2023 OUTPUT AUDIT REPORT v4

For PURO.EARTH

Company / CO_2 Removal Supplier	**O.C.O Technology Limited**
Production Facility Name	**O.C.O Aggregate Manufacturing Facilities: Avonmouth, Brandon, Leeds, UK**
Production Facility Address	**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
Net Volume of CO_2 Removal	**20,831 CORCs** **Avonmouth: 6,649 CORCs** **Brandon: 2,650 CORCs** **Leeds: 11,532 CORCs**
Removal Method	**Carbonated Building Material**
Removal Period	**1 Oct 2022 –30 Sept 2023**
Auditor	**Bill Chatterton 350Solutions, Inc.**

O·C·O® TECHNOLOGY
CARBON:CAPTURED®

ISSUED: AUGUST 5, 2024

350 SOLUTIONS

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2023 OUTPUT AUDIT REPORT

Company: O.C.O Technology Limited	Company Contact: Dr. Peter Gunning	Audit Team: *Bill Chatterton Tim Hansen, PE
Removal Method: Carbonated Building Material		
Report Date: August 5, 2024		
Document No: 350VR-OC-PU2308		
Rev: 4		

** 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 for the period of October 1, 2022 through September 30, 2023. 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.

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 and removed via direct air capture 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.

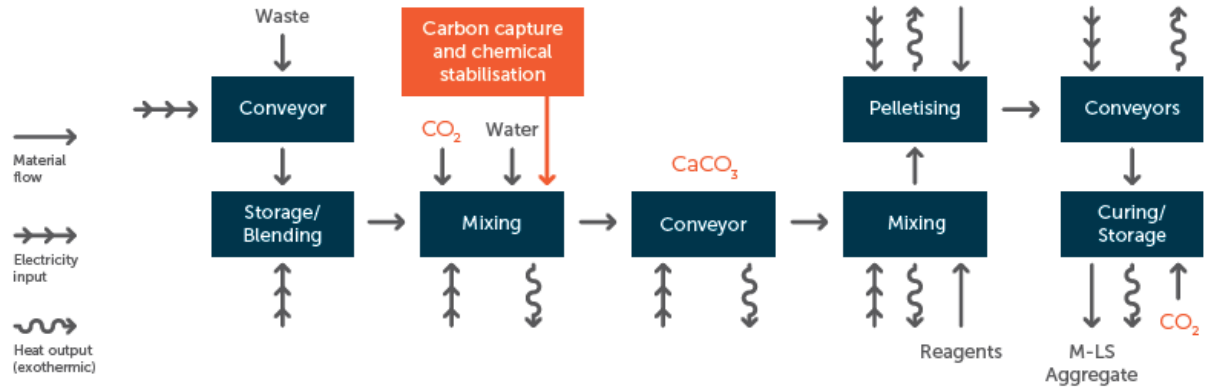

FIGURE 1. O.C.O TECHNOLOGY CARBONATED AGGREGATE PROCESS

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.

In December 2022, 350Solutions conducted an 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 3.0) and Carbonated Building Material Methodology (Edition 2022, v 1.0) [1], [2]. This follow-up output audit was conducted to verify O.C.O's reported CORCs for the period of October 1, 2022 through September 30, 2023.The audit and verification began with a document review followed by a teleconference audit on December 5, 2023.

TABLE 1. O.C.O OUTPUT AUDIT SUMMARY

Verification Summary	
CO_2 Removal Supplier	O.C.O Technology Limited
Production Facility Name and Registry	O.C.O Aggregate Manufacturing Facilities: **Avonmouth** - GSRN: 643002406801000671 **Brandon** - GSRN: 643002406801000688 **Leeds** - GSRN: 643002406801000695
Removal Method	Carbonated Building Material: Production of carbonated aggregate from waste materials
Verified CO2 content of Product	119 kg CO_2 / tonne aggregate product
Verified CORCs	20,831 CORCs
Audit Report Date	August 5, 2024
Output Audit Date	December 5, 2023
Production Facility Location (Address and GPS Coordinates)	**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
Audit Type	Annual Output Audit for Puro.Earth Puro Standard General Rules (v3.0) and Annex B: Carbonated Building Material Methodology

2. AUDIT SUMMARY

2.1. 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 and the Annex B Carbonated Building Materials Methodology. Specific audit activities conducted are summarized in Table 2. A completed Puro Carbonated Building Materials Methodology Audit Checklist used during the audit is attached to this report as Appendix 1. Auditor qualifications are attached as Appendix 2.

TABLE 2. AUDIT ACTIVITIES

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
Dec 1-5, 2023	Document and 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	- [1A] Manufactured LimeStone EPD - [1B] 2022-2023 Mass Balance - [1C] EPD Raw Data - [1D] Avonmouth Daily Records - [1E] Brandon Daily Records - [1F] Leeds Daily Records - [2A] CO2 Removal Methodology - [2B] Empirical Data Report - [2C] Empirical Data Summary - [3A] Court Farms Contract (see section 7) - [3B] CO2 Deliveries - [4A] Sustainability-Report 2021-22 - [4B] BES 6001 Certificate Jul 23 - [4C] BES 6001 Report Jul 23 - 5A] M-LS 6F - Sales Factsheet - [5B] M-LS BlockMix - Sales Factsheet - [5C] Aggregate customers and applications - [5D] UKCA Certificate - [5E] UKCA Certificate - [5F] UKCA Certificate - [5G] UKCA Certificate - [5H] UKCA Certificate - [5I] UKCA Certificate - [5J] UKCA Certificate - [5K] UKCA Certificate - [5L] UKCA Certificate - [6A] EPD based CORC calculation Oct22-Sep23 - [6B] Product Despatch Report Oct22-Sep23 - [7A] O.C.O Technology Summary - [7B] Technology Brochure - [7C] Carbon Brochure - New_measurement_report_2022_2023_info_pack_v6.pdf - RE_calculation_of_CORC_Claim_Oct22-Sep23.xlsx - WCO2 By Source.xlsx
Dec 5, 2023	Teleconference Audit	- 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, independent measurement cross checks	

2.2. 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. 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 are 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 a result of the exothermic reaction of carbonate formation. 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 3 summarizes the observed inputs and outputs from the process and typical rates from supplied operational data.

TABLE 3. VERIFIED PRODUCTION FACILITY INPUTS & OUTPUTS

Input/Output	Verified Rate for Reporting Period*	Notes (Specifications, source, etc.)
APCr (tonne)	175,951	O.C.O tests each APCr delivery to ensure it is within specifications to enable aggregate production.
CO_2 (tonne) - Biogenic injected - Fossil injected - Direct Air Capture (during curing)	2,942 2,917 25 -	CO_2 values provided for reporting period are the total CO_2 delivered to O.C.O. Primarily biogenic sourced, with 25.2 tonne fossil based CO_2 input
Water (m^3)	64,803	Utility metering data
Cement (tonne)	40,618	Data recorded using process control output files associated with production facility weigh scales
Limestone dust (tonne)	113,317	
Other waste materials (sand, C&D debris, scalpings, recycled glass, etc.) (tonne)	21,468	
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	146,239 liter 2,078,815 kwh	No additional energy inputs are required. All electricity and diesel usage is based on utility bills or purchase records.
Aggregate product output (tonne)	442,580	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})	136 kg CO_2e per tonne aggregate	Based on measured carbonate content of M-LS aggregate, as detailed in [2B] CO2 Removal Empirical Data Report
CO_2 present in feedstock ($E_{priorcarbon}$)	16.5 kg CO_2e per tonne aggregate	Based on analysis of APCr feedstock material and rate.
Production and operation CO_2 emissions output ($E_{production}$)	72.4 kg CO_2e per tonne aggregate	From EPD. Includes all raw material extraction and transportation and aggregate production process.
Net CO_2 emissions	-47.07 kg CO_2e per tonne aggregate	From EPD (stored – production-priorcarbon)

**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.*

2.3. VERIFIED OUTPUT & CORCS

Table 4 includes the specific CORCs claimed by O.C.O Technology for its three UK facilities during the reporting period, as well as the level verified by 350Solutions during the on-site audit and data review.

TABLE 4. VERIFIED CORCS FOR O.C.O TECHNOLOGY LIMITED

Performance Metric Name / Description	Claimed Value	Verified Value	Data Source	Reporting Period
Net CO_2 Removal Factor*	63.6 kg CO_2/ tonne aggregate	47.07 kg CO_2/ tonne aggregate	[6A] EPD based CORC calculation Oct22-Sep23 [6B] Product Despatch Report Oct22-Sep23 [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [2A] CO2 Removal Methodology [2B] Empirical Data Report [2C] Empirical Data Summary New_measurement_report_2022_2023_info_pack_v6.pdf RE_calculation_of_CORC_Claim_Oct22-Sep23.xlsx	10/01/2022 - 09/30/2023
Aggregate Output	442,580 tonne	442,580 tonne		
Biogenic CO_2 Injected	2,917 tonne	2,917 tonne		
Total CORCs	29,179 CORCs	20,831 CORCs Avonmouth: 6,649 Brandon: 2,650 Leeds: 11,532		

**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 99.9% 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).*

3. AUDIT SUMMARY

3.1. 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 and the Annex B Carbonated Building Material Methodology***

☐ ***Meets the requirements of the Puro General Rules and the Annex B Carbonated Building Material Methodology with minor modifications***

☐ ***Does Not Meet the requirements of the Puro Standard General Rules and the Annex B Carbonated Building Material Methodology***

A summary of specific findings associated with each requirement of the Puro Standard and Carbonated Building Material Methodology and any identified issues with the audit are summarized below.

TABLE 5. AUDIT FINDINGS

Puro Standard CBM Method. Section Ref.	Audit Verification Topic	Final Findings
1.1.1	*CO_2 Source*	**Acceptable.** O.C.O utilized biogenic CO_2 during the reporting period (<1% of CO2 injected was fossil sourced). A significant portion of the CO_2 in the product occurs via direct air capture/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 -47.07 kg CO_2 removed per tonne of aggregate (Originally claimed -63.6 kgCO2/tn net sequestration was updated to -47.07 kgCO2/tn to account for prior carbon present in the 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.
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.

3.2. AUDIT ISSUES

Between the initial production facility and output audit and this 2023 output audit, reporting and implementation requirements have all been addressed by O.C.O. No further action is required. Sufficient information was provided by O.C.O to support the output audit for the reporting period with respect to all data, claims, and verified CORC values.

Sampling and analysis of incoming APCr and M-LS product is conducted in-house by O.C.O production facilities and laboratories. Evidence of qualifications for these activities are documented through O.C.O's demonstrated accreditation with ISO 9001 – Quality Management Systems, ISO 14001 – Environmental Management Systems, and ISO 45001 – Health and Safety Management Systems. At the request of auditors, O.C.O has provided details of the sampling and analytical procedures and methods used, as well as performer qualifications and quality assurance procedures currently in place as standard operations for these analyses.

The following items are those that did not require immediate action and are recommendations for improvement of future LCAs, as well as monitoring and recordkeeping procedures. Addressing these recommendations to improve future data quality is suggested but is not required.

3.3. RECOMMENDATIONS & OPPORTUNITIES FOR IMPROVEMENT

Based on the above audit findings and issues, as well as on-site observations, 350Solutions has the following recommendations for improvements prior to the next output audit and verification.

During this reporting period, O.C.O adopted a direct measurement approach to replace the Steinour calculation to determine CO_2 content in product. This procedure involves regular sampling and testing on the aggregate to determine the CO_2 content. A detailed methodology and a report summarizing the testing was provided for this output audit and includes four seasonal sampling events at each of the three production facilities. Auditors recommend continuing this procedure on a regular basis at intervals no less than quarterly, and compiling results such that variability in the CO_2 uptake values can be examined further.

Following up on a recommendation from the initial production facility audit, it is recommended that CO_2 flow meters for injection be calibrated. Auditors acknowledge that O.C.O plans to address this recommendation on a meter replacement basis, purchasing calibration certificates for replacement meters as old meters are replaced (typically within 18-24 months of use).

4. REVISION HISTORY

Original date of issue: December 26, 2023.

Version	Date Issued	Noted Changes
Draft Versions (v1.1)	Dec 26, 2023	NA
Final Version (v2.0)	Jan 8, 2024	Reviews by Puro and OCO
Final Version (v3)	Apr 25, 2024	Correction to final reported CORCs
Final Version (v4)	Aug 5, 2024	Correction to final reported CORCs to account for prior carbon present in feedstock material

REFERENCES

[1] Puro.Earth, *Puro Standard General Rules, Version 3.0, Edition 2022.* https://puro.earth/puro-standard-carbon-removal-credits/

[2] 350Solutions, *Production Facility & Output Audit Report for Puro.Earth, v1.2, O.C.O Technology Manufactured Limestone (M-LS).* February 24, 2023.

APPENDIX 1: PURO.EARTH CARBONATED BUILDING MATERIALS METHODOLOGY AUDIT CHECKLIST

2023 Output Audit - Carbonated Building Element Methodology	
Audit ID	Puro O.C.O Technology, Ltd.
Audit Inception Date	5 December 2023
Production Facility ID	GSRN 643002406801000671, 643002406801000688, and 643002406801000695
Production Facility Locations	Avonmouth, Brandon, and Leeds, UK
Auditing Body	350Solutions
Auditor	Bill Chatterton
QA	Tim Hansen

Checklist Version: 2.1 (October 18, 2022)

Please refer to the Carbonated Building Materials Methodology 2022 v 1.0 for additional details and supporting references.

Guideline Reference	Requirement	Requirement Met Y/N	Compliance Evidence Provided Insert evidence used to verify requirement	Audit Findings If applicable	Verification Remarks Insert auditors comments	Value Insert numerical value or description (if applicable)	Units Insert unit (if applicable)
Eligibility Checklist							
Annex B - 1.1	**The carbon dioxide mineralised in the carbonated building 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	[3A] Court Farms Contract (see section 7) [3B] CO2 Deliveries	CO2 utilized in 2022-2023 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 2917 tonne). Remainder of CO2 uptake is from direct air capture via diffucion and reaction in the product while curing in the stockpiles.	Contract in place going forward for biogenic CO2 supply from AD only (for all sites). CO2 delivery source noted on all delivery tickets and documented in CO2 delivery spreadsheet.		
	The raw material used in the carbonated building element production is of eligible type and that EU, other national, or local legislation is followed in its sourcing and extraction	Y	[2A] CO2 Removal Methodology, Section 2.1 [4A] Sustainability-Report 2021-22 [4B] BES 6001 Certificate Jul 23	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).	Confirmed.		
Annex B - 2.1	**The carbonated building element that possesses the CO2 absorbing characteristics is used in construction to replace currently used concrete elements that are manufactured using conventional technologies**	Y	[6A] EPD based CORC calculation Oct22-Sep23 [6B] Product Despatch Report Oct22-Sep23 see sales records docs [5A] through [5L]	Sales records indicate provision of aggregate product for a variety of construction related end uses where aggregate is typically used, This includes concrete (ready-mix and masonry), asphalt, The product is also certified as a lightweight construction aggregate under EN	All end uses result in permanent removal of CO2.		

Production Facility Checklist (Desktop, Verbal, or Site Visit Confirmation)							
Annex B - 3 *(Lifecycle GHG Emissions)*	**CO2 Removal Supplier provides a LCA (LCA report or environmental product declaration)**	Y	[2A] CO2 Removal Methodology, Section 4 [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [1D] Avonmouth Daily Records [1E] Brandon Daily Records [1F] Leeds Daily Records	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		
	LCA follows general guidelines of ISO 14040 and ISO 14067 rules for product LCA (where carbonated building material is the product and LCA is cradle to gate)	Y	[2A] CO2 Removal Methodology, Section 4 [1A] Manufactured LimeStone EPD	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.		
	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.	Confirmed		
	The LCA activity boundary includes CO2 emissions from transporting the raw material to the production facility where the carbonated building elements are produced	Y		Confirmed.	Confirmed via review of EPD and raw data files.		
	The LCA includes all GHG emissions associated with production at the production facility	Y		Confirmed.	Confirmed via review of EPD and raw data files.		
	In case of waste or secondary materials being used in the production of the carbonated building material, it is recommended to apply the cut-off approach for waste, recycled, and secondary products (see Annex B Section 3.1.5	Y		Confirmed. EPD states use of cutoff approach for waste/secondary materials.	Confirmed via EPD.		
	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.	Confirmed via review of EPD and raw data files.		
Annex B - 1.2.1, 5 *(Production Facility Audit Proofs and Site Visit)*	**Confirm the process that is in place to quantify emissions from the extracting, handling, and transport of raw materials, including documentation from such activities and emission factors utilized.**	Y	[2A] CO2 Removal Methodology, Section 4 [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [1D] Avonmouth Daily Records [1E] Brandon Daily Records [1F] Leeds Daily Records	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.	Confirmed		
	The LCA specifics and emissions boundary are consistent with observations on site, including inclusion of all inputs and outputs, energy used, wastes emitted, and production processes	Y		Confirmed. All site activities and production processes are accounted for in the EPD and LCA. All inputs and outputs are included. No additional inputs, outputs, wastes, or energy use was identified.	Confirmed		
	Proof that the production process and technology used for the manufacturing of the carbonated building element results in a net CO2-negative product (that is, the product stores more CO2 than the processes for producing it and the raw materials used). Note: The above items may be demonstrated via a a third party EPD or LCA	Y		Confirmed. The EPD was created with one-click LCA and independently verified by EPDHub. 350Solutions verified EPD data via tracing of EPD input data and comparison to annual operating data.	Confirmed via review of EPD and raw data files. Note that 350 verified raw data and annual usage data for 2021-2022 and compared to the 2019-2020 data that the EPD is based on to confirm all operations were similar and that EPD net negative value would be within similar range. Confirmed.		
	The carbon content of the carbonated building element product is documented via laboratory analysis or other third party scientific analysis (Annex B Section 5.2) (this should also account for any carbon content in raw materials)	Y	[2A] CO2 Removal Methodology, Section 4 [2B] OCO CO2 Removal Empirical Data Report [2C] CO2 Removal Data Summary	Adopted a direct measurement approach to replace the Steinour calculation. This involves regular sampling and testing 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.	Accounts for prior carbon in APCr feedstock as determined via acid digestion analysis of materials	119.50	kg CO2e/tonne product
	The quantity of the carbonated building element produced and sold is quantified and documented in a reliable manner	Y	[6B] Product Despatch Report Oct22-Sep23	Total product produced is measured via weighbridge for all product shipments leaving the facility. The product dispatches are tracked in the plant operating system software and are summaried in the Product Dispatch spreadsheets.	Confirmed. Every shipment is weighed and documented.	442,580 tonne aggregate product	tonne
	Relevant meters are in place and they are calibrated for measuring carbonated material product output, CO2 input, and raw material consumption;	Y	From initial production facility audit: 50 Leeds Weighbridge Certificate 41 Roxspur SC250 Flow Meter Specification Weighbridge callibration report - Avonmouth 51 Brandon Weighbridge Certificate (1)	All CO2 uptake is based on product shipments and calculation procedure. All shipments are weighed via calbrated weigh scales. All calibrations are completed annually and are up to date (Avonmouth: 10-11-2022, Brandon: 05-10-2022, Leeds: 9-14-2022)	Note that CO2 meters are used in plant operation system to monitor and control CO2 injection, and load cells are used in process to monitor inputs. These meters are purchased with specifications, but national-standard-traceable calibrations were not previously purchased for these. However, the data from these meters is not used for calculation of full CO2 uptake, but solely as a cross check. Recommend purchasing and maintaining calibration in the future, but not critical to CORC calculation.		
	The emissions from the extracting and transporting of the raw material are estimated and calculated in a reliable manner (section 5.2.), with documentation of emission factors used, including scope of such emission factors.	Y	[2A] CO2 Removal Methodology [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [1D] Avonmouth Daily Records [1E] Brandon Daily Records [1F] Leeds Daily Records	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.	Confirmed		
	The energy use of the Production Facility can be quantified and the emissions from the process calculated	Y					

Quantification and Calculation Checklist - Ouput Audit							
Annex B - 4	**The producer of the carbonated building element (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		Total product produced is measured via weighbridge for all product shipments leaving the facility. The product dispatches are tracked in the plant operating system software and are summaried in the Product Dispatch spreadsheets.	Confirmed. Every shipment is weighed and documented.		
Annex B - 4.1	**CORCs = Estored - Eproduction**	Y	[6A] EPD based CORC calculation Oct22-Sep23 [6B] Product Despatch Report Oct22-Sep23 [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [1D] Avonmouth Daily Records [1E] Brandon Daily Records [1F] Leeds Daily Records	Confirmed	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. Also note that initial CORC file utilized incorrect fossil value for one facility and was corrected during site visit.	20,831	CORCs
Annex B - 4.2	**Estored = Q_{CBE} x A_{CO2}**	Y		Confirmed	Confirmed	20,831	tonne CO2
	QCBE = the amount of carbonated building material, in metric tonnes, produced by the supplier. It is calculated by the supplier, and appropriate documentation must be available (e.g., number of units produced, weight of units produced	Y		Confirmed	Confirmed	442,580	tonne
	ACO2 = actual amount of carbon dioxide sequestered in tonnes CO2 per tonne product. It is based on measurements or on other scientifically sound methods verified by a qualified third-party auditor	Y	[2A] CO2 Removal Methodology, Section 4 [2B] OCO CO2 Removal Empirical Data Report [2C] CO2 Removal Data Summary	Confirmed (see above for details)	Confirmed (see above for details)	119.50	kg CO2e/tonne product
Annex B - 4.3	**Eproduction = GHG emissions from all activities involved in production of carbonated building material**	Y	[6A] EPD based CORC calculation Oct22-Sep23 [6B] Product Despatch Report Oct22-Sep23	Confirmed (see above for details)	Confirmed (see above for details)	47.07	kg CO2e/tonne product
	Eproduction activities are are grouped as: sourcing of CO2, sourcing of raw meterials, production of building materials	Y	[4A] Sustainability-Report 2021-22 [4B] BES 6001 Certificate Jul 23 [4C] BES 6001 Report Jul 23 [1B] 2022-2023 Mass Balance	Confirmed (see above for details)	verified via review of [4B and 4C] 6001 report		
	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	[6A] EPD based CORC calculation Oct22-Sep23 [6B] Product Despatch Report Oct22-Sep23 [1A] Manufactured LimeStone EPD [1B] 2022-2023 Mass Balance [1C] EPD Raw Data [1D] Avonmouth Daily Records [1E] Brandon Daily Records [1F] Leeds Daily Records	Confirmed (see above for details)	Confirmed (see above for details)		

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 Technology**
Date:	**12/5/2023**

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 CO_2 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 CO_2 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, Verification Program Manager

EDUCATION
B.S. Environmental Science, SUNY at Plattsburgh, 1982
Certified Measurement and Verification Professional (CMVP), 2019

Professional Experience
William Chatterton is an Environmental Scientist with 28 years' experience in technology evaluation and demonstration, project management, air pollution monitoring, testing, and regulation. He serves as Program Manager at 350Solutions and manages projects and programs for commercial and government clients. Previously the past 20 years at Southern Research, Mr. Chatterton has managed, and supported programs designed to integrate, demonstrate, and evaluate technology performance in the advanced energy field. 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. Mr. Chatterton has been heavily involved in the evaluation of numerous emerging energy technologies, distributed generation technologies, and technologies relevant to transportation and oil and gas markets. Mr. Chatterton's roles in support of these projects has included program and project management from administrative and technical perspectives, lead or technical support on test plan development, method development and validation, design and implementation of field-testing activities, data evaluation and presentation, and reporting of results. He has managed numerous projects for both commercial and government clients.

350Solutions: 08-2019 – Present
Verification Program Manager: As Verification Program Manager, Mr. Chatterton manages and executes 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 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.

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. Mr. Chatterton also has direct experience with management and execution of projects under DOE and DoD grants and contracts. He has recently managed activities on three large DoD projects including Demonstration of a Solar Thermal Combined Heating, Cooling and Hot Water System Utilizing an Adsorption Chiller for DoD Installations, Demonstration and Verification of the Performance of Microturbine Power Generation Systems Utilizing Renewable Fuels, and the Electric Power with Small Scale Organic Rankine Cycle (ORC) Engine/Generator Technology demonstration.

350Solutions, Inc. Corporate Experience

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.

ANAB
ANSI National Accreditation Board

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.

R. Douglas Leonard Jr., VP, PILR SBU

Expiry Date: 25 September 2024
Certificate Number: AI-2618

ANAB
ANSI National Accreditation Board

ilac-MRA

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).

ANAB
ANSI National Accreditation Board

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, 2024** Certificate Number: **AI-2618**

General

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

R. Douglas Leonard Jr., VP, PILR SBU

Version 005 Issued: August 09, 2022 www.anab.org

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