

Takachar Production Facility & Output Audit Report

For Puro.Earth

CO ₂ Removal Supplier	Himalayan Sustainable Energy Solutions Pvt. Ltd. (dba Takachar)
Removal Method	Biochar
Production Facilities	Takachar Novato facility
Facility ID	980845
Production Facility Addresses	3900 Sears Point Road Novato 94945 United States
Net Volume of CO ₂ Removal	117.42 CORCs
Removal Period	November 1st, 2023 – January 31 st , 2025
Auditors	350Solutions Guy Ingram-Hardwick Tim Hansen
Version	V1.2.1

ISSUED: 12MAR2025

Contents

Takachar Production Facility & Output Audit Report.....	1
1. Introduction.....	3
2. Technology Description.....	4
3. Audit Summary.....	7
3.1 Audit Approach.....	7
3.3. Verified Output & CORCs.....	8
4. Audit Findings.....	9
4.1. Summary of Audit Findings	9
4.2. Audit Issues & Recommendations.....	11
4.2.1. Audit Issues.....	14
4.2.2. Opportunities for Improvement.....	15
5. Eligibility for Ongoing Issuance Rights.....	16
Revision History.....	16
Auditor Signatures.....	16
References.....	17
Appendix 1: Puro.Earth Biochar Methodology Audit Checklist.....	18
Appendix 2: Site Visit Photos.....	25
Appendix 3: Verifier Qualifications.....	28
 Figure 1 Douglas biochar reactor (left), Biomass pile dumped on site by tree management contractors (right).....	 4
Figure 2 Farm soil application of biochar in greenhouse	5
 Table 1. Takachar Production Facility & Output Audit Summary.....	 3
Table 2 Verified Production Facility Inputs & Outputs	7
Table 3 Audit Activities.....	7
Table 4 Verified CORCS for the Takachar Novato Facility	9
Table 5 Audit Findings	9
Table 6 Audit Issues and Recommendations.....	11

PRODUCTION FACILITY & OUTPUT AUDIT REPORT

Company: Takachar	Company Contacts: Vidyut Mohan, CEO and co-founder Kevin Kung, CTO and co-founder* Rod Kux, Operations manager	Audit Team: Guy Ingram-Hardwick* Tim Hansen
Removal Method: Biochar		
Report Date: 12-Mar-2025		
Document No: 350VR-PU2408		
Rev: 1.2.1		

*Primary contact/lead author

1. INTRODUCTION

350Solutions was contracted to perform an audit and validation of the production facility as well as verification of carbon dioxide removal credit (CORC) claims for Takachar's Novato biochar production and utilization project. Takachar utilizes waste woody biomass from regional forest management services to produce biochar. The regional forestry management operations include collection of woody waste from tree trimmings and fire management programs in the area, providing sustainable process feedstock streams to support Takachar's operations. The waste materials used would typically be disposed of on either the ranch site where Takachar operates, or in regional landfills, with small quantities used as fill or mulch materials. Takachar currently supplies biochar to local vineyards and neighboring farmland for soil application. A small amount of the biochar is being used by the farmers as a livestock feed additive.

350Solutions conducted an audit of the process, lifecycle CO₂ emissions assessment (LCA), and other administrative details to verify compliance with the requirements of the Puro.Earth Standard General Rules V3.1 [1] and Biochar Methodology (Edition 2022 Version 3) [2]. The audit and verification included a document review, a detailed data audit, and a site visit on February 5th, 2025.

TABLE 1. TAKACHAR PRODUCTION FACILITY & OUTPUT AUDIT SUMMARY

Verification Summary	
CO₂ Removal Supplier	Takachar
Production Facility Name	Takachar Novato facility
Facility ID number	980845
Production Facility Location (Address and GPS Coordinates)	Novato, 3900 Sears Point Road, Novato 94945, United States 38.12451494596527, -122.49244611161436
Removal Method	Biochar – Production from woody forest waste
Reporting Period	November 1 st , 2023 – January 31 st , 2025
Verified CORCs	117.42 CORCs
Verification Type	Combined Production Facility Audit and Output Audit for Puro.Earth, including on-site visit and facility audit; Puro Standard General Rules (v.3.1) and Biochar Methodology (2022 v3)
Site Visit Date	5-Feb-2025
Verification Report Date	12-Mar-2025

2. TECHNOLOGY DESCRIPTION

At the core of Takachar's approach is the deployment of small-scale, mobile biochar units that can be operated directly in rural communities and distributed sites. The decentralized model reduces the need for transporting biomass over long distances to reduce associated logistical emissions and costs. The technology, which involves the thermochemical conversion of biomass, results in formation of biochar and ultimately, with proper use, the long-term removal of carbon dioxide from the atmosphere.

The Takachar Novato facility has two operational biochar reactors, named 'Douglas' and 'Coni', that are each capable of converting one tonne of biomass per hour into biochar. Figure 1 provides an image of the 'Douglas' furnace which has been used for most of the biochar production credited. Douglas is powered electricity provided by a solar array and only occasionally by a gasoline generator. Coni runs solely on electricity provided by a gasoline generator. Fuel usages for both furnaces are accounted for within the LCA documentation.

The waste biomass is sourced from local landscape management services which maintain forests for fire prevention and ensure the safety of electric power installations and grid services managed by PG&E. These trimmings are chipped by the contractors and transported to the Petaluma River Ranch farm, the site of Takachar's Novato facility. A letter from the farm manager has confirmed that the ranch has served as a disposal site for the biomass prior to Takachar's operations and that for the current reporting period, no increased volume of biomass is being transported to the farm for Takachar to use. Figure 1 shows a pile of biomass being stored awaiting processing into biochar.



FIGURE 1 DOUGLAS BIOCHAR REACTOR (LEFT), BIOMASS PILE DUMPED ON SITE BY TREE MANAGEMENT CONTRACTORS (RIGHT)

Prior to combustion, biomass is fed into a hopper and delivered to the reactor chamber via an auger. Once the first amount of biomass reaches the ignition port, the auger is turned off and the biomass is

ignited manually. Once proper combustion has commenced, the auger is turned back on, and the reactor is continually fed biomass from the hopper. Only biomass is used as the fuel source for combustion and no other fossil fuels are added during startup and operation. The pyrolysis reaction occurs at a temperature range of between 450 and 650°C. The airflow into the combustion chamber is controlled via a blower system fitted to the side of the chamber, which can be seen in Figure 1. The combustion of pyrolysis gases and oils in the primary chamber helps to sustain the pyrolysis reaction in the chamber. After 10-15 minutes, biochar starts to form and is fed into an output drum. The average residence time of the biomass in the chamber is around 20 minutes. Another blower system is fitted to the other side of the furnace, higher up the exhaust to ensure the proper combustion of any pyrolysis gases produced.

Once the biochar has been produced, it is weighed using a load cell on the reactor system before being fed into a hopper whilst moisture is added in order to quench the biochar to an appropriate temperature. The biochar is then transported to a crane scale, where a measurement for the total mass of biochar produced is taken. Samples are then taken from the biochar to measure the biochar moisture content. This measurement, alongside the reading from the crane scale is what is used to derive the associated mass of dry biochar produced and the gross CO₂ removals. Finally, the biochar is transferred to a holding bin for distribution to the neighboring farm or loading into equipment for other distribution. While in the holding bin, biochar is quenched as needed to control temperature, prevent ignition, and so that it can be safely transported and stored before distribution.

The biochar is being used by local farmers and vineyards for agricultural soil application. An image of a local farm using the biochar for soil application in its greenhouses is shown in Figure 2. Some biochar is also used in livestock pens and may also be consumed as a feed additive.



FIGURE 2 FARM SOIL APPLICATION OF BIOCHAR IN GREENHOUSE

Normally a large portion of electricity used by operations is powered by a battery connected to an onsite solar array. On days when the stored energy is not enough to power site operations, a gasoline generator is used. The Douglas reactor electricity is provided by solar most of the time, and occasionally by a gasoline generator. The Coni furnace is run solely on electricity produced by a gasoline generator. The total energy provided by the solar array is monitored using an integrated power meter and an available online datalogging and data portal which shows energy usage over a given period. Embodied emissions associated with the use of the solar system are accounted for in the LCA. The emissions associated with the electricity produced by the generators is accounted for using receipts for purchased fuel and appropriate emission factors and accurately recorded in the LCA document. Other energy related inputs in the Takachar biochar process include the gasoline and diesel used for materials handling equipment (telehandlers, trucks, ATV's) as well as for pumping water from a local creek into a portable water bowser. Again, associated emissions are calculated using receipts for fuel purchases and appropriate emission factors. No emissions are associated with the process water used for quenching aside from diesel use for pumping and embodied emissions for storage and pumping equipment, as it is not treated nor provided by a local municipality. The water comes from the local agricultural irrigation system which Takachar have been granted permission to use by the landowners.

Under the Puro Standard Biochar Methodology 2022 V3, Biochar sampling and analysis is required at an appropriate sampling frequency such that the any variability and seasonality in the biomass feedstock and production conditions is reflected. Takachar currently meet this requirement with an annual biochar analysis benchmarked against quality thresholds defined in the International Biochar Initiative (IBI) Certificate Program [4].

Currently, Takachar is not required to conduct air emissions testing as their equipment falls under an air emissions test exemption from the California Air Resource Board (CARB). However, they are still conducting air emissions testing for GHGs coming out of their exhaust to accurately measure carbon removal. This is currently conducted infrequently by collecting a gas sample and transporting to a testing facility in India. Takachar is experimenting with a sampling technique that will allow more frequent, cost-effective, on-site testing system; however, this is yet to be implemented.

The production and LCA data verified here includes process operations during the reporting period of 01-Nov-2023 to 31-Jan-2025 where, over 149 days of production during the period, 238.41 tonnes of dry biomass was processed, 60.70 tonnes of biochar was produced, and 128.10 tonnes of carbon was sequestered (gross). Table 2 summarizes the observed inputs and outputs from the process and typical rates from supplied operational data.

As the biochar generated is the sole product from the operations of the Takachar Novato facility, no allocation of emissions was necessary, and 100% of the emissions documented were allocated towards the production of biochar.

TABLE 2 VERIFIED PRODUCTION FACILITY INPUTS & OUTPUTS

Input/Output	Verified Rate	Notes (Specifications, source, etc.)
Waste woody biomass input	238.41 tonnes (dry mass) Average of 3.93 tonnes of dry biomass/ tonne dry biochar	Waste from local forestry management contractors, all chipped outside of project boundary.
Biomass supply inputs (collection, handling, transportation emissions), (E_{biomass})	0 kg CO ₂ -eq. /dry tonne dry biochar	No emissions are accounted for regarding any processing or transport of biomass conducted by forestry management as this was already occurring in the baseline scenario.
Production and operation emissions output ($E_{\text{production}}$)*	171.71 kg CO ₂ e/tonne dry biochar	Emissions from all production processes and supporting equipment, process operations, emissions controls, material handling equipment fuel usage, and equipment manufacture.
Product distribution emissions output (E_{use})	4.27 kg CO ₂ e/tonne dry biochar	Verified based on actual transport distances from production facility to end user.
Biochar production output	60.70 dry tonnes produced	Total biochar production during the reporting period.

**A slight discrepancy can be seen between these values in the Takachar LCA file and CORC calculation file. These discrepancies are resultant from differences in value rounding between the two documents. The values displayed in this report are taken from the CORC calculator file.*

3. AUDIT SUMMARY

3.1 AUDIT APPROACH

A planned series of audit activities were conducted by 350Solutions to independently validate and verify the production facility, its operations, production, and output data, and CORC claims. The audit was conducted following the specifications of Puro General Rules (v3.1) and the Biochar Methodology (2022 v3). Specific audit activities conducted are summarized in Table 3. A completed Puro Biochar Methodology Compliance Checklist used during the verification is attached to this report as Appendix 1: Puro.Earth Biochar Methodology Audit Checklist. Verifier qualifications are attached as Appendix 3.

TABLE 3 AUDIT ACTIVITIES

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
23Jan2025 – 12Mar2025	Document Review – Production Facility Audit	- Review of facility registries and permits - Review of LCA and supporting inputs - Reviews of facility eligibility, additionality, and biomass sustainability - Review of production facility design and operation - Review of MRV - biochar characterization and critical measurements	- Takachar_PuroRegistration.pdf - California Burn Permit.pdf - AirPermitExemption(2-1-126).pdf - takachar_puro_LCA_California_final_2.8.xlsx - CORC Report Summary_Takachar_FinalOutput California_2.8.xlsx - Certificate of Status_Takachar_1739012570578.pdf - California_Biomass_Eligibility.pdf - Environmental Evaluation, Report.docx - Takachar_additionality_document-California pdf - Response from Takachar in the RFI list, File: Takachar RFI list - California_biochar-sales-records.xlsx - Takachar_Unit_User_Manual_Diagrams.ppt

			- Biochar_safety_sheet.pdf - Deriving Soil Temperature for Biochar Application_Takachar (1).docx - biochar sales receipts folder - Solar Electricity Usage.pdf - Takachar_California_Biochar_HogFuel.pdf - Takachar_California_HeavyMetals.pdf - Douglas and Coni – letter of no transportation.pdf
23Jan2025 – 12Mar2025	Data Review – Output Audit	- Review of waste biomass sources and sustainability - Review of system inputs and outputs - Review evidence of product output - Review of biochar properties - Review of biochar end use - Review of CORC calculations and supporting data	- California_Biomass_Eligibility.pdf - Douglas and Coni – letter of no transportation.pdf - takachar_puro_LCA_California_final_2.8.xlsx - Deriving Soil Temperature for Biochar Application_Takachar (1).docx - CORC Report Summary_Takachar_FinalOutput California_2.8.xlsx -Sonoma_batch_records.xlsx - Takachar_California_Biochar_HogFuel.pdf - Takachar_California_HeavyMetals.pdf
5 Feb 2025	On-site Visit	Site visit occurred on the 5th of February 2025. Operations were not observed due to heavy rain in the days previous which meant that the biomass was not suitable to be processed into biochar. Some site operations were observed, but full process operations were not observable during the visit. Delivery of biomass or delivery of biochar to farm user was not observed, but biomass supply and biochar application sites were observed. Verifier completed equipment confirmation/ operations observation of: - Presence of equipment and materials relating to biomass receipt, handling, storage, and process feed present. - Presence of biochar boiler and emissions control system confirmed. - Equipment for biochar quantification and sampling confirmed - Operation of material handling process for transport of biochar observed. - Equipment associated to an example pick-up of biochar from local farmer for soil application usage confirmed. - Equipment for key process measurements and instrumentation - Review of equipment and calibrations - Confirmation of company and facility administrative details - Confirmation of facility environmental and social safeguards	

Photographs of the facility equipment and operations captured during the production facility site visit are provided in Appendix 2.

Verifiers also reviewed the processes and calculations used for the LCA and CORC quantifications. Takachar utilizes operational parameter measurement systems, data acquisition systems, data historian, manual data logging systems and procedures, and Puro.Earth CORC calculator templates to record, track, and report the Novato facility biochar production, CORCs, and LCA emissions. Takachar also uses Carbon Pilot as a MRV system to document and access this data. Verifiers were granted online access to data recording systems to enable review and verification of the facility inputs, data processing, and quantified outputs.

3.3. VERIFIED OUTPUT & CORCS

Table 4 includes the specific CORCs claimed by Takachar at its Novato facility for the specified reporting period, and the values verified by 350Solutions during the on-site audit and following data review.

TABLE 4 VERIFIED CORCS FOR THE TAKACHAR NOVATO FACILITY

Performance Metric Name / Description	Claimed Value ¹	Verified Value	Data Source	Reporting Period
CORC Factor	1.94 tonnes CO ₂ /tonne biochar	1.94 tonnes CO ₂ /tonne biochar	CORC Report Summary Takachar_FinalOutput_California_2.6.xlsx Takachar_puro_LCA_California_final_2.6.xlsx	01-Nov-23 to 31-Jan-25
Biochar Production	60.70 dry tonnes	60.70 dry tonnes		
Total CORCs	117.42 CORCs	117.42 CORCs		
¹ Claimed values are those submitted by Takachar after completion of LCA revisions based on results of Puro reviews and independent audit by 350Solutions. Verified values are based on verification of final biochar production records for the reporting period. Output is reported in dry biochar tonnes in accordance with Puro guidance.				

4. AUDIT FINDINGS

4.1. SUMMARY OF AUDIT FINDINGS

350Solutions has reviewed and audited the documentation of the technology, the instrumentation, the procedures, performance and collected data and has found that the data presented in the Puro Audit Package and during the site visit and follow up:

- ☒ **Meets the requirements of the Puro General Rules V3.1 and the Biochar Methodology V3**
- ☐ **Meets the requirements of the Puro General Rules V3.1 and the Biochar Methodology V3 with minor modifications**
- ☐ **Does Not Meet the requirements of the Puro General Rules V3.1 and the Biochar Methodology V3**

A summary of specific findings associated with each requirement of the Puro Standard and Biochar Methodology and any identified issues with the audit are summarized in Table 5 below.

TABLE 5 AUDIT FINDINGS

Puro Standard Biochar Method. Section Ref.	Audit Verification Topic	Findings
1.1.1 5.2.1	<i>Sustainable Feedstock</i>	Acceptable. Takachar obtains waste woody biomass from local forestry management contractors. Under the baseline alternative, the woody waste would typically be transported to the same site location and left to decay.
1.1.2 5.4.2	<i>Biochar Use</i>	Acceptable. Takachar has demonstrated that the biochar is safely sequestered within local agricultural applications. Transport and spreading emissions associated with biochar transport and delivery are properly considered in the LCA.

1.1.3 5.2.2 5.3.3 5.4.1	<i>Net-Negative LCA</i>	Acceptable. Takachar has demonstrated an appropriate basis for CORCs according to the Puro Biochar Methodology. Takachar data collection and calculations were carried out using appropriate data collection systems and procedures, and custom-built applications in Microsoft Excel and the Carbon Pilot Platform. This includes data collection sheets, and a calculator based on Puro.Earth methodology CORC structure, requirements, and calculation formulae used for the LCA and CORC quantifications. Carbon Pilots MRV data platform is also being used successfully by Takachar for data management and reporting. Some errors/ issues were identified during the initial review of the LCA and CORC calculation files and the Carbon Pilot program which required modifications to ensure full appropriate determination of the LCA and CORC values.
1.1.4	<i>Prohibition of Fossil fuel use for process heat</i>	Acceptable. Only waste biomass is being ignited to within the reaction chamber. Pyrolysis gases and oils are being ignited within the reaction, and the heat generated contributes to keeping the reaction going. No fossil fuel is used for process heating.
1.1.5	<i>Negligible methane emissions</i>	Acceptable. Emissions from the process only occur from flue gas stack. Although the plant operates under a permit waiver, Takachar have conducted flue gas analysis and shown methane emissions to be negligible and managed via their secondary air injection and combustion.
1.1.6, 5.3.4	<i>Molar H:C Ratio < 0.7 & Biochar Qualities</i>	Acceptable. Biochar analytical results have demonstrated an average molar H:C ratio of 0.55 for one sample analyzed during the reporting period.
1.1.7	<i>Safe Environment & Biochar Handling</i>	Acceptable. Takachar has been granted a burn permit by the local fire department chief as well as an air permit waiver due to currently low volumes of production. Produced biochar is quenched, collected and stored safely on site before being transported for local soil applications.
1.2.2	<i>Environmental & Social Safeguards</i>	Acceptable. Takachar has completed community and stakeholder outreach activities which have been documented. An environmental evaluation report has also been completed and documented. In addition, Takachar has implemented standard operating procedures, safety procedures, and training for all operators to ensure a safe working environment
1.2.3	<i>Demonstrated Additionality</i>	Acceptable. Takachar has submitted that: The project is not required by existing laws, regulations, or other binding obligations. Biochar is the only item produced by site operations. 0-30% of revenues for the site are generated from the production and sale of the biochar product, with the remaining required revenues to maintain operation from carbon finance. Therefore, Takachar would not be able to continue operations without the sale of CORCS.
1.2.4 5.3.1 5.3.2	<i>Biochar Quantification</i>	Acceptable. Mass of biochar produced is taken by transporting the biochar in its metal container to a crane scale which is calibrated yearly. Mass of the biochar is recorded manually. A 5g sample is taken to quantify the average moisture content of the biochar to calculate the dry mass of the biochar produced.
1.2.5	<i>Verified Production Facility standing data</i>	Acceptable. Conformance to the requirements of Section 1.2.5 of the Biochar methodology is documented and verified.
5.4.3	<i>Justification of Soil Temperature</i>	Acceptable. An appropriate regional soil temperature of average 15.45°C in the project area was derived, and the necessary documentation provided. The methodology for the derivation was deemed appropriate.
5.5.2	<i>Statement re: Double Counting</i>	Acceptable. Takachar gains signature from those that use the biochar to confirm they will make no claim to any of the carbon sequestration from the product.
5.5.3	<i>Marketing / Branding</i>	Acceptable. Verifiers have found no evidence of double counting. Producer documents on all invoices as a requirement of purchase that the end-user (soil

	<i>Restrictions on end-user</i>	application/ feed additive) will not use biochar for energy production or combustion of any kind and will make no claim to the carbon sequestration from the use of the product.
--	---------------------------------	--

Verifiers also reviewed the processes and calculations used for the LCA and CORC quantifications. Takachar utilizes in-house spreadsheets and Puro.Earth templates to record, track, and report the Novato facility biochar production, CORCs, and LCA emissions. Takachar also uses Carbon Pilot, an MRV data platform. Verifiers were granted access to all relevant data records and calculation instruments to enable review and verification of the facility inputs, data processing, and platform outputs. Additional details regarding audit activities, documents reviewed, and observations during the audit process are summarized in Section 4.2 below and in Appendix 1.

4.2. AUDIT ISSUES & RECOMMENDATIONS

Findings for the verification of the production facility and the output audit include: (a) audit issues that identify findings that must be addressed to fully conform to the requirements of the Puro standard and biochar methodology, and (b) identification of opportunities for improvement that are recommended to improve future MRV processes. Key findings are summarized in Table 6.

TABLE 6 AUDIT ISSUES AND RECOMMENDATIONS

Finding Category	Finding Description	Recommended Corrective Action	Takachar Implementation Status
Audit Issues	MSDS documentation is not provided in evidence of safe working environment.	Produce a comprehensive MSDS document for Takachar operations.	Takachar have provided a biochar safety data sheet which outlines protocols for how the biochar should be safely handled and processed.
	Discrepancies in original LCA and CORC calculation files resulting in summary calculations not matching. Specific error identified in Carbon Pilot logs regarding mass units. Furthermore, differences between accounting for amount of biochar sold to end users, soil temperatures, and reporting period also required adjustment.	Review LCA and CORC files, specifically, those called out in the RFI list to correct the discrepancy issues.	Completed. Takachar and Carbon Pilot identified the issues causing the discrepancies and provided an updated LCA and CORC file to be referenced for this verification.
	Air permit documents not sufficient to show that permission from the California Air Resources Board was given for emissions exemption	Takachar to provide the further evidence discussed during site visit to show air permit waiver was granted.	Takachar provided further documentation relating to air permit waiver, including the regulations for when this applied and an email from a member of the California Air Resources Board that stated the terms of their exemption.

	Some missing documentation relating to the registration of the Takachar site with Puro as a CO2 removal supplier production facility as well as trade registry documentation for the state of California.	Takachar to provide this missing documentation if currently in possession of it.	Takachar have since provided all necessary documentation referenced here.
	Statement from Takachar missing regarding whether they have received public funding in any form.	Provide statement on whether public funding has been received, and if so, details surrounding in what way they have benefited.	Full description of how Takachar has benefited from public funding provided.
	Calibration documentation for load cells missing from the original data package provided.	Provide all requested calibration certificates for load cells.	Takachar provided all Load cell calibration certificates. Were found to have passed. Calibration was completed just over 6-months after the beginning of the reporting period; however, it was deemed that the pass certificate was sufficient to provide confidence that the load cells were calibrated correctly for the full reporting period.
	Calibration documentation for the crane scale missing from the original data package provided.	Provide all requested calibration certificates for the crane scale.	Takachar provided a pass certificate for the calibration of the crane scale. The calibration was conducted prior to the site visit of the auditor. However, seen as the calibration completed resulted in a pass, it was deemed that the pass certificate was sufficient to provide confidences that the crane scale was calibrated correctly for the full reporting period.
Opportunities for Improvement	End users' declaration on receipts state soil applications only. This was found not to be the case for all end users – some being used as feed additive.	Adapt invoice template to reflect all potential end users for each case.	
	Biochar characterization is completed once per year.	Increase frequency of biochar IBI testing to once per quarter. Complete IBI Test category B (PAH and assay tests) for one sample	
	Emissions factors used in LCA calculations could be more representative.	Use more representative emissions factors for LCA calculation (EF of Gasoline, Diesel, steel etc.) representative of cradle to grave emissions	Takachar updated LCA emission factors, using data that was more representable of the site operations.

		(well to wheel) specific to the region where the facility is located where possible	
	Description of Baseline scenario provided was not fully representative.	Provide a more comprehensive description and ongoing monitoring of the baseline scenario and evidence to support this.	Comprehensive description of the baseline scenario was provided, alongside a letter from the landowner confirming that the biomass was being dumped by PG&E prior to the arrival of Takachar and that no increase in biomass deliveries has been observed since operations began.
	Maintenance log in operator's manual found, but no evidence of it being used.	Ensure operators are using maintenance log and that any materials consumed for maintenance are included within LCA.	Maintenance log being completed. Data for materials consumed documented in this log should be reflected in Takachar's LCA calculation files to show embodied emissions.
	Biochar safe handling document produced and being followed with monitoring of biochar temperature and moisture content as well as manually checking the biochar pile is not too hot. Some additional evidence in the form of logs for this would be helpful to prove that this is occurring.	Provide access to data log for temperature probe in biochar to show it is cooled appropriately before handling/ storage.	
	Flue gas measurement is conducted relatively infrequently.	Increase frequency of flue gas analysis and provide the results within the data package.	Takachar is developing an experimental procedure to conduct on site analysis of flue gas. Documentation of how this is implemented in the future should be included for future audits.
	Use of the water meter and providing of data collected associated to water usage would be a useful cross reference check to gauge fuel usage for pumping.	Log and provide access to water usage data for future audits.	
	The auditor was unable to observe actual site observations due to the damp condition of the biomass.	It is recommended that for future audits, the Takachar team shelter some biomass from rainfall so that it may be dry enough to be used in preparation of site operations for observation of the auditor.	
	Calibration documentation for crane	Takachar should request from the calibration	

	scale was limited and did not provide information pertinent to what testing was conducted or data that was collected.	service provider further details surrounding calibration testing completed and specific data collected and provide this information for any future audits.	
--	---	--	--

4.2.1. Audit Issues

- MSDS for biochar was initially missing from evidence for safe working environment folder data submission. Since receiving feedback on this, Takachar have provided a Biochar Safety Data Sheet evidencing safe working practices surrounding the handling, transportation and storage or the biochar. This documentation outlines protocols that mitigate the risk of the biochar combusting, forming excessive amounts of dust clouds/ particulates, use of PPE and others.
- Discrepancies between the LCA and CORC calculation file were found and reported to the Takachar and Carbon Pilot team. The issues identified included differences in the stated reporting period, production data anomalies, biochar sales referencing errors, data unit standardization issues and source data variances. These errors were identified and investigated by the carbon pilot and Takachar team and promptly corrected, with updated LCA and CORC files provided. The errors were not deemed to be significant, casting no doubt on the robustness of the Takachar and Carbon pilot data management system.
- Air permit documentation was missing from the initial data package. It was found that Takachar was benefitting from an air permit waiver from the California Air Resources Board (CARB), and so documentation for this permit waiver was requested. Takachar provided regulation documentation for permit waivers alongside an email from a member of CARB relating to the terms of the air permit waiver which granted the request provided Takachar do not receive two or more nuisance complaints towards their operations. This permit waiver was granted for current operations only. Any future development in the size of Takachar’s operations will require this air permit waiver to be renewed.
- Missing documentation regarding the registration of Takachar as a Puro.Earth Carbon removal supplier and trade registry documentation for the state of California was requested and promptly provided by the Takachar team.
- Information as to whether Takachar has benefited from public support was missing from the original data package. A request for this information from Takachar was made who provided the following statement *‘The current site and equipment have been supported by Breakthrough Energy Fellowship, the U.S. Department of Energy, U.S. Forest Service, and Pacific Gas and Electric Company through an Electric Program Investment Charge (EPIC) grant. In the future, it will be supported by CalSEED which is another EPIC program.’*
- Calibration documentation for the load cells was requested and promptly provided by the Takachar team. These documents showed various certificates stating the correct calibration of load cell equipment between April and October 2024. As the load cells were deemed to be calibrated correctly, there is high confidence that this was true for the time between the start of the reporting period and date of the calibration test.

- Similar to the load cells, calibration certification was also missing for the crane scale used to measure the weight of the biochar produced. Takachar completed a calibration test on the 11th of February after the site visit on the 5th of February. The certificate showed that the scale was calibrated correctly, and so it can be assumed with a high degree of certainty that the scale was calibrated for the entirety of the reporting period.

4.2.2. Opportunities for Improvement

- Declaration on receipts states the end users' intentions for the biochar as soil application. It was found that this was the case for nearly all end user applications, except for a local farm using the biochar on the ground of a livestock habitat where the biochar may be consumed by the livestock. This should be documented within the declaration. Recommendation for receipts to show all the end user activities, with proper activities selected, such that they are documented correctly.
- Biochar characterization is said to be completed once per year. Over the reporting period, evidence for only one test has been provided. Although this is still acceptable under the Puro biochar methodology as there is very little biomass variation, for refined accuracy, it is recommended that this characterization occurs quarterly. This will account for any seasonal variations that may affect the characteristics of the biochar.
- Emission factors used within the LCA were found to be a little general for certain data. These emission factors included that for Diesel, Gasoline, steel production and transport emissions. For better representation, more applicable emission factors that are representative of the region should be identified and used within the LCA. This was completed by the Takachar team.
- The operational manual provides some detail for how biochar should be processed and handled once produced but does not provide a great amount of detail. Recommendation for a detailed SOP to be produced and followed for processing and handling of freshly produced biochar (mass measurement, sampling, quenching, storage) alongside relevant documentation to evidence this safe handling.
- Operators' maintenance log in the operator's manual, but no evidence to suggest this being used. If this maintenance log is being used, the documents should be provided. Furthermore, the maintenance log should record the use of any consumable materials and report to the LCA.
- A temperature probe is being used to measure the temperature of the biochar to ensure that it can be safely stored, however, these results are not being recorded and provided as evidence. Request that this data is recorded and made available to auditors.
- Flue gas measurements are being taken to align with the Puro standards; however, they are relatively infrequent. Frequency of this measurement should be increased to at least quarterly measurements.
- A water usage meter was being used on site, but no evidence of the data associated to this was provided. Recording this data would provide auditors a good reference point for biochar moisture contents and fuel usages.
- For future audits, it would be helpful if site operations are observed during the site visit. It is therefore recommended that enough biochar for a run of operations is kept protected from excessive rain with a tarpaulin or similar in the days leading up to the site visit.
- Calibration documentation for the crane scale is a key piece of documentation as it relates to the accuracy for the measurement of the amount of biochar produced during the reporting period. Therefore, it is recommended that Takachar request the calibration service provider

include further details behind the testing that was completed, the standards the testing was done according to and the data that was collected.

5. ELIGIBILITY FOR ONGOING ISSUANCE RIGHTS

Puro.Earth are currently transitioning to use the 4.0 version of the Puro General Rules [3]. Although the Takachar facility and output audits described in this report were conducted using version 3.1 of the General Rules, certain rules described in the updated version of the document (v4.0), such as the Ongoing Issuance Right, are applicable to all projects currently registered or in the process of getting registered on the registry. Specifically, Appendix A of the updated rules dictates that “the evaluation of the Ongoing Issuance Right is done in the performance verification by the 3rd party Auditor as part of the Output Audit” (A.4.1) and that “This evaluation can be done when a Production Facility has demonstrated regular industrial operation and successfully completed performance verification for the previous Monitoring Period with a minimum of 3 months of Output” (A.4.2).

Based on the operational history of the Takachar Novato facility, stability of operations, and production data submitted by Takachar, 350Solutions confirms that the facility can maintain regular industrial operation and repeat the procedures for regular output monitoring. 350Solutions has reviewed and audited the documentation of the technology, the instrumentation, the procedures, performance and collected data and has found that the Takachar’s Novato facility:

- ☒ ***Meets the requirements for ongoing Issuance rights of the Puro General Rules V4.0***
- ☐ ***Does Not Meet the requirements for ongoing Issuance rights of the Puro General Rules V4.0***

REVISION HISTORY

Version	Date Issued	Noted Changes
Draft Version (v1.0)	02-26-2025	NA
Draft Version (v1.1)	02-28-2025	Minor edits from internal 350Solutions QA review
Final Version (v1.2.1)	12-03-2025	Updates to document based on information from communications with Takachar and findings documented within RFI Addresses review comments from Puro.Earth and Takachar

AUDITOR SIGNATURES

Guy Ingram-Hardwick (Lead Auditor)
Carbon Removal Verification Engineer
350Solutions, Inc.

Tim Hansen (Quality Assurance)
Sr. Carbon Removal Verification Engineer
350Solutions, Inc

REFERENCES

- [1] Puro.Earth, "Puro Standard General Rules," Version 3.1, [Online]. Available:
<https://puro.earth/document-library>.
- [2] Puro.Earth, "Biochar Methodology," Edition 2022 V3, Feb 2024. [Online]. Available:
<https://puro.earth/methodologies/>.
- [3] Puro.Earth, "Puro Standard General Rules," Version 4.1, [Online]. Available:
<https://puro.earth/document-library>.
- [4] IBI Certification Program, [Online]. Available:
<https://biochar-international.org/biochar-standards/>

APPENDIX 1: PURO.EARTH BIOCHAR METHODOLOGY AUDIT CHECKLIST

Production Facility and Output Audit - Biochar Methodology	
Audit ID	PU2408
Audit Inception Date	January 10 th 2025
Production Facility ID	980845
Production Facility Location	Novato 3900 Sears Point Road Novato 94945 United States
Auditing Body	350Solutions
Auditor Initials	GIH
QA	TAH

Guideline Ref	Requirement	Requirement Met Y/N	Verification Remarks Insert auditors' comments	Evidence Document Insert evidence used to verify requirement
1.2.5	The following standing data has been collected from Puro and checked for consistency against other evidence: - A certified trade registry extract for the CO2 Removal Supplier - CO2 Removal Supplier registering Production Facility - Evidence of the location of the Production Facility - Evidence of the Volume of Output for the full calendar year prior to registration - Evidence of the Removal Method(s) for which the plant is eligible to receive CORCs - Evidence of the date on which the Production Facility became eligible to receive CORCs - If the Production Facility has benefited from public support, evidence to show this - Documentation on Environmental and Social Safeguards imposed		1. Provided 2. Provided 3. Facility location confirmed on site visit, evidenced with photos. 4. Takachar produced 60.70 tonnes of biochar eligible for CORCs based on production records and logs for the facilities. This includes biochar stored in inventory as well as biochar sold for eligible applications. This is over a reporting period of 2023-11-05 to 2025-01-31. 5. Takachar produces biochar using Hog fuel that is an acceptable feedstock eligible for CORC issuance. 6. Testing of the facility (Novato, California) began January 8th, 2023, before full scale operations on the 1st of November 2023. The facility was registered on the Puro Registry on the 12th of April 2024. Eligible biochar production for CORC claims would be 18 months prior to submittal date of application, which means that the CORC claims within the stated production period are valid. 7. The facility has received funding from Breakthrough Energy Fellowship, U.S DOE, U.S. Forestry Service, 8. California Department of Forestry and Fire Protection Burn Permit provided. Environmental Evaluation Report completed also. Air permit waiver evidence supplied.	1. File: Certificate of Status_Takachar_1739012570578.pdf 2. File: Takachar_PuroRegistration 3. On site verification 4. File: takachar_puro_LCA_California_final_2.8.xlsx 5. File: Biochar production equipment questionnaire (1) (4).xlsx 6. File: CORC Report Summary_Takachar_FinalOutput California_2.24.xlsx 7. Response from Takachar in the RFI list, File: Takachar RFI list 8. File: California Burn Permit.pdf, Environmental Evaluation, Report.docx, AirPermitExemption(2-1-126).pdf, Air permit email copy.pdf
5	All necessary evidence has been provided to the auditor by the Production facility as per Section 5 of the Biochar Guidelines and has been used to complete the compliance checklist. - Proof of sustainability of raw material for forest biomass (FSC, SFI, PEFC, other certifications) - Proof of sustainability of raw material for waste biomass - LCA data for biomass and biochar production, supply and use, including climate change impact and the contribution of each life cycle stages. - Proof of product quality: laboratory analysis of total organic carbon content, hydrogen content and H/Corg		1. N/A 2. Wood used in biochar production comes solely from forestry trimmings during landscape management and proactive wildfire prevention. Sub-contractors of Pacific Gas and Electric Company provide the sustainable biomass. Letter of support from PG&E and completed Puro Baseline and Additionality Assessment document states that this is the case. 3. LCA is complete with Estored, EbioMass, Eprod, and Euse calculated separately. Emissions factors used include non-CO2 greenhouse gases to determine CO2-eq. 4. Lab test completed by Control Laboratories for biochar analysis of biochar profile by dry weight from dry combustion (Carbon, organic carbon, carbonates, Hydrogen, H/Corg.). Also provided is a biochar heavy metals levels profile. One test has been conducted for the reporting period which is acceptable. 5. Production logs are provided documenting all biochar	1. N/A 2. File: Takachar_additionality_document-California pdf, California_Biomass_Eligibility.pdf 3. File: Takachar_Puro_LCA_California final_2.8.xls 4. File: Takachar_California_Biochar_HogFuel.pdf, Takachar_California_HeavyMetals.pdf 5. File: CORC Report Summary_Takachar_FinalOutput_California_2.2 4.xlsx 6. File: Takachar_Puro_LCA_California final_2.8.xls, CORC Report Summary_Takachar_FinalOutput_California_2.2 4.xlsx 7. File: CORC Report

	- Proof of production volume: documentation for the whole period and methodology applied to calculate the dry mass of biochar produced. - For mobile units or carbonizer operator: proof of load cell measurement of the biochar for the whole period, and water input measurement. - Proof of end use of biochar: offtake agreement, shipment, and other records indicating the intended use of biochar. - Justification on the soil temperature selected for the calculation of the biochar sequestration. - Proof of sales - Proof of no double counting/C positive marketing (See V4.0 of standard)		production, including weighed biochar amount and moisture content of biochar using appropriate methods. 6. Load cell measurements and water measurements recorded within full production logs and LCA. 7. Biochar end use is documented in full set of sales records receipts for biochar uses. All uses are documented for soil application. Receipts, signed by the customer state that they shall not burn the biochar nor claim any carbon sequestration from the product. 8. Documentation justifying the soil temperature (15.4 degrees) used in Estored calculations provided. 9. Takachar has supplied invoices for all sales of biochar and current inventory claimed for CORCS. 10. Statement in receipts with biochar end users that the biochar cannot be used to make claims for carbon sequestration from the use of this product. No evidence of double counting observed	Summary_Takachar_FinalOutput_California_2.2 4.xlsx, Biochar Sales Receipts Folder 8. File: Deriving Soil Temperature for Biochar Application_Takachar (1).docx 9. Files: California_biochar-sales-records.xlsx, CORC Report Summary_Takachar_FinalOutput_California_2.2 4.xlsx 10. Files: Biochar Sales Receipts Folder
1.1.1	Biochar is used in applications other than energy.		Biochar end use is for soil application in local land only. A small quantity of biochar is being spread in livestock areas where it may become a feed additive, but this is acceptable under the Puro methodology.	Onsite observations, File: biochar sales receipts folder
1.1.2	Biochar is produced from sustainable forest or waste biomass raw materials (consult list of raw materials).		Biomass used is waste Hog fuel from local agricultural management that would otherwise have been left at the site to decompose.	File: Takachar_additionality_document_California (5).docx
1.1.3	LCA shows: - carbon footprint of the biomass production and supply - emissions from the biochar production process - carbon footprint of the biochar end use - cradle to grave		- Waste biomass emissions are not accounted for within the LCA as the biomass is a waste. Supply emissions are also omitted as the biomass was being dumped in this location prior to the presence of Takachar. - Biomass production emissions include all appropriate operational and infrastructure emissions. - Energy is appropriately metered from onsite solar panels and accounted for within the LCA. Energy sourced from the onsite generator is also accounted for using fuel receipts. - Euse includes the fuel associated to biochar transport and application. Calculations seem appropriate. No bags are used at the California site, biochar is distributed by hand. - Infrastructure and equipment manufacturing are included. Estored calculation is accurate.	File: takachar_puro_LCA_California_final_2.8.xlsx File: Biochar_LCA_report_takachar_final_2.8.docx File: Solar Electricity Usage.pdf Onsite observations
1.1.4	Pyrolysis reactor input fuel for heating is not a fossil fuel. Unless only used for ignition/pre heating or in a mobile unit and the emissions are fully included in the LCA. The use of waste heat from other industrial processes (eg. Biodigesters, cement production) is permitted.		Input fuel for ignition is a small amount of biomass. Emissions associated to this are not included in the LCA as is permitted by the Puro standard.	File: Biochar_LCA_report_takachar_final_2.8.docx

1.1.5	Pyrolysis gases are combusted or recovered. Bio-oil and pyrolysis gases can be stored for later use as renewable energy or materials.		Pyrolysis gases are combusted to maintain the thermal reaction in the chamber.	File: Biochar_LCA_report_takachar_final_2.8.docx
1.1.6	The molar H/Corg ratio is less than 0.7.		Confirmed. 0.55 based on calculation in LCA document from Puro.Earth. Number confirmed by Lab results. Note that the Lab results reference the value as 0.56 - Puro request that the H/C value used be from their calculation.	File: takachar_puro_LCA_California_final_2.24.xlsx, Takachar_California_Biochar_HogFuel.pdf
1.1.7	Evidence of safe handling and transport is provided and adequate for the production facility.		MSDS provided for biochar that includes details of safe handling and transport. This is deemed to be adequate for the production facility.	File: Biochar_safety_sheet.pdf
1.1.8	Biochar products meet the product quality requirements existing in the jurisdiction where biochar is used and for the specific applications considered.		Confirmed. The biochar meets the requirements for its application under the Puro methodology and USDA standard on biochar from woody residue document.	File: takachar_puro_LCA_California_final_2.8.xlsx File: Takachar_additionality_document_California (5).docx
1.1.9	The SDG outcome meets the claims below: Specific: must refer to a specific individual outcome rather than being overly broad or abstract. Cause-and-effect relationship: must establish a direct and inherently clear cause and-effect relationship between the carbon removal activity and the impact, i.e., the impact should be additional and attributable to the CO2 Removal activity. Quantitative metric: Numeric measurement allows for objective assessment and comparison as per Section 4 of SDG assessment requirements Accuracy: can be determined without relying heavily on input assumptions. Manageable monitoring, reporting and verification (MRV): Pragmatic MRV processes limit the costs of data collection.		Biochar production at the California site is only possible with carbon finance and was not in frequent prior to registration with the Puro registry. 0-30% of the projects overall revenue is made from the sale of biochar - thus, without carbon finance, the project would not be financially viable. Only a few input assumptions are used in the LCA for quantifying the carbon removed, rather, empirical measurements are used.	File: Takachar_additionality_document_California_1 1.26.docx File: Biochar_LCA_report_takachar_final(2).docx
1.2.1	Evidence of Production Facility eligibility under the general rules of Puro Standard.		Confirmed	Onsite observations
1.2.2	The Production Facility demonstrate Environmental and Social Safeguards.		Confirmed	Onsite observations, Files: Evidence of safe working environment folder

1.2.3	CO2 Removal Supplier shall be able to demonstrate additionality, meaning that the project must convincingly demonstrate that the CO2 removals are a result of carbon finance. Even with substantial non-carbon finance support, projects can be additional if investment is required, risk is present, and/or human capital must be developed. To demonstrate additionality, CO2 removal Supplier must provide full project financials and counterfactual analysis based on Baselines that shall be project-specific, conservative and periodically updated. Suppliers must also show that the project is not required by existing laws, regulations, or other binding obligations.		Only 0-30% of revenue is generated through the sale of the biochar product, the rest comes directly from carbon finance through the issuance of CORCs. No biochar production or biomass use is required by any current laws or regulations.	File: Takachar_additionality_document_California_11.26.docx
1.2.4	The Production Facility's documentation system is accurate and reliable		Confirmed - data management system is accurate and reliable (including carbonpilot)	Takachar files and Carbon pilot files
	The quantity of the biochar produced and sold is quantified and documented in a reliable manner		Documentation of biochar produced (60.70 tonnes) and sold (60.68 tonnes) is robust.	File: takachar_puro_LCA_California_final_2.8.xlsx
	Relevant meters are in place and they are calibrated;		Relevant meters confirmed to be in place during site visit. Documentation for their calibration provided.	File: Scale_Calibration(Certificate Sharp Electronics).pdf, LoadCell_Calibration.pdf
	The emissions from the cultivating, harvesting and transporting of the biomass are estimated and calculated in a reliable manner		Biomass transport is included in LCA. Harvesting and cultivating are not included, as this is waste biomass bound for landfill otherwise. No special handling for biomass required.	File: Biochar_LCA_report_takachar_final(2).docx
	The energy use of the Production Facility can be quantified and the emissions from the process calculated		Electrical energy usage for drying of biomass is metered and recorded. Gasoline used for production of energy using generator is recorded within LCA using fuel receipts. Emissions associated to electricity generation and transmission is included from Ecoinvent 3.1 and IPCC databases.	File: solar electricity usage.pdf File: takachar_puro_LCA_California_final_2.8.xlsx
	The auditor goes through the Quantification of CO2 Removal requirements with the CO2 Removal Supplier, so that the Supplier is able to calculate the CO2 Removal independently in its Output Report		Completed.	Call with Takachar and Carbon pilot team.
3.1	The CO2 Removal Supplier shall provide a life cycle assessment (LCA) for biochar activity including disaggregated information on the emissions arising at different stages. The system boundary is set cradle-to-grave and		Feedstock is a waste biomass source only and so cultivation and harvesting emissions are not included within the LCA. Delivery emissions are also omitted as in the baseline scenario, the waste biomass was already being dumped at the site. All emissions are	File: takachar_puro_LCA_California_final_2.8.xlsx

	shall include emissions from production and supply of the biomass, from biomass conversion to biochar, and from biochar distribution and use.		appropriately calculated and included within the LCA document in a cradle-to-grave system.	
3.2	Life cycle assessment (LCA) shall follow ISO standard, WRI GHG protocol or similar method.		LCA document states that the document adheres to methodological guidelines outlined by ISO and incorporates Puro.Earth Standard for attributional LCA.	File: Biochar_LCA_report_takachar_final(2).docx
3.3	The default baseline emission scenario for the project activity feedstock is zero, which is a conservative assumption since it is not taking into account methane emissions derived from decay of manure or combustion of waste biomass. If a non-zero baseline presented, needs to be accepted by Puro.Earth		Baseline emission scenario is assumed to be zero	Takachar_additionality_document_California_11.26.docx
3.4	Environmental Safeguards are demonstrated through: Environmental Impact Assessment (EIA) Environmental permit Other documentation approved by the Issuing Body on the analysis and management of the environmental and social impacts		Documentation provided showing an environmental evaluation was completed. Furthermore, an air permit waiver was provided.	Air Permit Email Copy.pdf, AirPermitExemption (2-1-16).pdf, Environmental Evaluation Report.docx
3.5	Safety measures include, but are not limited to, providing a Material Safety Data Sheet, post-production quenching and cooling of biochar, and appropriate flue gas treatment systems.		Post-production quenching discussed on site, team confirmed, and buyer confirmed that this process is managed well. Flue gas treatment is conducted, with gas analysis also being completed.	Separate conversations with individual team members. Onsite observations. File: Takachar_unit_user-manual_diagrams.pdf
3.6	The risk estimation shall be quantitative, and the Overall Risk Effect shall be given in percentage of the Output volume. The Reversal risk estimation shall consider all material risks arising from: Nature-induced risks (e.g., flora, fauna, or climate conditions). Human-induced risks (e.g., design and construction faults, operational risks). Geopolitical risks (e.g., potential effects of the legal and political environment). Any additional factors mentioned in the applicable Methodology.		No risk of reversal because biochar is applied directly to soils/ used as livestock feed additive. Customer attestations for end use application and that the biochar is not burned were provided.	File: Biochar Sales Receipts

Guideline Ref	Requirement	Requirement Met Y/N	Verification Remarks Insert auditors comments	Value	Units
4.2	Qbiochar = Quantity of biochar produced over the reporting period (dry char)	Y	Confirmed	60.70	tonne
	FpTHTs = c + m x H/Corg	Y	Confirmed	68.6%	%
	C Biochar = carbon content of biochar	Y	Confirmed	83.9%	%
	Estored = biochar carbon storage = Qbiochar x Cbiocharorg x FpTHTs x 44/12	Y	Confirmed	2108.69	kg CO2e/tonne biochar (dry)
4.3	Ebiomass = LCA emissions of production and supply of biomass	Y	Confirmed	0.0000	kg CO2e/ tonne biochar (dry)
4.4	Eproduction = LCA emissions from biochar manufacturing	Y	Confirmed	171.71	kg CO2e/ tonne biochar (dry)
4.5	Euse = LCA emissions of the use of biochar, including distribution up to the point of final use	Y	Confirmed	4.2700	kg CO2e/ tonne biochar (dry)
4.1	CORCs = Estored - Ebiomass - Eproduction - Euse	Y	Confirmed	1933	kg CO2e/ tonne biochar (dry)
	Quantity of CORCs (in evidence).	Y	Confirmed	117.42	CORC
	Confirm consistency.	Y	Confirmed	60.70	tonnes

APPENDIX 2: SITE VISIT PHOTOS



Figure A2-1. Takachar biochar collection hopper



Figure A2-2. Takachar crane scale and reader



Figure A2-3. Agricultural run-off water source (left), Water bowser (center) and water meter (right)



Figure A2-4. Solar array (left), Battery storage (center) and energy meter (right)



Figure A2-5. Produced biochar in storage prior to being distributed by the end user. Bulk storage(left) and prior to being distributed (right).



Figure A2-6. Drying oven used to measure biochar moisture content.

APPENDIX 3: VERIFIER QUALIFICATIONS

Supporting documentation, including verifier resumes, and verifier or corporate accreditations are also included in this appendix.

Verifier Qualifications

Company Name:	Himalayan Sustainable Energy Solutions Pvt. Ltd. (dba Takachar)	
Date:	03/03/2025	
Verifier Name:	Guy Ingram-Hardwick	
Company Name (where applicable):	350Solutions	
Verifier Contact Information:	guy@350solutions.com	
Verifier Address:	1053 E. Whitaker Mill Rd. Suite 115, Raleigh, NC 27604	
Verifier Scope of Activities:	Verification through observation and review of key technology components and documentation.	
Verifier Qualifications	Criteria Met?	Evidence / Notes (note how the criteria was met, specific documents - resume/CV, publications, certifications, etc.).
Verifier has relevant technical knowledge of the type of technology being evaluated and carbon removal processes in general		
A) Does Verifier have:		
1. An in-depth technical knowledge of the technology type under verification;	☒	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 Environmental Technology Verification (ETV) as a Type A (third party) Inspection Body (ANAB Certificate Number: AI-2618). The technical scope of 350's accreditation includes verification of performance and environmental impact as it relates to design, materials, equipment, installation and operations of technologies in the categories of Energy, Clean Production and Process, and Air Pollution Monitoring and Abatement. As documented in 350Solutions' ETV Standard Operating Procedure (ETV QPM 350-223-03), and Quality Systems Procedures for verifier qualifications (QSP-350-005-02), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to verifier qualifications and procedures relevant to the Puro.Earth General Standard.
2. Knowledge of specific risk areas associated with performance of such technologies (i.e. common failure points, performance issues, barriers to scaleup);	☒	
3. Knowledge of the environmental implications related to the use of the technology from a life cycle perspective, such as impact of the technology on lifecycle CO2 emissions and carbon removal;	☒	
4. Knowledge of relevant applicable test methods and standards for evaluating performance or impact of the technology;	☒	
5. Knowledge of relevant calculation, modeling, and statistical methods in order to assess test results and calculations of performance metrics and uncertainty, as applicable;	☒	
6. Knowledge of data quality and data validation approaches, including QA/QC procedures, for example.	☒	
Verifier is a credible independent 3rd party		
B) Is Verifier:		
1. third-party body independent of the team registered for the Puro Earth CORCs;	☒	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 ETV as a Type A (third party) Inspection Body. As documented in 350Solutions ETV Policy Manual (ETV QPM 350-200-03), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to impartiality for Type A inspections, pursuant to ISO 14034 activities. These procedures and quality management programs are generally relevant to verification under the Puro.Earth General Standard. Note that verifications completed for Puro.Earth are not equivalent to ISO 14034 verifications.
2. Not directly involved in the design, manufacture or construction, marketing, installation, use or maintenance of the specific technologies submitted to Puro.Earth for verification, or represent the parties engaged in those activities.	☒	
3. Not part of a legal entity that is engaged in design, manufacture, supply, installation, purchase, ownership, use or maintenance of the items inspected.	☒	

Guy Ingram-Hardwick
Carbon Removal Verification Engineer, 350Solutions

EDUCATION:

MEng Materials Science and Engineering, Loughborough University, UK - 2022

EXPERIENCE SUMMARY:

Guy Ingram-Hardwick is a Carbon Removal Verification Engineer, with experience in materials engineering, process engineering, MRV protocol development, experimental design and life cycle analysis (LCA). At 350 Solutions, Guy's efforts center on validation and verification of varied carbon removal pathways, including biochar, biomass storage, and DAC+S. Guy has led the verification of a biochar CDR supplier registered with Puro.Earth and supported verifications of bio-oil and biomass geologic storage pathways as well as DAC technology assessments. Guy began his experience in carbon removal working to develop an LCA model for Brilliant Planet, a marine based carbon removal company growing, processing and burying microalgae for carbon sequestration. Once completing the LCA model, Guy managed the third-party verification and co-authored the MRV methodology for Brilliant Planet before managing its adoption with carbon market registries and developing relevant documentation required for carbon removal verification and crediting.

Guy also studied degradation mechanisms for biodegradable polymers which was the focus of his Master's thesis. His work during the Master's thesis and at Brilliant Planet provided experience in experimental design and execution, including conducting field trials for developing novel technologies. This included leading design and execution of demonstration and testing of processing and storage of the microalgae, displaying the long-term permanence of the carbon removal system. Prior to his experience at Brilliant Planet, Guy worked as a process engineer at Pirelli's rubber compound manufacturing plant in Burton-on-Trent with a focus on data analytics for driving continuous improvement, as well as developing familiarity with industrial manufacturing operations and data, quality assurance, and international standards.

RESEARCH AND PROFESSIONAL EXPERIENCE:

January 2025 – Present: Carbon Removal Verification Engineer, 350Solutions
Verify carbon dioxide removal technologies on behalf of registries and private companies ensuring high quality and meaningful climate impact.

Jul 2022 – Dec 2025: LCA and MRV Associate, Brilliant Planet
Quantified the carbon removal efficiency of the Brilliant Planet system across a variety of engineering designs using LCA. Developed the proprietary MRV methodology and PDD as well as setting up a novel experimental design to display the permanence of the stored carbon.

July 2019 – September 2020: Process engineer, Pirelli
Completed data analytics to drive continuous improvement for increasing efficiency, safety and rubber compound quality.

Tim Hansen, P.E.
Founder and CEO, 350Solutions

EDUCATION:

B.S., Chemical Engineering, University of Virginia, 1993

M.S., Engineering Science, Thayer School of Engineering, Dartmouth College, 1995

EXPERIENCE SUMMARY:

Mr. Hansen has 28 years of experience in management of energy and environmental technology development and demonstration projects and programs, as well as multimedia environmental engineering efforts. The majority of his recent work has focused on the evaluation of carbon removal (CDR) technologies, including validation of projects and verification of credits for multiple CDR pathways. Mr. Hansen's primary technical focus has been the management and technical performance of large technology evaluation programs in the advanced energy, transportation, and climate change areas, with a specific focus on verification of innovative low-carbon and carbon removal technologies.

RESEARCH AND PROFESSIONAL EXPERIENCE:

2019-Present Founder – CEO, 350Solutions, Inc.

Owns and operates a small cleantech engineering consulting business focused on the independent evaluation of new cleantech and low-carbon innovations and their impacts, with a current focus on carbon removal technologies. Provides independent technology verification, carbon removal credit verification, engineering consulting, testing and evaluation, techno-economic assessment, and other support to companies developing, using, or investing in new low-carbon technology innovations.

2012-2019: Director - Energy and Environment, Southern Research

Managed scientific and technical staff performing research, development, and evaluation of innovative clean energy technologies. Projects range from \$25,000 to \$6 million in size. Technical focus areas included biofuels and biochemicals, carbon capture and utilization, and renewable energy.

PROJECT EXPERIENCE:

Mr. Hansen has executed several independent technology performance verifications of emerging climatetech and carbontech innovations, as CEO of 350Solutions, Director of Energy & Environment at Southern Research, and Director of the U.S. EPA's Greenhouse Gas Technology Center. Mr. Hansen has recently focused on carbon removal technologies, completing verifications of carbon removal credit projects (biochar, carbonated materials, biomass injection) for registries, due diligence audits of enhanced weathering, DAC, direct ocean capture, and CO₂ to polymer technologies for credit offtake buyers, and leading development of independent methodologies for bio-oil sequestration for a novel CDR registry. Mr. Hansen has completed clean technology evaluations for various commercial and government clients, involving evaluation of commercial feasibility, economic and environmental impacts, and technology performance. Mr. Hansen has evaluated and verified technologies for the XPRIZE Carbon Removal in 2022 and 2024 and served as the contracted Measurement and Verification Program Lead for the NRG COSIA Carbon XPrize. Mr. Hansen served as U.S. Technical Expert for the development and implementation of ISO 14034 – Environmental Technology Verification.

RECENT PUBLICATIONS:

- Hansen, et al. Pilot Scale Demonstration & Independent Verification of Carbon Utilization Technologies for the NRG COSIA Carbon XPRIZE. TechConnect Briefs 2019. June 17, 2019.
- Tim Hansen, Kevin McCabe, Bill Chatterton, Michael Leitch, Integrating the ISO 14034 standard as a platform for carbon capture and utilization technology performance

evaluation, *Clean Energy*, Volume 5, Issue 4, December 2021, Pages 600–610, <https://doi.org/10.1093/ce/zkab033>



350Solutions serves as an independent expert in cleantech, low carbon, and environmental technologies. We provide an unbiased assessment of innovative technologies. 350Solutions is accredited through ANAB under ISO 17020 as an independent inspection body to provide independent technology evaluation services using the ISO 14034 ETV process. In addition, 350Solutions staff include a Certified Measurement and Verification Professional (CMVP for IPMVP) and a North Carolina Registered Professional Engineer (P.E.). 350Solutions ANAB Accreditation certificate is provided below.



CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

350Solutions, Inc.
1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604

Fulfills the requirements of

ISO/IEC 17020:2012

and

**ISO 14034:2016, Environmental Management - Environmental
Technology Verification (ETV)**

In the field of

INSPECTION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.



Jason Stine, Vice President

Expiry Date: 25 September 2026

Certificate Number: AI-2618



An inspection body's fulfilment of the requirements of ISO/IEC 17020:2012 means the inspection body meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid inspection results (refer to joint ISO-ILAC-IAF Communiqué dated Sept 2013).



SCOPE OF ACCREDITATION TO ISO/IEC 17020:2012

and

ISO 14034:2016, Environmental Management - Environmental Technology Verification (ETV)

350Solutions, Inc.

1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604

Tim Hansen tim@350Solutions.com
(919) 675-6432

INSPECTION TYPE A (THIRD-PARTY) BODY

Valid to: September 25, 2026

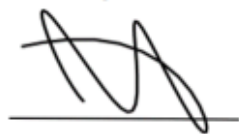
Certificate Number: AI-2618

General Inspection

Products Categories	Range	Stage	Methods and Procedures
Energy Technologies (ET):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP-350-223-02 - SOP ISO 14034 ETV
Cleaner Production and Processes (CPP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - SOP ISO 14034 ETV
Air pollution monitoring and abatement (APP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - SOP ISO 14034 ETV
Water monitoring and treatment (WMT)	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - SOP ISO 14034 ETV

Note:

- This scope is formatted as part of a single document including Certificate of Accreditation No. AI-2618.



Jason Stine, Vice President

Version 007 Issued: September 6, 2024

www.anab.org

Page 1 of 1

