O.C.O 2024 Output Audit Report

For Puro.Earth

CO_2 Removal Supplier	O.C.O Technology Limited
Removal Method	Carbonated Materials
Production Facilities	O.C.O Aggregate Manufacturing Facilities: Avonmouth, Brandon, Leeds, UK
Production Facility Addresses	Avonmouth: Unit 1 Severn View Industrial Estate, Central Ave, Avonmouth, UK BS10 7SD Brandon: High Street Brandon, Suffolk UK IP27 0AX Leeds: Hub 45 37 Knowsthorpe Gate Leeds, UK LS9 0NP
Net Volume of CO_2 Removal	14,873 CORCs Avonmouth: 4,789 CORCs Brandon: 1,075 CORCs Leeds: 9,009 CORCs
Removal Period	October 1, 2023 – September 30, 2024
Auditors	350Solutions Bill Chatterton
Version	v1.3

Issued: December 27, 2024

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PRODUCTION FACILITY & OUTPUT AUDIT REPORT		
Company O.C.O Technology Limited	Company Contacts: Dr. Peter Gunning Stephen Roscoe	Audit Team: Bill Chatterton* Lily Schacht
Removal Method: Carbonated Materials		
Report Date: December 27, 2024		
Document No: 350VR-OCO-PU2405		
Rev: 1.3		

** primary contact/lead author*

1. Introduction

350Solutions, Inc. was contracted to perform an audit of carbon dioxide removal credit (CORC) claims for O.C.O Technology Limited's carbonated aggregate production process. 350Solutions declares that we are an impartial auditor, free from any conflicts of interest, capable, and qualified to complete this audit according to Puro Standard and related Validation and Verification Body Requirements.

In December 2022, 350Solutions conducted a Production Facility audit of the process, lifecycle CO_2 emissions assessment (LCA), and other administrative details to verify compliance with the requirements of the Puro.Earth Puro Standard General Rules (Version 3.1) and Carbonated Materials Methodology (Edition 2022, v 1.0) [1], [2]. The Production Facility audit remains valid until December 2027. This follow-up output audit was conducted to verify O.C.O's reported CORCs for the period of October 1, 2023 through September 30, 2024.The audit and verification began with a teleconference review on December 10, 2024, followed by a detailed document review and audit.

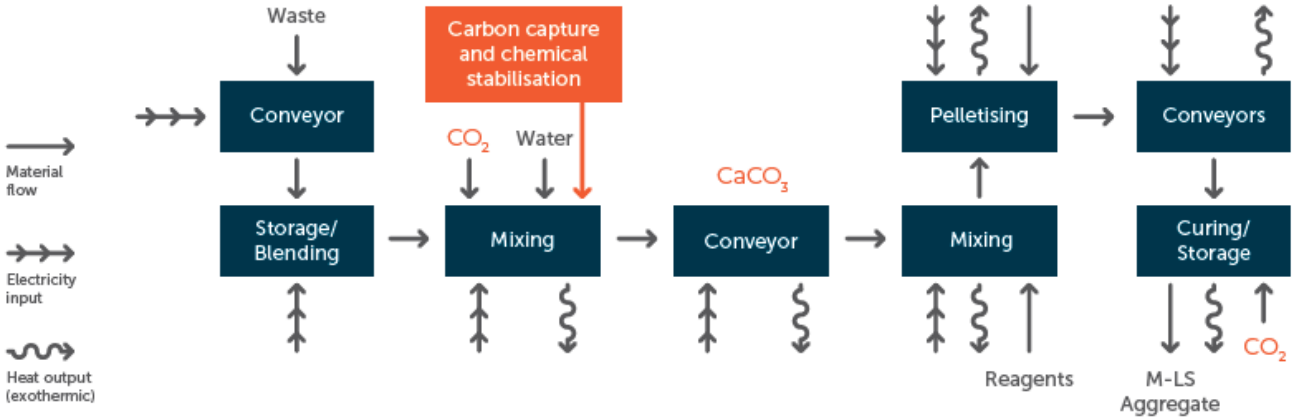
Table 1. 2024 O.C.O Output Audit Summary

Verification Summary	
CO_2 Removal Supplier	O.C.O Technology Limited
Removal Method	Carbonated Material: Production of carbonated aggregate from waste materials
Verification Type	Annual removal supplier output audit; Puro Standard General Rules (v3.1) and Carbonated Materials Methodology (v2)
Production Facility Name and Registry	O.C.O Aggregate Manufacturing Facilities: Avonmouth - GSRN: 643002406801000671 Brandon - GSRN: 643002406801000688 Leeds - GSRN: 643002406801000695
Production Facility Locations	Avonmouth: Unit 1 Severn View Industrial Estate, Central Avenue, Avonmouth, UK BS10 7SD Brandon: High Street, Brandon, Suffolk UK IP27 0AX Leeds: Hub 45, 37 Knowsthorpe Gate, Leeds, UK LS9 0NP
Verified CORC Factor	0.041 t CO_2-eq/t aggregate product
Verified CORCs	14,873
Audit Kickoff Date	December 10, 2024
Audit Report Date	December 27, 2024

2. Technology Description

The O.C.O Technology (O.C.O) process and technology uses carbon dioxide to treat various waste materials via Accelerated Carbonation Technology (ACT). O.C.O produces a lightweight carbonated aggregate for use in construction applications, such as in precast concrete block and ready-mixed concrete. O.C.O currently operates from three sites in the UK treating air pollution control residue (APCr) primarily from waste-to-energy plants and producing aggregate that meets EN13242 and EN13055 requirements. The aggregate production process utilizes CO_2 from biogenic or other sources injected during the accelerated carbonation step, and also absorbs and reacts with significant amounts of CO_2 in ambient air during on-site curing and storage. For CORC purposes, only CO_2 from biogenic sources, or absorbed directly from the atmosphere during curing is credited. CO_2 is permanently sequestered in the aggregate product in the form of carbonates. The process is summarized in Figure 1.

Figure 1. O.C.O Technology Carbonated Aggregate Process.



O.C.O operates three production facilities in the U.K. (Avonmouth, Brandon, Leeds) utilizing the same general process, inputs, and outputs in each location. O.C.O Manufactured LimeStone (M-LS) aggregate is currently sold primarily as construction material to concrete block makers, ready-mix concrete producers, and for pavement, earthworks (i.e. foundation fill), and similar applications.

2.1. Process Inputs & Outputs

The O.C.O aggregate manufacturing process uses similar inputs as a concrete batching process, with the primary exception being the use of air pollution control residue (APCr) as a primary feedstock, which the O.C.O process treats and stabilizes in the aggregate carbonate matrix that forms. Primary inputs include APCr, water, CO_2, sand, and other aggregates or residues, such as limestone dust or scalpings (crushed rock). The process uses electricity for operation of equipment, and requires heavy equipment for material handling, which require diesel fuel use.

The O.C.O process produces very little to no waste products and has very limited emissions of any kind from the facility. Any waste produced on site is typically recycled and used in the mix in small quantities, as they are often components of feedstock or product. There are no air emission points, with the primary potential emissions being fugitive dust, which is controlled and monitored at the sites, and water vapor emitted as bound water in the raw material is released during the

carbonation reaction. All CO_2 inputs are absorbed and reacted in the Stage 1 process, which is controlled and monitored by pressure in the sealed mixer to ensure CO_2 is not injected until prior injection has been reacted.

Table 2 summarizes the observed inputs and outputs from the process and typical rates from supplied operational data.

Table 2. Verified Production Facility Inputs & Outputs

Input or Output	Item	Verified Amount Over Monitoring Period	Notes (Specifications, source, etc.)
Inputs	APCr (tonne)	159,854	O.C.O tests each APCr delivery to ensure it is within specifications to enable aggregate production.
	CO_2 (tonne) - Biogenic injected - Fossil injected Ambient CO_2 absorbed during curing	3,612 3,307 304 -	CO_2 values provided for reporting period are the total CO_2 delivered to O.C.O. Primarily biogenic sourced, with 304 tonne fossil-based CO_2 input
	Water (m^3)	62,072	Utility metering data
	Cement (tonne)	37,123	Data recorded using process control output files associated with production facility weigh scales
	Limestone dust (tonne)	62,744	
	Other waste materials (sand, C&D debris, scalpings, recycled glass, etc.) (tonne)	37,183	
	Raw material supply inputs (extraction, handling, transportation emissions)	Included in Production & Operation CO_2 emissions below	Emissions are from raw material extraction and production processes (OneClick EPD software used for EPD emission factors and calculation) as well as transport of materials to O.C.O. EPD independently verified by EPD Hub
	Production inputs: - materials handling equipment (diesel) - site electricity use	130,706 liter 1,682,640 kwh	No additional energy inputs are required. All electricity and diesel usage is based on utility bills or purchase records.
	CO_2 present in feedstock ($E_{priorcarbon}$)	14.0 kg CO_2e per tonne aggregate	Based on monthly analysis of APCr feedstock material and rate.
Outputs	Aggregate product output (tonne)	363,065	Aggregate product output is based on delivered product weighed as it leaves the plant gate on calibrated weigh scales.
	CO_2 stored in aggregate (E_{stored})	124.6 kg CO_2e per tonne aggregate	Based on measured carbonate content of M-LS aggregate (monthly), as detailed in document 1C1Carbon Assessment Datasheet
	Production and operation CO_2 emissions output ($E_{production}$)	69.6 kg CO_2e per tonne aggregate	From EPD. Includes all raw material extraction and transportation and aggregate production process.
	Net CO_2 emissions	-41.0 kg CO_2e per tonne aggregate	From EPD (E_{stored} – $E_{production}$-$E_{priorcarbon}$)

3. Audit Summary

3.1. Audit Approach

A planned series of audit activities were conducted by 350Solutions to independently validate and verify production and output data, and CORC claims for the reporting period. The audit was conducted following the specifications of Puro General Rules (Version 3.1) and Carbonated Materials Methodology (Edition 2022, v 1.0). Specific audit activities conducted are summarized in Table 3. A completed Puro Carbonated Materials Methodology Audit Checklist used during the audit is attached to this report as Appendix 1. Auditor qualifications are attached as Appendix 2.

Table 3. Audit Activities

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
December 10, 2024	Teleconference and Introductory Document Review	- Opening meeting and review of operational and procedural changes - Review of LCA and supporting documentation - Review of Puro CORC calculations - Review of raw material sources and sustainability - Review of system inputs and outputs - Review evidence of product output - Review of product properties - Review of product end use - Review of equipment and calibrations	Audit Document Index.docx 1A1 CO2 Supplier 1 Contract 1A2 CO2 Supplier 2 Contract 1A3 CO2 Deliveries 1B1 Raw Materials Delivered 1B2 BES6001 Sustainable Sourcing Certificate 1C1 Carbon Assessment Datasheet 1C2 O.C.O Methodology for CO2 Removal v3 1C3 Acid Digestion Method (Section 2.2) 2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data
August 19 – 30, 2024	Data Review	- Review of LCA and supporting documentation - Review of Puro CORC calculations - Review of facility registries and permits - Review of raw material sources and sustainability - Review of carbon content of input materials - Review of system inputs and outputs - Review evidence of product output - Review of product properties - Review of product end use	3A1 CORC Report Summary - Avonmouth 3A2 CORC Report Summary - Brandon 3A3 CORC Report Summary - Leeds 3B1 Terms and Conditions of Sale 3C1 Aggregates Customers 3C2 Product Despatch Report 3C3 BlockMix - Sales Factsheet 3C4 6F - Sales Factsheet 3C5 UKCA Blockmix 3C6 UKCA 6F 3C7 Permanence Risk Assessment
December 12-14, 2024	Report Writing	- Compose Verification Report - Internal quality control	*No additional documents reviewed following data review*

3.2. Verified Output & CORCs

Table 4 includes the specific CORCs claimed by O.C.O. and verified by 350Solutions during the output audit process.

Table 2. Verified CORCs for O.C.O Technologies

Performance Metric Name / Description	Claimed Value	Verified Value	Monitoring Period
Net CO_2 Removal Factor*	41.0 kg CO_2/ tonne aggregate	41.0 kg CO_2/ tonne aggregate	October 1, 2023 – September 30, 2024
Aggregate Output	363,065 tonne	363,065 tonne	
Biogenic CO_2 Injected	3,308 tonne	3,308 tonne	
Ambient CO_2 absorbed during curing**	11,565 tonne	11,565 tonne	
Total CORCs***	14,873 CORCs	14,873 CORCs Avonmouth: 4,789 Brandon: 1,075 Leeds: 9,009	

** CO_2 Removal factor is the net value of CO_2 removed in the aggregate product based on the O.C.O M-LS Environmental Product Declaration. Over 91% of all CO_2 injected during the reporting period was of biogenic source, CORCs are calculated based on this biogenic fraction of CO_2 injected (fossil-based CO_2 injected is deducted).*

*** Determined using the average measured carbonate content of M-LS aggregate and the mass of biogenic CO_2 injected.*

**** CORC calculations are based on the net CO_2 emission rate determined and verified in the valid Environmental Product Declaration (EPD) for the reporting period, and the average measured carbonate content of M-LS aggregate. CORC values are calculated based on this factor and the total aggregate product delivered during the reporting period. The values of inputs during the reporting period are verified and reported here for completeness and to cross check versus the EPD.*

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 Carbonated Materials Methodology V2***

☐ ***Meets the requirements of the Puro General Rules V3.1 and Carbonated Materials Methodology V2 with minor modifications***

☐ ***Does Not Meet the requirements of the Puro General Rules V3.1 and Carbonated Materials Methodology V2***

350Solutions utilized a reasonable level of assurance in performance of the outputs audit. A summary of specific findings associated with each requirement of the Puro Standard and Carbonated Materials Methodology and any identified issues with the audit are summarized below.

Table 5. Audit Findings

Puro Standard CM Method. Section Ref.	Audit Verification Topic	Findings
1.1.1	*CO_2 Source*	**Acceptable.** O.C.O utilized biogenic CO_2 during the reporting period (<9% of CO2 injected was fossil sourced). A significant portion of the CO_2 in the product occurs via absorption from ambient atmosphere and reaction in the aggregate during the curing and storage process on-site.
1.1.2 *5.2.1* *5.2.2*	*Sustainable Raw Materials*	**Acceptable.** O.C.O utilizes waste material (APCr) as a primary input, serving as a certified End-of-Waste treatment facility. In addition, O.C.O has obtained BES 6001 certification for Responsible Sourcing of Construction Materials for other inputs.
1. *3.1.1* *3.1.2* *3.1.3* *5.2.1* *5.3.1* *5.3.2* *5.3.3*	*Net-Negative LCA*	**Acceptable**. O.C.O has demonstrated an appropriate basis for CORCs according to the Puro Methodology. The LCA was completed and independently verified as part of the independently verified EPD development, and utilizes the appropriate standard (ISO 14040/14044), system boundary (cradle to gate – excluding distribution use and end-of-life), cut-off approach for secondary materials, and results in a net-negative LCA, with -41.0 kg CO_2 removed per tonne of aggregate (after accounting for prior carbon present in the APCr feedstock material).
1.2.4	*Output Quantification*	**Acceptable.** All reported aggregate production is based on deliveries at the gate, as measured on a calibrated weigh scale at each facility (Brandon uses an off-site, but calibrated scale). All shipped aggregate product is accounted for in dispatch records, which form the basis for the claimed production and CORCs. O.C.O also documents raw material usage and production via plant SCADA systems, which can be used for cross-check purposes. Water, electricity, and diesel fuel use are determined by either on-site meters, utility bills, or purchase receipts, respectively. O.C.O has a valid EPD for the M-LS aggregate product. All LCA inputs in the EPD are complete and analysis performed in compliance with the Puro methodology.
2.1.3 *5.4.1*	*Product usage*	**Acceptable.** The carbonated aggregate produced by O.C.O is utilized in a variety of construction processes. O.C.O maintains a complete list of customers and a summary of applications of the aggregate. In addition, O.C.O certifies that the product meets EN13242 and EN 13055 standards for specific aggregate types for use in certain construction materials.
2.2.5	*Demonstrated Additionality*	**Acceptable.** O.C.O has provided financial models and financial records demonstrating the need for carbon finance. Specifically, the primary counterfactual for the O.C.O process is the treatment and landfilling of the APCr residues. Companies that perform this process are typically able to provide lower tipping fees than what O.C.O charges for treatment, which is in large part due to the additional costs of operating the O.C.O process compared to traditional landfilling. To remain competitive with the counterfactual, O.C.O requires carbon finance to enable tipping fee reductions for APCr, to secure their primary input. In addition, with increasing operating costs (electricity, CO2), and low value of aggregate product, the carbon finance revenues support financial results that significantly improve options for future investment and scaling.

4. 5.3.2	*CORC Calculation Methodology*	**Acceptable.** O.C.O follows the CORC quantification methodology in the CBM Methodology. Note that O.C.O now uses direct measurement of carbonate content of M-LS to quantify CO_2 uptake. Direct measurement of carbon content of APCr waste feedstock material is used to deduct prior carbon from the end-product carbon content.
5.5.1	*Statement re: Double Counting*	**Acceptable.** O.C.O is aware of end-user customer practices and assures no-double counting is taking place. O.C.O has provided written confirmation of use of product. O.C.O utilizes language in its terms and conditions that state that the carbon credits associated with the product do not transfer with the product purchase and credit ownership may be negotiated separately.

Additional details regarding audit activities, documents reviewed, and observations during the audit process are summarized in Appendix 1.

4.2. Ongoing Issuance

Puro.earth are currently transitioning to use the 4.0 version of the Puro General Rules. Although this Production Facility and Output Audit was 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).

350Solutions confirms that the O.C.O production facilities audited here are eligible for Ongoing Issuance because they have successfully demonstrated regular industrial operation and verifiable reporting for over 3 months.

4.3. Audit Issues

No audit issues are noted.

4.4. Recommendations for Improvement

No recommendations for improvement are noted at this time.

5. Revision History

Version	Date Issued	Noted Changes
Draft v1.1	December 14, 2024	Initial Draft
Draft v1.2	December 16, 2024	Updated following internal 350Solutions QA review
Final v1.3	December 27, 2024	Following reviews by Puro and O.C.O

6. Auditor Signatures

Bill Chatterton
December 27, 2024

Bill Chatterton (Lead Auditor)
Carbon Removal Verification Manager
350Solutions, Inc.

Lily R Schacht

Lily Schacht (Quality Assurance)
Carbon Removal Verification Engineer
350Solutions, Inc.

7. References

[1] Puro.Earth, Puro Standard General Rules, Version 3.1. https://puro.earth/documents/

[2] Puro.Earth, *Carbonated Materials Methodology (Edition 2022, v2).*, https://puro.earth/methodologies/

Appendix 1: Puro.Earth Carbonated Materials Methodology Audit Checklist

Guideline Ref	Requirement	Requirement Met Y/N	Verification Remarks Insert auditors comments	Evidence Document Insert evidence used to verify requirement
Carbonated Materials § 2.1 - Eligibility Requirements	The carbon dioxide mineralised in the carbonated material shall be of biogenic origin or from direct capture from the ambient atmosphere (CO2 from fossil fuels or cement production is not eligible)	Y	CO2 utilized came from a variety of sources. Primary CO2 source is from biogenic CO2 from anaerobic digester. Some CO2 was from fossil sources. Total CO2 (biogenic) delivered to facility in reporting period is 3308 tonne). Remainder of CO2 uptake is from direct air capture via diffusion and reaction in the product while curing in the stockpiles.	1A1 CO2 Supplier 1 Contract 1A2 CO2 Supplier 2 Contract 1A3 CO2 Deliveries
	The raw material used in the carbonated material production is of eligible type and that EU, other national, or local legislation is followed in its sourcing and extraction	Y	Raw materials are primarily a waste product (APCr) along with CO2 , cement, water, sand (or other filler). OCO has obtained BES Certification of responsible Sourcing (BES 6001).	1B1 Raw Materials Delivered 1B2 BES6001 Sustainable Sourcing Certificate 2A1 2023-2024 EPD
	The eligibility of the Production Facility is determined in the Production Facility Audit	Y	Production facility eligibility verified for all three production facilities in 2022.	Production facility audit report "OCO PU2204 VR FINAL", February 2023
Carbonated Materials § 4 - Lifecycle GHG Emissions	CO2 Removal Supplier provides a LCA (LCA report or environmental product declaration)	Y	O.C.O maintains an EPD for its aggregate product which includes full LCA analysis. EPD LCA analysis complies with Puro requirements, boundary, and methodology.	2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data
	LCA follows general guidelines of ISO 14040 and ISO 14067 rules for product LCA (where carbonated material is the product and LCA is cradle to gate)	Y	EPD references ISO 14040, ,ISO 14044, EN 15804+A2 and ISO 14025 and ISO 21930. The EPD was created with one-click LCA and verified by EPDHub. EPD LCA analysis complies with Puro requirements, boundary (cradle to gate), and methodology. Note that the EPD includes CO2 removal using any CO2 source for injection. O.C.O provided additional calculations to remove any injected fossil-derived CO2 from LCA and CORC calculation.	

Carbonated Materials § 4 - Lifecycle GHG Emissions	The LCA activity boundary includes raw material used: CO2 emissions from extraction and production of the raw material used for the production of the carbonated elements	Y	Review of EPD indicates all emissions from extraction and production of raw materials and equipment are included in LCA. Ecoinvent database is used for emission factors.	2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data
	The LCA activity boundary includes CO2 emissions from transporting the raw material to the production facility where the carbonated materials are produced	Y		
	The LCA includes all GHG emissions associated with production at the production facility	Y		
	In case of waste or secondary materials being used in the production of the carbonated materials, it is recommended to apply the cut-off approach for waste, recycled, and secondary products (see Section 4.0.4).	Y	Confirmed. EPD states use of cutoff approach for waste/secondary materials.	
	The activity boundary excludes: transport of elements to construction site(s), construction activities, and end of life (e.g., emissions from demolition or end of life activities)	Y	Confirmed via review of EPD and raw data files.	
Carbonated Materials § 6 – Removal Supplier Proofs	The *Output* of a *Production Facility* is eligible for issuance of CORCs once the facility has undergone a process of third-party verification by an auditor against the specific methodology for the carbonated material. This verification is done in a *Production Facility Audit*.	Y	Production facility eligibility verified for all three production facilities in 2022.	Production facility audit report "OCO PU2204 VR FINAL", February 2023
	The CO2 *Removal Supplier* must present information on: • The raw materials used and their composition. • The assumed emission factors for the supply (extraction and manufacturing) of the raw materials. • The scope of emissions included in the emission factors. The information may be presented in the form of a product LCA.	Y	O.C.O maintains an EPD for its aggregate product which includes full LCA analysis and supporting materials documentation. EPD LCA analysis complies with Puro requirements, boundary, and methodology.	2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data
	The raw materials (e.g., sand, gravel, binder, CO2, water, slag) should be sustainably sourced and sourced in accordance with local regulations.	Y	This is demonstrated through a current certificate of compliance to BES6001.	1A1 CO2 Supplier 1 Contract 1A2 CO2 Supplier 2 Contract 1A3 CO2 Deliveries 1B1 Raw Materials Delivered 1B2 BES6001 Sustainable Sourcing Certificate
	The CO2 *Removal Supplier* must present proof of net CO2 negativity, i.e. that the product stores more CO2 than has been emitted within the system boundaries defined in this methodology. The proof can take the form of an LCA report.	Y	Proof of net CO2 negativity verified.	2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data

Materials § 6 – Removal Supplier Proofs	The CO2 *Removal Supplier* must present laboratory test results (or other scientifically reliable analyses by a trusted third party) quantifying the amount of CO2 sequestered by the material.	Y	Supplier adopted a direct measurement approach to replace the Steinour calculation. This involves regular sampling and analysis on the aggregate to determine the CO2 content. Provided a detailed methodology and a report summarizing the testing results for the relevant period in the audit pack.	1C1 Carbon Assessment Datasheet 1C2 O.C.O Methodology for CO2 Removal v3 1C3 Acid Digestion Method (Section 2.2)
	The CO2 *Removal Supplier* must provide a statement of end use for the carbonated material. Specifically, the statement of end use must detail how the permanence of the CO2 storage is ensured by the end use conditions.	Y	Product is tested and certified as aggregate product to blockmix and readymix standards. EN13242 and EN 13055.	3C1 Aggregates Customers 3C2 Product Despatch Report 3C3 BlockMix - Sales Factsheet 3C4 6F - Sales Factsheet 3C5 UKCA Blockmix 3C6 UKCA 6F 3C7 Permanence Risk Assessment
	The CO2 *Removal Supplier* must provide a risk assessment and mitigation plan for the risks related to the permanence of the CO2 sequestration and potential re-emission of CO2.	Y	The risks associated with the permanence of the CO2 have been deemed to be insignificant (see appendix 2 for more detailed information	2A1 2023-2024 EPD 3C7 Permanence Risk Assessment
	The CO2 *Removal Supplier* must provide a long-term storage plan for any carbonated material intended for permanent storage.	NA	M-LS is not manufactured for the purpose of long-term storage of the product	2A1 2023-2024 EPD
	The carbonated material must not be exposed to conditions resulting in the reversal of CO2 sequestration, nor utilized for purposes where exposure to such conditions can occur.	NA	M-LS is not exposed to conditions resulting in the reversal of CO2 sequestration, nor utilized for purposes where exposure to such conditions can occur	2A1 2023-2024 EPD

Quantification and Calculation Checklist - Ouput Audit						
Guideline Ref	**Requirement**	**Requirement Met** Y/N	**Verification Remarks** Insert auditors' comments	**Evidence Document** Insert evidence used to verify requirement	**Value**	**Units**
Materials § 5 – Calculation methodology for the quantification of CO2 *Removal Certificates* (CORCs)	The removal supplier provides data and documentation on the production volume (in kg) of the carbonated elements produced in the production process of the eligible production facility.	Y	Verified	3C1 Aggregates Customers 3C2 Product Despatch Report		
	CORCs = Estored - Eproduction	Y	Confirmed. Note that CORC calculation requires (and was completed by O.C.O) removal of fossil derived CO2 from the calculated CO2 removals, as the EPD CO2 content of the aggregate is for any CO2 source.	3A1 CORC Report Summary - Avonmouth 3A2 CORC Report Summary - Brandon 3A3 CORC Report Summary - Leeds	14,873	CORCs
	Estored = QCBE x ACO2	Y	Verified	1C1 Carbon Assessment Datasheet	45,238	tonnes CO2
	QCBE = the amount of carbonated material produced by the supplier. It is calculated by the supplier, and appropriate documentation must be provided.	Y	Verified	3C1 Aggregates Customers 3C2 Product Despatch Report	363,065	tonnes aggregate
	ACO2 = actual amount of CO2 sequestered per tonne product. It is based on measurements or other scientifically sound methods verified by auditor	Y	Includes regular sampling and analysis on the aggregate and raw materials to determine CO2 content. Provided a detailed methodology and a report summarizing the testing results for the relevant period in the audit package. Includes 14.0 kg CO_2e/ tonne aggregate prior carbon (Epriorcarbon) from raw material input	1C1 Carbon Assessment Datasheet 3A1 CORC Report Summary - Avonmouth 3A2 CORC Report Summary - Brandon 3A3 CORC Report Summary - Leeds	124.6	kg CO2e/tonne product
	Eproduction = GHG emissions from all activities involved in production of carbonated material	Y	Emissions factor must include natural gas production and distribution per ISO14040	2A1 2023-2024 EPD 2A2 EPD Detail Report 2A3 2023-2024 EPD Raw Data	69.6	kg CO2e/tonne product
	Eproduction activities are grouped as: sourcing of CO2, sourcing of raw materials, production of carbonated materials	Y	Verified			
	For all Eproduction activities included, a full scope of emissions is provided, i.e., including all life cycle stages (manufacturing, use and disposal) of the processes involved.	Y	Verified			

Appendix 2: Verifier Qualifications

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

Verifier Qualifications

Company Name:	**O.C.O Technologies**
Date:	**12/10/2024**

Verifier Name:	**Bill Chatterton**
Company Name (where applicable):	**350Solutions**
Verifier Contact Information:	**bill@350solutions.com, 984-215-0585**
Verifier Address:	**1053 E. Whitaker Mill Rd. Suite 115, Raleigh, NC 27604**
Verifier Scope of Activities:	**Output Audit through review of key technology components, operational data, 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. 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. 350 staff have participated in the evaluation and verification of novel technologies that sequester carbon via various methods, including biomass conversion to liquids, solids, and other products which are then permanantly stored in ways such as land application or geologic storage, conversion of captured CO2 into building materials and co-products, and the production of chemicals, fuels, and products via biomass pyrolysis and gasification. 350 also served as lead verifier for the Carbon XPrize competition and contributed to the development of procedures and processes for verification of relevant calculations, modeling, and statistical methods in order to assess team results and calculations of performance metrics and uncertainty. 350 has demonstrated knowledge of data quality and data validation approaches and execution in supporting verification of performance claims and results.
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.
2. Not directly involved in the design, manufacture or construction, marketing, installation, use or maintenance of the specific technologies submitted to Puro.Eargh 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.	☑	

William Chatterton
350Solutions
Senior Verification Manager

EDUCATION
B.S. Environmental Science, SUNY at Plattsburgh, 1982
A.A.S. Environmental Technology, Paul Smith College, 1979
Certified Measurement and Verification Professional (CMVP), 2019

OVERVIEW AND EXPERTISE
William Chatterton is an Environmental Scientist with over 30 years' experience in demonstration, evaluation, and performance verification of technologies addressing environmental issues, advanced energy production and use, and carbon removal. His skills include management, design, and execution of technology demonstration and verification projects, with particular expertise in measurement, reporting, and verification (MRV) of technology performance. He serves as a Senior Verification Manager at 350Solutions and manages projects and programs for commercial and government clients in these areas. During his previous 20 years at Southern Research Institute, Mr. Chatterton managed and supported programs designed to integrate, demonstrate, and evaluate technology performance in the advanced energy and environmental mitigation fields. Technology demonstrations and evaluations that he has been involved with include technologies designed to promote sustainable energy sources, increase energy use and efficiency, mitigate GHG and other emissions, and in most cases provide other social and economic benefits to potential users.

At 350Solutions, he has led efforts toward 350Solutions becoming the first US-based technology evaluation firm accredited to conduct Environmental Technology Verifications under the international standard ISO 14034 – an international standard issued in 2016 to unify the general approach for the evaluation of innovative technologies with potential beneficial impact on the environment.

Mr. Chatterton has had technical roles in several projects focused on identifying and evaluating carbon dioxide (CDR) removal technologies. Under these projects, he verifies the efficacy, performance, scalability, and sustainability of a range of carbon removal technological approaches. Each project culminated in verification statements and reports that summarized verification findings, presented verified performance data, and identified risks associated with broad implementation of the technologies.

PROFESSIONAL EXPERIENCE
350Solutions: 08-2019 – Present
Senior Verification Manager: In this role, Mr. Chatterton manages and executes technology performance demonstrations and verifications of emerging technologies including carbon removal, advanced energy, emissions mitigation, and transportation technologies for commercial clients and U.S. governmental agencies. These performance evaluations generally involve evaluation of commercial feasibility, economic impacts (installation, operating, and capital costs, simple payback, and return on investment), environmental impacts (primarily greenhouse gas and criteria pollutant emission reductions), and technology performance. He also manages and monitors 350Solutions' quality management programs and ISO accreditations.

Recently, he has led diligence and verification activities of CDR technologies for an advance market commitment consortium that aims to accelerate the development of carbon removal technologies by guaranteeing future demand for them. Under a recent project, he verified the efficacy, performance, scalability, and sustainability of two leading enhanced rock weathering (ERW) technologies in the Southern US.

He has also led or supported several technology verifications and performance audits of CDR technologies for one of the world's leading crediting platforms for engineered carbon removal. Technologies verified have included biochar, geologic storage, ERW, and carbonated materials CDR systems.

Previously, Mr. Chatterton served as lead verifier in support of the NRG-Cosia Carbon XPRIZE competition. Following ISO 14034 protocol, the performance of ten CO_2 capture and conversion technologies were independently evaluated and verified at pilot scale demonstrations while utilizing CO_2 in flue gas. His specific roles in supporting this project included review of technology specifications and commissioning, development of verification plans, field verification of performance, and development and submittal of ISO conformant verification reports and statement.

Southern Research Institute: 1999 - 2019
Program Manager, Energy & Environment Technologies: As Program Manager, Mr. Chatterton has managed and executed several technology performance demonstrations and verifications of emerging energy (efficiency and green building) and transportation technologies, primarily for U.S. governmental agencies, energy research associations, and state energy agencies. These performance evaluations have involved evaluation of commercial feasibility, economic impacts (installation, operating, and capital costs, simple payback, and return on investment), environmental impacts (primarily greenhouse gas and criteria pollutant emission reductions), and technology performance. He has also directed field tests at industrial or commercial sites of oil and gas extraction and processing, power generation, advanced energy, green building, and mobile source technologies. Technology performance assessments typically include management of multiple team efforts and result in peer reviewed deliverables such as test plans and reports and other outreach activities.

Project Manager: Managed projects for both private and governmental clients primarily in support of EPA's Environmental Technology Verification (ETV) Greenhouse Gas (GHG) Center. Technology demonstrations focused on energy efficient, GHG relevant, and environmentally sustainable technologies including advanced power generation systems (CHP and micro-CHP), fuel cells, the oil and gas industry, and transportation technologies (on- and non-road retrofits and emerging technologies). As a senior project manager at Southern, he has been involved with performance verification of numerous GHG mitigation technologies and several distributed generation electrical generators, many in NYS. His support of these verifications has included lead or technical support on test plan development, design and implementation of field-testing activities, data evaluation and presentation, and reporting of results. He has managed performance evaluations of four alternative energy cogeneration systems including microturbine, internal combustion, and fuel cell-based systems, all fueled with biogas. Under EPA's ETV Program, assisted with the formation of and participated in two Stakeholder Groups – The Oil and Gas Industry Stakeholder Group, and the Advanced Energy Stakeholder Group.

Lily Schacht
Carbon Removal Verification Engineer, 350Solutions

EDUCATION:
MS, Environmental Engineering, University of Wisconsin – Madison, 2019
BS, Chemical, Energy, and Environmental Engineering, Washington University in St. Louis, 2017

EXPERIENCE SUMMARY:
Lily Schacht is an Environmental and Chemical Engineer with experience in process engineering, environmental chemistry, analytical methods, and life cycle analysis (LCA). At 350Solutions, Lily works on verifying carbon dioxide removal (CDR) technologies, with a focus on mineralization-based pathways, including enhanced weathering, direct air capture, and ocean alkalinity enhancement. Previously, Lily led agronomic research at an enhanced weathering CDR supplier where she organized field trials across multiple states to quantify carbon removal and crop yield changes after rock application. Before that, Lily developed rapid prototyping instrumentation to optimize a biomineralization process in concrete production and aided in scaling up the process to pilot-scale. Lily also built environmental impact models for process variable sensitivity analysis of demo-scale manufacturing processes. These models were used to drive the direction of research and development to minimize product life cycle impacts. Throughout her career, Lily has developed analytical chemistry methodologies for both liquid- and solid-phase analyses.

RESEARCH AND PROFESSIONAL EXPERIENCE:
March 2024 – Present: Carbon Removal Verification Engineer, 350Solutions
Verify CDR technologies on behalf of registries and the XPRIZE Carbon Removal challenge. Specializes in mineralization pathways, including mineralization kinetics, measurement methods, and open-system modeling.

Nov 2022 – Feb 2024: Researcher, Lithos Carbon
Quantified carbon removal rates and agronomic impacts of enhanced weathering on cropland across six US states; Evaluated chemical analysis methods for precision relative to cost.

Nov 2023 – Jan 2024: Independent Consultant, Keel Labs
Built an environmental impact model to evaluate potential material and process changes; Recommended areas for reducing material usage up to 80%

Dec 2020 – Oct 2022: Research Scientist II
Guided experimentation and data analysis throughout all R&D teams to inform techno-economic analysis (TEA) and LCA; built and led the carbonate biomineralization prototyping workstream for rapid iteration; developed real-time measurement techniques for critical process parameters in solid state

SELECTED PUBLICATIONS & PRESENTATIONS:

- **Schacht, L.**, Baum, M., Liu, H., & Yap, M. (2023) Scaling Enhanced Rock Weathering: Agronomic Impacts at Field-Scale [Abstract]. ASA, CSSA, SSSA International Annual Meeting, St. Louis, MO.
- **Schacht, L.** and Ginder-Vogel, M. Arsenite Depletion by Manganese Oxides: A Case Study on the Limitations of Observed First Order Rate Constants. *Soil Syst.* 2018, 2(3), 39. https://doi.org/10.3390/soilsystems2030039