

Puro Standard

OUTPUT AUDIT STATEMENT

Statement No:
DNV-2024-ASR-C738877

Issuance date:
29.11.2024

Statement validity: 5 years
29.11.2024 – 28.11.2029

DNV Business Assurance Finland Oy Ab has verified, in accordance with Puro Standard General Rules (Version 4.0 published 9.2.2024), the CO₂ removal achieved by the organization:

Climeworks AG



The result of the facility and output audit is reported in the document entitled "PURO OUTPUT AUDIT REPORT" dated 26.9.2024 detailing the activities carried out at the following sites:

Mammoth (Suðurvellir 1, 816 Ölfus), operated by Climeworks (project applicant), inclusive of the storage infrastructure operation subcontracted from Carbfix hf.

Facility ID: 417791

VERIFICATION OPINION

Based on the verification process, DNV states that the organization was found to have defined and maintained procedures relevant for production of CO₂ removal method: Geologically Stored Carbon Edition 2024, V2. Based on this statement the Organization is found compliant with Puro Standard requirements.

Verification opinion: POSITIVE

OUTPUT AUDIT

Audited Output production period: 1.6.2024 – 31.10.2024

Reports and data files for the quantification of CO₂ removal have been produced and updated in a reliable way to assess the CO₂ removal achieved by Geologically Stored Carbon with Direct Air capture.

Detailed removals

CO₂ captured (C captured): 196.549 tn CO₂eq.

Natural CO₂ (C_Natural): 5.292 tn CO₂eq.

CO₂ stored (C stored): 191.257 tn CO₂eq.

CO₂ reversal (E loss¹): 0.503 tn CO₂eq.

Project Emissions (E project): 113.264 tn CO₂eq.

CO₂ removal eligible for CORCs: 77.49 tn CO₂eq.

¹ See Mammoth output report Climeworks GSC Jul-Nov24 for further explanation.

CORC Uncertainty: 11.57 tn CO₂eq.

Verification Objective

The objective of this verification is to assess compliance to the below reported verification criteria. The verification results are reported in the document entitled "PURO OUTPUT AUDIT REPORT" dated 29.11.2024 relative to Climeworks AG.

Verification Scope

Scope of verification

- Output for the period of 1.6.2024 – 31.10.2024 for CO₂ removal method: Geologically stored Carbon with Direct Air Capture

Verified areas

- Production output of Geologically Stored Carbon for the period of 1.6.2024 – 31.10.2024

Level of Assurance

The verification was conducted by DNV with a reasonable level of assurance. An audit is based on verification of a sample of available information. Consequently, there is an element of uncertainty reflected in the audit findings. An absence of nonconformities does not mean that they do not exist in audited and/or other areas. Prior to awarding or renewing certification this report is also subject to an independent DNV internal review which may affect the report content and conclusions.

Verification Criteria

Puro Standard General Rules (Version 4.0 published 9.2.2024)

Puro Geologically Stored Carbon Methodology Edition 2024, V2

DNV Business Assurance Finland Oy Ab

X

Auditor

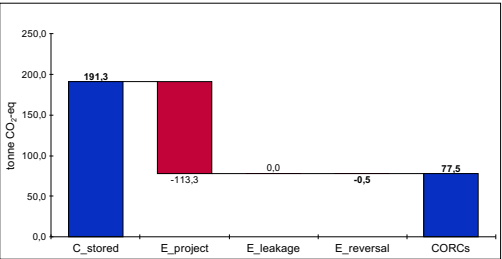
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Reviewer

Monitoring period & facility information		
Variable	Value	Instructions
Reporting period start	1.6.2024	Use format YYYY-MM-DD
Reporting period end	31.10.2024	Use format YYYY-MM-DD
Facility name	Mammoth	Names as in Puro-Registry
Facility ID	0	From Puro-Registry

CORC Overall Equation (all values reported as positive numbers)						
	Level 2	Level 3	Level 4 *	Total over period, tonne CO2-eq	Uncertainty (standard deviation), tonne CO2-eq	Footnote for remarks (see below)
C_stored	C_injected	C_injected_CH01		196,549	8,845	A
C_stored	C_injected	C_injected_CH02		0		A
C_stored	C_injected	C_Natural		5,292	0,155	B
C_stored	E_released	E_released_CH01		0		C
C_stored	E_released	E_released_CH02		0		C
E_project	E_capture	Operational emissions	Energy use, material use, waste treatment	113,264	7,451	D
E_project	E_capture	Embodied emissions	Construction, maintenance, disposal	0		D
E_project	E_transport	Embodied emissions	Construction, maintenance, disposal	0		D
E_project	E_injection	Embodied emissions	Construction, maintenance, disposal	0		D
E_leakage	E_ECO			0		E
E_leakage	E_MA			0		F
E_reversal	Intentional reversal events (e.g. monitoring)			0,503		G
E_reversal	Un-intentional reversal events			0		G
				77,49		
			CORCs			
			CORC factor (net removed / gross stored)	0.394252833		
			Gross carbon stored	196,549		
			Sum of all deductions from C_stored	5,292		

CORC Overall Equation - Aggregated results			
Contributions	Total over period, tonne CO2-eq	Uncertainty estimate (standard deviation), tonne CO2-eq	Uncertainty estimate (standard deviation), %
C_stored	191,3	8,8	4,63 %
E_project	-113,3	7,5	6,58 %
E_leakage	0,0	0,0	-
E_reversal	-0,5	0,0	-
CORCs	77,49	11,6	14,93 %



Space below can be used to provide further contextual information and data sources, as relevant via the Footnote table

Instructions: In any of the tables above, in the column "Source / Clarification / Footnote" insert one or several footnotes ID (e.g. A, B, C, D ...). In the table below, provide the footnote ID and text explanation as needed

This information will be added to the public disclosure. Only formatting change may be performed by Puro.

>>FootnoteTableStart<<		
Footnote ID	Topic	Public clarification
A	C_injected	The mass of CO2 injected into the geological storage reservoir in each well is determined from the volumetric flow and DIC content of the injected CO2-charged water stream.
B	C_Natural	Water used for the DAC and injection processes is sourced from local water networks. These waters contain natural DIC which's origin is varied and difficult to determine. As a result, this DIC is conservatively deducted from C_injected.
C	E_released	No release events
D	E_capture	Operational emissions associated with transport (electricity) and storage (electricity) are included in E_capture. Since all facilities are located at the same site and powered by the capture main supply.
E	E_ECO	E_ECO was assessed during the design phase and as part of an EIA for the Mammoth project. This assessment determined that nearby land and ecosystems would not be negatively affected, meaning this leakage is mitigated and EECO = 0
F	E_MA	Market leakage for project Mammoth is deemed 0 in line with evaluation of potential leakage sources
G	E_reversal	All reversals were a result of intentional pumping of water from the reservoir monitoring well.

>>insert rows above, as needed<<

>>FootnoteTableEnd<<