was completed than credits delivered (e.g., scientific consensus determines that geologic storage leakage is 10x our previous assumption), it is up to each Frontier buyer's discretion whether they write off that carbon removal purchase and re-buy if the credit was retired. We would not retroactively claw back payments from companies.

We also ask that protocols be updated periodically: frequently enough to reflect the best available science, but not so quickly that it makes operationalizing the protocol impossible, recognizing that companies need time to set up the appropriate quantification (sensors, lysimeters, modeling, etc.) and reporting infrastructure.