# Climeworks

# Mammoth Facility Output Audit Report

## For Puro.Earth

| | |
|---|---|
| $CO_2$ Removal Supplier | ClimeWorks |
| Removal Method | Direct Air Capture & $CO_2$ Storage in Basalt Formations |
| Production Facility | Climeworks Mammoth |
| Production Facility Address | Capture Facility: Nordurvellir 4, 816 Ölfus, Iceland |
| Net Volume of $CO_2$ Removal | 278.346 CORCs |
| Removal Period | March 1st, 2025 – August 31st, 2025 |
| Auditors | 350Solutions: Guy Hardwick Kelly Nesbitt Tim Hansen |
| Report Date | December 3, 2025 |
| Version | V1.2 |

# Contents

# Acronyms

| | |
|---|---|
| **CDR** | Carbon dioxide removal |
| **$CO_2$** | Carbon dioxide |
| **CORC** | $CO_2$ Removal Certificate |
| **DAC** | Direct air capture |
| **EF** | Emissions factor |
| **GHG** | Greenhouse gas |
| **MRV** | Measurement, Reporting, Verification |
| **RECs** | Renewable energy certificates |

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# OUTPUT AUDIT REPORT

| | | |
|---|---|---|
| **Company:** Climeworks Mammoth | Company Contact:<br>Pietro Rossi*<br>Fintan Tuohy | VVB: 350 Solutions<br>Guy Hardwick*<br>Kelly Nesbitt<br>Tim Hansen |
| **Removal Method:** Direct Air Capture & $CO_2$ Storage in Basalt Formations | | |
| **Report Date:** December 3, 2025 | | |
| **Document No:** 350-PU2507.02-OA | | |
| **Revision:** V1.2 | | |

**primary contact(s)/lead author(s)*

## 1. Introduction

Puro.Earth contracted 350Solutions to perform an audit of carbon dioxide removal credit (CORC) claims for Climeworks Mammoth direct air capture (DAC) process. The Output Audit included observation of operations during a site visit, collection of files and evidence, review of data collection and handling procedures, and evaluation of adherence of the project to the relevant Puro.Earth Standard, and Methodology. The crediting period for the audit is June 1, 2024 – June 1, 2039.

This output audit involved a site visit to the Mammoth facility on September 16, 2025 and a desk review of documents provided by Climeworks, including the facility audit documentation completed by DNV. 350Solutions affirms that Mammoth has the appropriate equipment, procedures, and protocols in place to quantify GHG removal through DAC and $CO_2$ storage in Basalt Formations in accordance with the requirements of the relevant Puro.Earth General Rules and Geologically Stored Carbon methodology:

- Puro.Earth General Rules v4 [1]
- Geologically Stored Carbon v2 (2024) [2]

A summary of the project and Output Audit is provided below.

**Table 1: Output Audit Summary**

| Audit Summary | |
|---|---|
| **$CO_2$ Removal Supplier** | Climeworks AG |
| **Removal Method** | Direct Air Capture & $CO_2$ Storage in Basalt Formations |
| **Verification Type** | Supplier Output Audit; Puro Standard General Rules (v4) and Geologically Stored Carbon Methodology (Edition 2024, v2) |
| **Production Facility Name and Registry** | Climeworks Mammoth, Facility ID: 417791 |
| **Production Facility Locations** | Capture Facility:<br>Nordurvellir 4, 816 Ölfus, Iceland |
| **Verified CORCs** | 278.346 tonnes CO2-eq |
| **Audit Kickoff Date** | July 17, 2025 |
| **Audit Report Date** | December 3, 2025 |

# 2. Technology Description

## 2.1. Process Overview

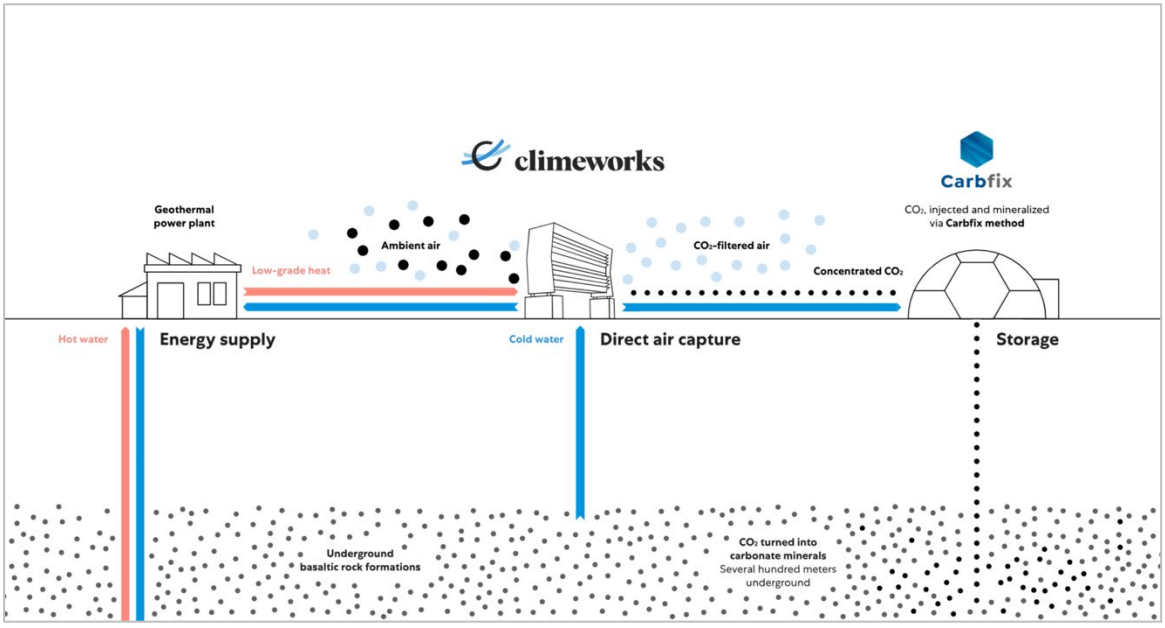


**Figure 1: Mammoth process description (Source: Climeworks)**

Climeworks Project Mammoth is the second DAC facility with permanent storage capabilities built by Climeworks, after Project Orca, based at the same address at the Hellisheiði geothermal powerplant, 50km southeast of Reykjavik. Project Mammoth operates its DAC facility following the same basic three steps as Orca; capture, transport and storage, with a few minor differences, and at a larger scale (when all collector containers are operational). All operations are powered by low-grade waste heat provided by the Hellisheiði geothermal powerplant, which is operated by the project partner ONPower, a subsidiary of Orkuveita Reykjavík (Reykjavík Energy). ONPower reports power and water usage monthly to Climeworks for use as part of their CORC calculations. Figure 1 shows a simplified process flow diagram for the Mammoth capture and storage system.

## 2.2. Capture and Processing

The first step of the system involves DAC which utilizes a series of fans and 'collector containers' containing solid sorbent material to chemically bind atmospheric carbon dioxide ($CO_2$). Air with reduced $CO_2$ concentration is released back into the atmosphere. Mammoth will have a total of 72 'contactor containers', with 3 in reserve on standby. The containers are stacked in 3's, each consisting of 6 container sub-units which operate in tandem with one another. Once the sorbent in a sub-unit is saturated with $CO_2$, it enters a desorption phase where the sub-unit is isolated and heated to around 100°C with a vacuum applied, to liberate the $CO_2$ from the sorbent. The process makes use of waste, low-grade heat from the geothermal facility. The sorbent material can complete [redacted] cycles before needing replacement. Figure 2 shows the front and back of each of the contactor containers, and how individual sub-units are isolated with a door that slides across each container. Figure 3 is a simplified depiction of the vacuum- temperature swing adsorption process.

**Figure 2: Left. Rear of contactor containers showing array of fans for drawing $CO_2$ across sorbent material. Right. Isolation door of contactor container sub-units for application of heat and vacuum for CO2 desorption.**

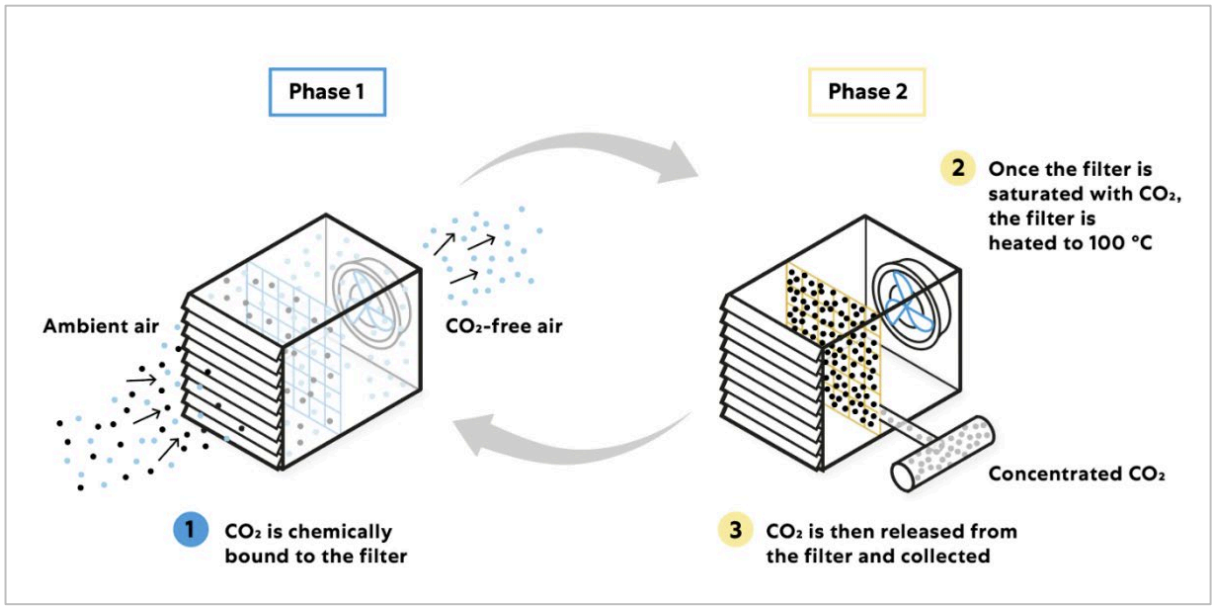


**Figure 3: Depiction of the Climeworks vacuum-temperature swing adsorption process**

The liberated $CO_2$ from each collector container feeds to two centralized, temporary, low pressure storage vessels. The $CO_2$ is then compressed and sent to the absorption tower where it is dissolved in water sourced from ONPower and two local wells. This ensures that water insoluble gases are removed prior to injection without the need for further processing. Figure 4 displays the water absorption tower. Water that is used for $CO_2$ dissolution is treated with a series softeners and deionizers to prevent carbonate scaling buildup and potential corrosion of equipment in the facility. The water quality is measured continuously to understand the carbonate content of the water prior to $CO_2$ dissolution to determine the baseline for Climeworks CORC calculation.

**Figure 4: Absorption tower where the captured $CO_2$ is dissolved into treated water.**

## 2.3. $CO_2$ Transportation

Project Mammoth and its injection facilities are located on the same site and are connected for $CO_2$ charged water by an underground pipeline of less than 300m. Booster pumps, controlled and powered by the DAC facility, feed the $CO_2$ charged water from the absorption tower to the injection wells. Upon arrival at the injection site, the $CO_2$ charged water is continuously monitored for $CO_2$ concentration, temperature, pressure and flow. These values are reported by Carbfix (the $CO_2$ storage partner) to Climeworks for use in their CORC calculations.

## 2.4. Injection and Storage

The $CO_2$-charged water is injected via two injection wells (CHI-01 and CHI-02) into a basaltic geological reservoir at a depth of at least 350m to ensure that there is sufficient pressure to keep the $CO_2$ dissolved in the water. Upon injection, the higher density of the $CO_2$-laden water relative to the reservoir water leads to it sinking, preventing upward migration of the $CO_2$ as would typically occur if it was injected as a free phase (i.e. not dissolved). Permanent storage of the $CO_2$ is provided through subsurface (in-situ) mineralization reactions in the basaltic rock. The $CO_2$-charged water is acidic (with a pH of between 3 and 5) which leads to the dissolution and release of calcium, magnesium and iron from minerals contained within the storage reservoir rock, which bind with the dissolved $CO_2$ to form stable carbonate minerals such as calcite ($CaCO_3$), magnesite ($MgCO_3$) and siderite ($FeCO_3$). It has been demonstrated that after two years, all the $CO_2$ will have mineralized, ensuring long term storage [3], with field trials showing that this process can occur within months of injection. The injection well and storage formation is managed by Carbfix, Climeworks' dedicated storage partner, and follows all local laws and regulations, and the EU CCS directive. During injection, pressure, temperature, and flow for both the gaseous $CO_2$ stream and the injected water are recorded continuously as part of Carbfix normal operations. The reservoir monitoring well (CHM-01) and groundwater monitoring wells located downstream of the injection well are used in combination with reservoir models to track the fate of $CO_2$ and verify that storage is

occurring as described. Figure 5 depicts the injection, permanent storage process and Carbfix operations. Carbfix assumes full responsibility for injection, monitoring, and long-term liability of the injection and storage site.

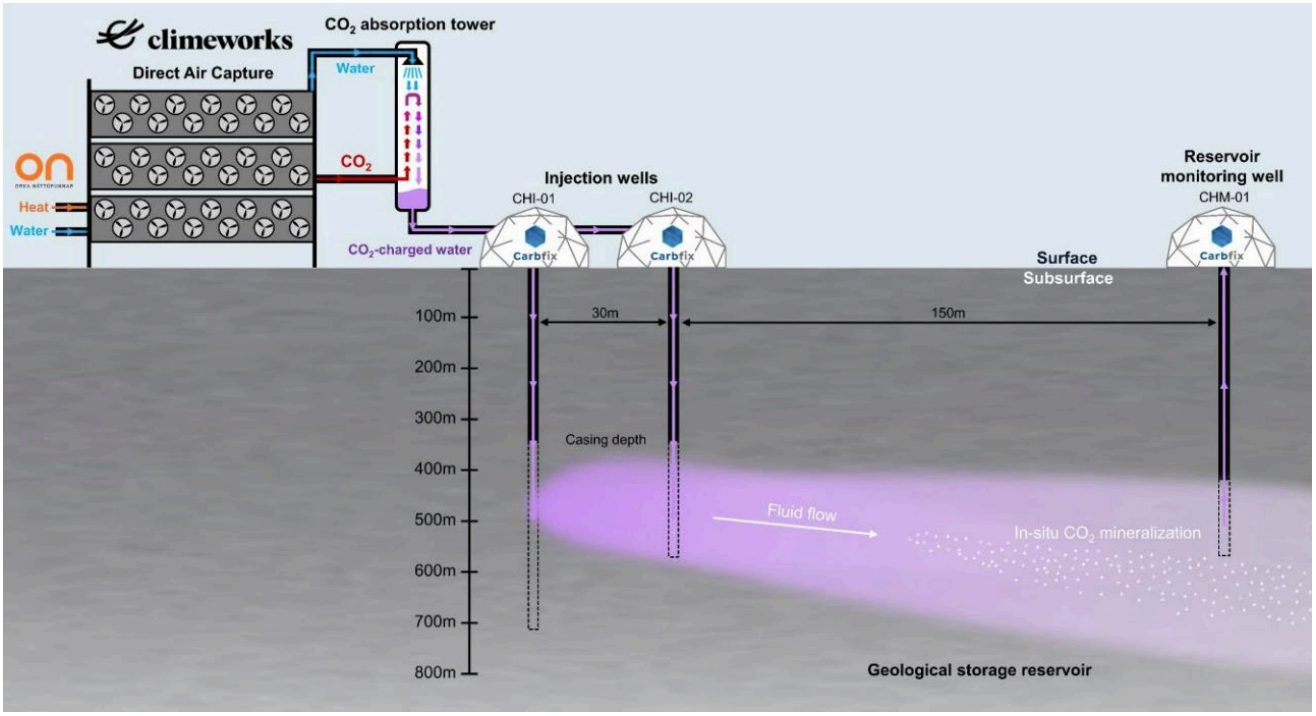


**Figure 5: Diagram depicting $CO_2$ Mammoth DAC process and Carbfix injection and monitoring process. Permanent storage mineral trapping mechanism is also displayed.**

## 2.5. Inputs and Outputs

A summary of process inputs and outputs associated with Mammoth's operations are included in Table 3.

**Table 2: Verified DAC Production Inputs & Outputs**

| Input / Output | Item | Verified Amount Over Monitoring Period[1] | Notes (Specifications, source, etc.) |
|---|---|---|---|
| **INPUTS** | | | |
| **Electrical Energy** | DAC, compression, water treatment, $CO_2$ dissolution, misc. site usage | [Redacted] | 100% provided by ONPower Geothermal power facility. Market leakage determined to be 0. |
| **Thermal Energy** | DAC, misc. site usage | [Redacted] | 100% provided by ONPower Geothermal power facility. Market leakage determined to be 0. |
| **Water** | Dissolution process, freshwater usage during ONPower energy generation | [Redacted] | Water is fully provided by ON Power, and $CO_2$ is dissolved in water before the $CO_2$ -rich water is delivered to Carbfix. In the case of Mammoth, |

| | | | |
|---|---|---|---|
| | | | Carbfix doesn't use any additional water. |
| **DAC Units & Infrastructure** | DAC containers, liquefaction, filtration, compression, storage, misc. site usage | - | Mammoth facility lifetime is expected to be until at least 2039. Embodied emissions amortization starting 2029 |
| **DAC Sorbent** | Sorbent consumed during monitoring period | [Redacted] | Spent |
| **Maintenance and Repairs** | Consumables used during associated maintenance for DAC units and Mammoth infrastructure | - | Internally tracked and compared to designated number of emissions within the total grey emissions to be amortized. |
| **Natural Carbon of water** | Natural carbon content of water used for Dissolution of $CO_2$ | [Redacted] | Calculated based on DIC test results conducted by external lab. |
| **OUTPUTS** | | | |
| **Captured $CO_2$** | Gross $CO_2$ captured during DAC process | [Redacted] | Total $CO_2$ captured during DAC measured by Climeworks |
| **Stored $CO_2$** | Gross $CO_2$ injected into geological storage | 452.138 tonnes | Total $CO_2$ injected, measured by Carbfix and reported to Climeworks |
| **$CO_2$ released/ reversal** | Total amount of CO2 released during injection and storage | 0.638 tonnes | Total $CO_2$ released during intentional pumping of water from monitoring well and unintentional released. |
| **Operational Emissions** | Emissions released during Climeworks and Carbfix operations | 163.113 tonnes | Total operational emissions related to heat, electricity, sorbent and water usage. |
| ** Calculated based on Total $CO_2$ injected (452.138 tonnes) minus natural Carbon contents of water used during dissolution of captured $CO_2$ (REDACTED). Discrepancy between Captured $CO_2$ (-) Total $CO_2$ stored is within the margin of error for the instrumentation being used.* | | | |

## 2.6. Changes since last Output Audit

Since the previous output audit, Climeworks has updated the project grey-emissions treatment for the Mammoth facility. The full amortization schedule for construction, maintenance, and decommissioning-related emissions has now been formalized, with allocations spread across years 6 to 15 of the plant's operating life. The schedule specifies annual percentage deductions from May 2029 through April 2039, ensuring a more transparent and consistent application of grey emissions in line with the facility's lifecycle profile. The updated schedule also better follows the principle of commencement of the amortization period when the production ramp-up phase is concluded and the facility has reached nominal capture capacity. In addition, a contingency provision for future repairs and major component replacements has been incorporated, enabling more accurate forecasting of potential adjustments to the total amortized emissions in subsequent reporting periods.

Furthermore, Climeworks have reduced the emissions factors associated with the thermal energy supply, electrical energy supply, water supply and sorbents supply during this reporting period.

- The reduction in emissions from thermal and electrical energy and water supplies were a direct result of operational changes made by ONPower from the implementation of project Silverstone. Project Silverstone reduces $CO_2$ emissions by dissolving waste gases from the

geothermal electricity production process into water and injecting into basaltic formations for permanent storage.

- The emissions reductions for sorbent production & use are due to Climeworks purchasing renewable energy credits for sorbent supply chain emissions. Puro Advisory Board approved an update to Rule 5.2.19 allowing ongoing fractional use of RECs to adjust LCA emission factors for long-lived consumables such as sorbents. Previously, only up-front in-full REC procurement was permitted. The updated rule now includes clarified conditions for REC eligibility (spatial matching, temporal matching, energy-source specification, and commissioning disclosure). This ensures Climeworks can legally and consistently apply REC-based emission adjustments for their future sorbent use.

# 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 4) and Geologically Stored Carbon Methodology (Edition 2024, v2). Specific audit activities conducted are summarized in Table 3. Auditor qualifications are attached as Appendix 3.

**Table 3: Audit Activities**

| Date(s) | Verification Activity | Verification Tasks | Documents Reviewed |
|---|---|---|---|
| **July 17, 2025** | Introductory Document Review and information exchange | - Opening meeting and review of operational and procedural changes<br>- Review of LCA and supporting documentation<br>- Requested previous audit reports and supporting documentation<br>- Review of Puro CORC calculations<br>- Review of product properties<br>- Review of product end use<br>- Discussed operational changes<br>- Discussed audit process and site visit dates<br>Discussed scope as “expanded output audit” | - Mammoth Project Grey Emissions amortization schedule.docx<br>- Mammoth LCA Model 2025-10-15 with RECs.xlsm<br>- Mammoth LCA Model 2025-10-15 without RECs.xlsm<br>- Mammoth RECs, Green heat certs and biodiesel certs.xlsm<br>- Puro CORC Report Mammoth_V1.1 - 2025-08-31_Puro modification with RECs.xlsx<br>- Puro CORC Report Mammoth_V1.1 - 2025-08-31_Puro modification without RECs.xlsx<br>- 2024-07-03 Calibration certificate Flow RMU.pdf<br>- 2025-01-17 Heartbeat verification Flow RMU.pdf<br>- 2025-02-18 FIR Carbo 6100.pdf<br>- Community_Engagement_Iceland_Sep2025_Update.docx<br>- LCA Report DC110_2025_06_30.pdf<br>- Leakage Determination.xlsx<br>- Mammoth risk register.xlsx<br>- Uncertainty calculation - 31-08-2025.xlsx<br>- 2025-03 Mammoth Monthly Monitoring Report.pdf<br>- 2025-05 Non-conformance report.pdf<br>- 2025-05 Mammoth Monthly Monitoring Report.pdf<br>- 2025-07 Mammoth Monthly Monitoring Report.pdf<br>- Non-conformance report 25_01.pdf<br>- Climeworks_Mammoth_2025_02-03.pdf<br>- Climeworks_Mammoth_2025_04.pdf<br>- Climeworks_Mammoth_2025_05.pdf<br>- Climeworks_Mammoth_2025_06.pdf<br>- Climeworks_Mammoth_2025_07.pdf |
| **September 16, 2025** | Site Visit | - Conducted onsite walkthroughs of Orca, Mammoth, and Carbfix facilities<br>- Reviewed $CO_2$ capture, transfer, and injection operations | |

| | | | |
|---|---|---|---|
| | | - Verified measurement instruments and calibration records<br>- Assessed $CO_2$ capture, injection, energy, and monitoring datasets<br>- Reviewed CORC quantification and LCA supporting documents<br>- Evaluated site permits, environmental safeguards, and monitoring plans<br>- Reviewed additionality evidence and community engagement practices | - Climeworks_Mammoth_2025_08.xlsx<br>- 2025_07_Electricity.pdf<br>- 2025_03 Mammoth ON invoices.pdf<br>- 2025_07_Absorption Water.pdf<br>- 2025_07_Cold Water.pdf<br>- CDR Report Mammoth.pdf<br>- File: Renewable energy procurement for supply chain<br>- Climeworks update on SDG goals progress - Sep 2025.pptx<br>- Trade Registry Certificate - Carbfix (Icelandic).pdf<br>- Trade Registry Certificate - Orca náttúrunnar (Icelandic).pdf<br>- Statement of Ownership Climeworks.pdf<br>- ISOR_Certificate of Registration (English).pdf<br>- Puro Additionality_Mammoth_final.pdf<br>- StoragePermitApplication-RiskAssessment-CONFIDENTIAL.pdf<br>- Puro Stakeholder Engagement Report_final.pdf<br>- Environmental and Social Safeguard Questionnaire - v1.0_final.pdf<br>- EIA for Hellisheiði - Report Submitted by Carbfix - Jan 2023 (Icelandic).pdf<br>- File: evidence of safe working environment<br>- Building permit approval (IS).pdf<br>- Capture site description.xlsx<br>- Environmental impact assessment waiver (IS).pdf<br>- Monitoring Plan.xlsx<br>- Mammoth PDD Direct Air Capture and Geological Storage V1.0.pdf<br>- Puro Public Project Description V1.0.pdf |
| **November 20 – 28, 2025** | Data Review | - Review of LCA and supporting documentation<br>- Review of Puro CORC calculations<br>- Review of raw material sources and sustainability<br>- Review of system inputs and outputs<br>- Review evidence of product output<br>- Review of product properties<br>- Review of product end use<br>- Review of equipment and calibrations<br>- Reviewed previous Output Audit Reports<br>- Reviewed original production facility audit documentation | |
| **November 26 – December 3, 2025** | Report Writing | - Compose Audit Report<br>- Internal quality control | Puro CORC Report Mammoth_V1.1 - 2025-08-31_Puro modification with up front RECs.xlsx<br>CDR Report Mammoth.pdf |

## 3.2. Verified Output & CORCs

Table 4 includes the specific CORCs claimed by Climeworks for its Mammoth facility during the reporting period, as well as the level verified by 350Solutions during the data review.

**Table 4: Verified CORCs for the Mammoth Facility**

| Performance Metric Name / Description | Revised Value | Verified Value[1] | Data Source | Reporting Period |
|---|---|---|---|---|
| **$CO_2$ Stored** | 442.097 tonnes | 442.097 tonnes | - Puro CORC Mammoth_V1.1-2025-08-31_Puro modification with up front RECs (1) | March 1st 2025 - August 31st 2025 |
| **$CO_2$ Emissions** | 163.113 tonnes | 163.113 tonnes | | |
| **$CO_2$ Releases/ Reversals** | 0.638 tonnes | 0.638 tonnes | | |
| **Total CORCs** | 278.346 | 278.346 | | |

[1] *Verified values are based on verification on final production records for the reporting period.*

# 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 V4 and* Geologically Stored Carbon Methodology (Edition 2024, v2)**

☐ ***Meets the requirements of the Puro General Rules V4 and* Geologically Stored Carbon Methodology (Edition 2024, v2) *with minor modifications***

☐ ***Does Not Meet the requirements of the Puro General Rules V4 and* Geologically Stored Carbon Methodology (Edition 2024, v2)**

350Solutions utilized a reasonable level of assurance in performance of the output audit. A summary of findings associated with primary requirements of the *Puro General Rules* and *Geologically Stored Carbon Methodology* and any identified issues with the audit are summarized below.

**Table 5: Audit Findings**

| Puro GSC Method. Section Ref. | Audit Verification Topic | Final Findings |
|---|---|---|
| **3.2** | Eligibility of the $CO_2$ Stream | Acceptable. The project demonstrated that captured $CO_2$ is fully eligible under Puro v4 requirements. DAC-derived $CO_2$ |

| | | |
|---|---|---|
| | | was verified as atmospheric through operational capture records, with no evidence of fossil-origin inputs. |
| **2.2 & 3** | Production Facility Definition & Eligibility | Acceptable. System components for capture, transport, and storage were clearly defined and aligned with the activity boundary criteria. All included infrastructure exists solely for $CO_2$ removal purposes as required. |
| **3.4** | Baseline Scenario Demonstration | Acceptable. The project provided a defensible baseline consistent with Puro v4 guidance. No alternative activity would result in greater geological carbon stock, and no fossil sources are involved. |
| **3.5** | Additionality Requirements | Acceptable. Documentation shows the $CO_2$ removal activity is not legally required and depends on carbon finance to operate at scale. No evidence of regulatory mandates or double-benefit conditions was observed. |
| **3.6** | Prevention of Double Counting | Acceptable. Contractual attestations confirm sole ownership of the carbon removal attribute and prohibit claims by any party in the capture, logistics, or storage chain. No marketing or corporate GHG accounting conflicts were identified. |
| **3.3** | Requirements for the $CO_2$ Removal Supplier | Acceptable. The Supplier demonstrated legal registration, metering capability, end-to-end contractual control of $CO_2$, and provided all required agreements with capture, logistics, and storage operators ensuring audit access. |
| **3.2.8–3.2.12** | Legal Framework, Permits & Regulatory Compliance | Acceptable. The storage site operates under a regulatory framework equivalent to Class VI/CCS Directive requirements. All relevant permits for capture, transport, and injection were reviewed and found to be valid and compliant. |
| **3.2.6–3.2.7** | Storage Reservoir Eligibility & Site Characterization | Acceptable. Geological characterization confirms the reservoir meets Puro's criteria for permanent storage, including caprock integrity and confinement. No evidence of incompatibility or sub-surface risks was identified. |
| **3.2.6 & 7.5** | Injection Operations & Conditions for Geological Storage | Acceptable. Injection parameters, well integrity records, and operational data confirm the site operates within required pressure and temperature limits. $CO_2$ is injected under conditions suitable for long-term containment. |
| **7** | Monitoring Requirements | Acceptable. A comprehensive monitoring plan is in place covering capture, transport, and storage phases. Instrument calibration records and plume monitoring procedures satisfy Puro v4 monitoring expectations. |
| **6** | Leakage Assessment, Mitigation & Quantification | Acceptable. The project evaluated all potential leakage pathways and provided mitigation measures. No ecological, market-based, or activity-shifting leakage risks were identified that would materially affect net-negativity. |
| **7.6 & 8.2** | Reversals, Release & Corrective Actions | Acceptable. The project maintains appropriate contingency and corrective action procedures for well failure, |

| | | |
|---|---|---|
| | | unexpected releases, or operational reversals. No conditions suggesting elevated reversal risk were observed. |
| **3.8 & 3.9** | Environmental and Social Safeguards | Acceptable. The project demonstrated that its activities cause no net harm and comply with relevant environmental and social safeguards, and community-level protections. |
| **4** | Quantification of $CO_2$ Removal (CORC Output) | Acceptable. Quantification follows Puro v4 methodology using complete datasets The calculations reviewed were internally consistent, traceable, and conservatively applied. |
| **5** | Life Cycle Assessment Requirements | Acceptable. The project submitted an LCA prepared according to ISO/WRI/PAS2050 principles. All emissions within the activity boundary were included and independently verified prior to audit review. RECs were also correctly used/applied according to the revised rule 5.2.19 |
| **4.8** | Uncertainty Assessment | Acceptable. Measurement uncertainties were identified and managed using lower-bound conservative values as required. Calibration documentation for flow meters and measurement systems was complete and current. |
| **8** | Risk and Uncertainty Management | Acceptable. Operational, geological, and logistical risks were appropriately assessed. The project has reasonable controls to ensure permanence, and no unmitigated high-risk factors were identified. |
| **3.3.6 & 7** | Data Availability, Documentation & Auditability | Acceptable. All required documentation—including operational records, data logs, calibration certificates, and contracts—was provided in full. Data trails were coherent, auditable, and sufficient for verification. |

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

## 4.2. Critical Findings and Exceptions

Assessment of the output audit package and associated CORC report identified several initial findings (Appendix 1). All findings, primarily associated with missing supporting evidence, have been addressed and closed. Findings of note include the following:

**Table 6: Critical Findings**

| ID No | Type | Finding / Issue | Conclusion / Resolution |
|---|---|---|---|
| **3** | Omission | A review of the project's risk registers to assess whether it adequately identifies, evaluates, and mitigates risks associated with $CO_2$ transport, geological storage, and potential reversals was undertaken.<br><br>The current version of the register did not explicitly address $CO_2$ transport risks and Geological storage.<br><br>In the absence of clearly documented risk categories and mitigation measures for these areas, the register did not fully meet expectations for comprehensive risk identification and tracking. | Climeworks revised the risk register accordingly. The additions now provide improved coverage of $CO_2$ transport, geological storage, and reversal-related risk categories. |

## 4.3. Forward Action Requests and Recommendations

A full list of Output Audit findings is provided in Appendix 2. Section 4.3 outlines the forward action requests (FARs) and recommendations for this reporting period, supporting improvements in future operations and CORC calculations while enabling monitoring of any emerging issues in subsequent Output Audits. A summary of open FARs and opportunities for improvement is presented below for reference in future verifications.

**Table 7: FARs and Recommendations**

| ID No | Type | Finding / Issue | Conclusion / Resolution |
|---|---|---|---|
| **15** | FAR | Modelling results for GHG assessment in reservoir | An assessment of the storage reservoir is being conducted by Carbfix in 2026. The results for this are to be made available during the next Output Audit to confirm the storage reservoir is behaving as predicted. |

| | | | |
|---|---|---|---|
| **32** | FAR | Permit update March 2026 (Carbfix) | The results from the permit update are also to be made available once they have been completed in March 2026 to ensure that Carbfix are still eligible for injection of $CO_2$ into the storage reservoir. |
| **1** | FAR | During the assessment of stakeholder engagement practices, the Verifier sought clarification on how interested or affected stakeholders—beyond existing business clients—can contact Climeworks to raise concerns, submit queries, or communicate with the company.<br><br>While Climeworks demonstrated well-structured communication pathways for contracted business customers (dedicated account owners, regular business reviews, and priority escalation), a clear and accessible mechanism for new stakeholders or impacted community members was not evident.<br><br>Under Puro General Rules 6.4.5, $CO_2$ Removal Suppliers must:<br><br>• maintain "accessible and transparent communication channels for all interested and affected stakeholders,"<br>• provide "clear instructions for submitting concerns or complaints," and<br>• ensure "stakeholder contact points are visible, publicly available, and easy to identify."<br><br>Climeworks currently relies on (a) Icelandic authorities' formal complaint mechanisms and (b) a general website contact form. However, neither is sufficiently visible nor clearly framed as the designated channel for submitting concerns regarding Climeworks' $CO_2$ removal activities. Additionally, the information is not displayed at facility entrances or publicly signposted in a way that satisfies Puro's expectation for accessible communication pathways. | Climeworks is required to establish a dedicated communication channel through which any interested or affected stakeholder can contact the company directly, including:<br><br>• clear instructions for submitting questions, concerns, or complaints;<br>• publicly accessible and visible information (e.g., on company website and/or signage at facility entrances);<br>• a designated point of contact or monitored address;<br>• documentation of procedures for receiving, recording, and responding to stakeholder input.<br><br>Evidence of implementation should be submitted for review as part of the next viable verification cycle. For Climeworks, this is expected to be the first audit conducted in 2026. |
| **33** | Recommendation | Maintenance and repairs tracker which documents all consumables and materials that have been used during normal maintenance and repair operations | Currently, Climeworks track these items internally and compare the calculated emissions to a designated amount of the grey emissions to be amortized in the future. |

# 5. Revision History

| Version | Date Issued | Noted Changes |
|---|---|---|
| **Draft v1.0** | November 28, 2025 | Initial Draft |
| **Draft v1.1** | December 1, 2025 | Post internal quality assurance review, minor edits |
| **Final v1.2** | December 3, 2025 | Edits following review by Puro |

# 6. Auditor Signatures

| Auditor Information | | |
|---|---|---|
| **VVB** | **Auditor** | **350Solutions Project ID No.** |
| 350Solutions, Inc. | Guy Hardwick (Lead Verifier) | PU2507.02 |
| 350Solutions, Inc. | Kelly Nesbitt (Supporting Verifier) | |
| 350Solutions, Inc. | Tim Hansen (Quality Assurance) | |

Guy Hardwick Digitally signed by Guy Hardwick Date: 2025.12.04 15:35:24 Z

**Signed:** Guy Hardwick (Lead Verifier)

Kelly Inder-Nesbitt Digitally signed by Kelly Inder-Nesbitt Date: 2025.12.04 10:32:45 -05'00'

Kelly Nesbitt (Supporting Verifier)

Timothy A. Hansen Digitally signed by Timothy A. Hansen Date: 2025.12.04 10:29:22 -05'00'

**Signed:** Tim Hansen (Quality Assurance)

## 6.1. Validation and Verification Body Details

350Solutions Inc. declares that we are an impartial verifying body, free from any conflicts of interest, capable, and qualified to complete this verification for the current operational period according to the Puro Standard and applicable methodologies.

350Solutions is an accredited inspection & verification body by ANAB under ISO 17020:2012 for completion of ISO 14034:2016 Technology Verifications and was the first accredited entity in North America for ISO 14034:2016. 350Solutions is based out of Raleigh, North Carolina, USA. 350Solutions Technical Lead for the Climeworks project Output Audit is Guy Hardwick, supported by Kelly Nesbitt. Quality assurance was provided by Tim Hansen. Complete qualifications are attached as Appendix 3.

Our opinion is provided with a reasonable level of assurance for Climeworks' activities at the Mammoth project.

*Notice: 350Solutions, Inc. declares that we are an impartial auditor, free from any conflicts of interest, capable, and qualified to complete this audit according to the Puro Standard and related Validation and Verification Body Requirements. Verifications and audits conducted by 350Solutions are based on an evaluation of technology performance and $CO_2$ removal claims via site visit observations and review of data submitted by the audited company. Audits are completed in accordance with rules and methodologies specified by Puro and utilizing the appropriate quality assurance procedures established under the 350Solutions accredited ISO 17020/14034 Quality Management Program, noting that this verification is not a fully compliant ISO 14034:2016 verification. 350Solutions makes no expressed or implied warranties as to the performance of the technology and does not certify that a technology will always operate at the levels verified, nor that it meets all state, local, or federal legal requirements.*

# 7. References


[1] Puro.Earth, Puro.Earth General Rules version 4.0, 2024, Website: https://puro.earth/document-library?tab=methodologies

[2] Puro.Earth, Puro.Earth Geologically Stored Carbon version 2, 2024, Website: https://puro.earth/document-library?tab=methodologies

[3] Matter et al., Rapid carbon mineralization for permanent disposal of anthropogenic carbon dioxide emissions, 2016, Website: https://www.science.org/doi/10.1126/science.aad8132

# Appendix 1: Log of Findings

All material clarifications, misstatements, and omissions have been resolved.

| Type | Finding/Issue | Required Action | Supplier Response | 350 Response | 2nd Supplier Response | Conclusion/Resolution |
|---|---|---|---|---|---|---|
| Clarify | How can stakeholders contact you / authorities / convey their concerns? | | Stakeholders: Climeworks has circa 160 **business customers**. Each business customer has a Climeworks account owner. The business can reach out to the respective account owner with concerns and any concern from a business is treated as a priority. If the account owner moves on from Climeworks, the account ownership is transferred to a colleague. Account owners actively arrange regular business reviews with their business customers. | How do new interested and /or affected parties contact you? (Community Engagement Iceland - Update 2025) Point 5. you provide information where people can submit complaints or queries, but how do people find this information? Is it displayed on a sign board at your premises entrance and on your company website? | Community Engagement Iceland - Update 2025 Point 5: this is a communication channel specific for official complaints through the Icelandic authorities, not a communication channel established by Climeworks. Here it is assumed that stakeholders know our business since their complaint would be specific to us. As we are a registered business in Iceland the municipality or other relevant agencies have our business contact and would contact us to handle any such complaint.<br><br>More in general, our website provides a contact form where any interested stakeholder can get in contact with us. Those emails are routinely checked by our Communications team. (https://climeworks.com/contact) | Climeworks have conducted and continue to conduct extensive community engagement. See line 6 for recommendations regarding grievance mechanisms. |
| Clarify | | | Stakeholders: Individual consumers or **Pioneers** can contact Climeworks via the Climeworks Pioneers email address. Climeworks has a dedicated Pioneers and Sustainability Lead responsible for dealing with any concerns from Pioneers. | | | See line 6 |
| Clarify | | | Stakeholders: A number of **carbon rating agencies** have contacted Climeworks with concerns and questions regarding our operations. Climeworks has a Senior Science and Technology Manager responsible for dealing with concerns from carbon rating agencies. | | | See line 6 |
| Clarify | | | Stakeholders: Climeworks employs a Project Director Country Director for Iceland who to only handles concerns which are raised by the **local community** but proactively reaches out to community members in Iceland. | | | See line 6 |
| | | | Stakeholders: **The Government** | | | See line 6 |
| Clarify | Is there a grievance register in place? | Provide document | No, but we have a robust communication process that connects external stakeholders with | | | Recommendation that Climeworks put together a robust grievance |

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| | | | the relevant Climeworks employee and the plant manager. | | | mechanism which is easily accessible via their website and communicated to the wider community. Grievance log is recommended to monitor grievances, when they were raised and how/ if they were resolved. |
| Omission | The current risk register does not address $CO_2$ transport risks, geological storage risks, or include a reversal-risk assessment. | Update the risk register to include:<br>- $CO_2$ transport risks - pipeline (operational interruptions, handling, accidental release, regulatory compliance).<br>- Geological storage risks (well integrity, mineralization performance, monitoring failure, leakage pathways).<br>- A clear reversal-risk assessment outlining potential reversal mechanisms and mitigation measures. | Lines 41 to 51 address CO2 transport risks (line 47) and geological risks (43-46, 48, 50) as well as other CO2 injection risks. Reversal risks are covered by answer in line 5 of this RFI. A line in the Risk Register for reversal risk has been added as well | | | Thank you for pointing out these items and updating the risk register |
| Omission | A documented reversal-risk assessment | Please provide documentation in which you discuss/evaluate project specific factors that could increase the overall reversal | | | | See above |
| Clarify | Please confirm the location of the CO2 purity tests for the CO2 captured at both facilities | CO2 stream tests | Purity tests are conducted for Orca on a monthly basis. Results are in "2025-08-25 LE121590-0001 test report.pdf"<br><br>In Mammoth, dissolved CO2 is injected (not pure CO2), therefore the requirement of purity test doesn't apply. The CO2 stream is continuously monitored at the point of injection | | | Thank you for clarifying this item |
| Omission | Documentation for roles and responsibilities for Mammoth facility with Carbfix is missing. Please confirm whether the Monitoring plan for Orca, which calls out responsibilities | Confirm Monitoring Plan for Mammoth is the same as Orca or provide Mammoth monitoring plan | The monitoring plan details who between Carbfix and Climeworks is responsible for which instrument (column Q). The ownership of each instrument is complete (data quality, maintenance, inspections...) | | | Updated monitoring plan received. Thank you |

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| | of each party is appropriate. | | | | | |
| Clarify | Please confirm that Climeworks operations do not fall under the NDC's for Iceland | Confirm information | Climeworks' CDR activities at the Orca and Mammoth in Iceland are certified under the Puro Geologically Stored Carbon Methodology and verified by external auditors. Certification ensures that each ton of $CO_2$ removed is issued as a Carbon Removal Certificate (CORC) in the Puro.Earth registry, which is designed for voluntary carbon markets—not Iceland's own NDC. | | | Thank you for providing the statement. |
| Omission | Documentation associated to the permitting for water use is not present in the Carbfix permits, or any other documentation | Please provide water use permits for Carbfix and Climeworks | No documentation, Climeworks is not the licensee for water extraction. ON Energy provides water for Climeworks in Iceland. ON Energy has a license to extract 2,000 liters / second from the Engidalur well 5 km north of Hellisheidi. Currently, ON avails of approximately 900 liters / second. | Is the water that is also used by Carbfix for Orca operations also provided by ONPower? Specifically, I am thinking about the water sourced from the two local wells. Is this the case for the well those feeds into Mammoth also? | Water for Mammoth is provided by ON Power. In case of Orca, Carbfix extracts the water where CO2 is dissolved and reinjects that underground. The water permit from Carbfix has been added (Water Permit Carbfix Orca - Leyfi-OS-2015-L026-02, relevant part in articles 4 and 6).<br>Make-up water for Climeworks process is provided by ON Power. Orca cooling water is provided and circulated back to ON Power.<br><br>Water for Mammoth is fully provided by ON Power, and CO2 is dissolved in water before the CO2-rich water is delivered to Carbfix. In the case of Mammoth, Carbfix doesn't use any additional water. | Confirmed presence of Carbfix water extraction permit for injections purposes from two local wells. Thank you for clarifying regarding water sourcing from ONPower. |
| Clarify | Confirm that the flow meter for the CO2 injected has a measurement frequency of 15 minutes or less | Please clarify | The flow sensors for the injection water flow have a measurement frequency of 10 sec. Average minute values are used for the calculation of CO2 injected. | | | Confirmed - thank you |
| Omission | Please provide a copy of the LCA report which justifies the modelling choices made for the CORCs model | Please provide LCA explainer document | Documentation provided for all relevant LCA's | | | Confirmed in Facility audit package provided |
| Clarify | Please clarify that emissions associated to ongoing monitoring are less than 1% of the emissions of the storage stage. | Please clarify | The only material monitoring emissions are related to water samples extracted from the monitoring well, few kg per sample. The monitoring plan post-closure calls for no more than 5 samples per year which renders these emissions negligible (against a total construction emission of the storage stage of ~500 tCO2). | | | Explanation covers this requirement. Thank you |

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| | | | Monitoring emissions before closure are duly accounted for as intentional reversals (see CORC report) | | |
| Clarify | Confirm when Carbfix last conducted monitoring of well pressure decay and ensured location of charged water was what was expected by the well model | Please confirm date and report if any. | The wellhead pressure is monitored continuously (see document with hourly averaged values). The results of the updated model will be submitted for the storage permit report in April 26. | | Confirmed. Thank you for clarifying. FAR for review of updated well model |
| Omission | No Stakeholder engagement report provided. | Provide document | This document is part of the facility audits documentation. Puro.Earth should have given access to the facility audit documentation to 350 Solutions.<br>In addition, the file (Puro Stakeholder Engagement Report_final) has been added to the RFI folder.<br>A short update on the activities relevant for the year 2025 has also been provided (Community Engagement Iceland - Update 2025.docx) | | Document provided for review |
| Omission | Missing a copy of the explicit anti-discrimination policy | Provide document | | | Document provided for review |
| Omission | Missing a copy of the document referencing human rights principles | Provide document | | | Document provided for review |
| Omission | Missing documentation on Labor rights and working conditions | Provide document | | | |
| Omission | Missing documentation on Gender and non-discrimination | Provide document | | | Document provided for review |
| Omission | Climeworks does not address pollution prevention to air, water and soil as well as noise and vibration | Provide document, EIA? | | | sufficient data/clarification provided |

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| Omission | Avoiding or minimizing adverse impacts to community health and safety | Provide EIA for review | There is one EIA covering the entire Hellisheidi site, comprising of both Climeworks and Carbfix facilities for both Orca and Mammoth projects. This was prepared by Carbfix in 2023 and is provided both in original language, Icelandic, and in English translation.<br>This document is part of the facility audits documentation. Puro.Earth should have given access to the facility audit documentation to 350 Solutions.<br>In addition, the file (EIA for Hellisheiði - Report Submitted by Carbfix - Jan 2023) have been added to the RFI folder. | | Document provided for review |
| Omission | Missing documentation covering assumption, model, parameter representativeness and default-value justification, System-level and storage-related uncertainty factors, Full uncertainty propagation to final $CO_2$ removal values | Provide documents | Sources added to the uncertainty calculation. Error propagation formula valid as is. Details for injected water and DIC values for the monitored period have been added and the final uncertainty updated | | sufficient data/clarification provided |
| Clarify | Climeworks outlines their monitoring system including QA/QC procedures and a secure data management system, quantitative monitoring information is collected and managed appropriately. Omission in documentation: Documentation does not explicitly outline | Is this occurring? Revise applicable documentation to include this process | The Monitoring Plan outlines how often sensors, which are relevant to the CDR calculation chain, are validated or calibrated.<br>The document "QA/QC procedures for measurement device" still applies as in the facility audit.<br>The chapter 3.5 of the Project Description still applies as in the facility audit.<br>SOPs for internally validated instruments are added (O4131-GEN--ALL-SOP-10005 and O4131-GEN--ALL-SOP-10006). Externally calibrated instruments are calibrated as per manufacturers procedures. Reports for Master instruments are submitted during output audits whenever due, as per the Monitoring Plan | | sufficient data/clarification provided |

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| | that time stamp data is occurring (this is assumed) | | | | |
| Omission | Monitoring Plan required, reference is made to this document in the PPD. | Provide a copy of mammoths monitoring plan for review | It looks like the Monitoring Plan is not there anymore, despite having discuss a few changes about that during the Eligibility Check with Puro.Earth. It has now been uploaded again in "02 Updated facility documents" | | Document provided for review |
| Omission | documentation showing continuously monitoring of temp and pressure at the well | Please provide copies for review | The temperature and pressure sensors for the injection have a measurement frequency of 10 sec. Average hourly data is provided in the additional documents. | | Monitored by storage partner and parameters reported monthly. |
| Clarify | Where do you take your chemical sampling from? | Please clarify | Chemical samples of the CO2 stream are taken at the interface between Climeworks and Carbfix facilities in Orca and at the injection well in Mammoth | | sufficient data/clarification provided |
| Clarify | How does Climeworks track maintenance and repairs for Mammoth that are to be compared to the allotted figure of amortized emissions to ensure it is covered. | Confirm how consumables for repairs and maintenance are tracked and included within the LCA | Currently, Climeworks track these items internally and compare the calculated emissions to a designated amount of the grey emissions to be amortized in the future. | | Noted that this is kept internally. It is recommended that Climeworks make available a maintenance tracker that documents materials used for repairs and maintenance for future verification. |

# Appendix 2: Site Pictures


**Figure A: $CO_2$ and $H_2S$ sensors used by Climeworks staff as part of their HSE equipment**

**Figure B: Carbfix $CO_2$ charged water Injection well housing, one of two.**

# Appendix 3: Verifier Qualifications

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

| Verifier Qualifications | Criteria Met? | Evidence / Notes<br>*(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 Isometric Standard. Note that verifications completed for Isometric are not equivalent to ISO 14034 verifications.<br><br>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 Isometric Registry | ☑ | 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 Isometric 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.

**Kelly Inder-Nesbitt**

**Senior Carbon Removal Verification Engineer, 350Solutions Inc**

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**Education:**

- Master of Science in Geography, Archaeology, and Environmental Studies, University of the Witwatersrand, 2014
- Bachelor of Science with Honors in Geography, University of the Witwatersrand, 2011
- Bachelor of Arts in Geography and Archaeology, University of the Witwatersrand, 2010

**Experience Summary:**

At 350Solutions, Kelly specializes in verifying carbon removal projects to ensure compliance with ISO 14034 standards and carbon registry requirements. With over a decade of experience in environmental compliance and carbon management, she brings extensive expertise in operational compliance and MRV framework implementation, enhancing accuracy, transparency and integrity in the voluntary carbon market.

Kelly's career spans multiple sectors, including aquaculture, mining, and carbon removal technology, where she has developed and audited environmental management systems that promote sustainable practices and attract investor finance. At 350Solutions, she leads the validation of diverse carbon removal pathways, including biochar, BECCS, DAC and direct ocean capture and biomass burial. Her responsibilities encompass site audits and rigorous evaluation of MRV systems to ensure scientifically validated project claims.

Previously Kelly led the development of Brilliant Planet's carbon dioxide removal methodology protocol for algal biomass burial and contributed as an author. She was also responsible for developing and implementing an ISO 14001 compliant EHSS Management System for the FirstWave Group, who are aquaculture industry leaders in Southern and Eastern Africa. This system is also aligned with IFC World Bank Best Practices and leveraged software tools to streamline compliance monitoring and enhance ESG reporting for investor and regulatory alignment.

Throughout her career, Kelly has consistently collaborated with project developers, communities, regulators, and clients to enhance the credibility of environmental initiatives through rigorous documentation and alignment with international standards. Her approach emphasizes precise data management and actionable reporting, elevating compliance practices into a strategic, value-adding process that drives sustainable business growth.

Kelly's strong communication skills and commitment to fostering collaboration enable her to manage complex compliance initiatives effectively. Her ability to bridge the gap between technical requirements and stakeholder expectations continues to advance science-driven, impactful solutions in the carbon removal industry.

**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