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Audit Report 2023

In accordance with the following requirements:

Puro.earth - Biochar Methodology

Sonnenerde GmbH
7422 Riedlingsdorf
Operator's No.: PE-70402

Contact details operator

Name and address

Sonnenerde GmbH
 Oberwarter Strasse 100
 AT-7422 Riedlingsdorf

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Contact person(s)

Audit visit details

Date

17.01.2024

Persons present including their function

MOISL Elias, Quality manager
 Philipp Seitz, bio.inspecta AG, Auditor

	very good			not satisfactory			
Clarity of documentation	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Audit visit preparation:	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>

O.K.
 Corrective action required
 Not verified
 Not relevant

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				1	Audit Description
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.01	Audited Standard: <i>Puro.earth CO2 Removal Marketplace General Rules 3.0 – Biochar Methodology (Annex A)</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.02	Type of Audit: <i>Output Audit</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.03	Auditing Body: <i>bio.inspecta AG, Ackerstrasse 117, CH-5070 Frick www.bio-inspecta.ch</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.04	Audit order assigned to an impartial auditor, free from any conflicts of interest, capable and qualified to complete this audit according to Puro Standard. <i>Auditor (name/surname): Philipp SEITZ</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.05	Audit ID: <i>PE-70402</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.06	Audit Date: <i>20.09.2023</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.07	Production Facility Location: <i>Oberwarter Strasse 100, 7422 Riedlingsdorf</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.08	Production period: <i>ba-at-34-1-4: 01.09.2022 - 31.08.2023 / ba-at-34-2-1: 01.09.23 - 19.12.23</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	1.09	Audit could be finished within the scheduled time frame
				2	Standing Data Confirmation

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 Corrective action required
 Not verified
 Not relevant

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				2	Standing Data Confirmation
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	2.01	<p>The standing data has been collected from Puro and checked for consistency against other evidence. (GL Ref.1.2.5.)</p> <p><i>Trade registry available; location evidenced; removal method eligible; no public support. Evidence of output volume: P500: The period comprises 12 months since the end of the previous validation period (16.09.21 to 31.08.22), corresponding to the batch ba-at-34-1-4. Sales instead of production figures have been considered. PyroDry: Validation comprises the period from 01.09.23 to 19.12.23, corresponding to batch ba-at-34-2-1; biochar used entirely in compost manufacturing. In the absence of individual big bag weighing, the respective bulk densities of the analytical certificates have been factored in.</i></p>
				3	Evidence Confirmation
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	3.01	<p>All necessary evidence has been provided to the auditor by the Production facility and has been used to complete the compliance checklist. (GL Ref. 5.)</p> <p><i>Proof of product quality: EUROFINS laboratory analyses AR-21-FR-041077-02 for ba-at-34-1-4 and AR-23-FR-059763-01 for ba-at-34-2-1. Proof of output volume: P500: The period comprises 12 months since the end of the previous validation period (16.09.21 to 31.08.22), corresponding to the batch ba-at-34-1-4; biochar used entirely in compost manufacturing. Sales instead of production figures have been considered. PyroDry: Validation comprises the period from 01.09.23 to 19.12.23, corresponding to batch ba-at-34-2-1. Proof of sales: Reported volumes for ba-at-34-1-4 have been sold as per sales overview (see attached). Reported volumes for ba-at-34-2-1 used for composting. Proof of no double counting: For ba-at-34-1-4 written declaration of buyer available, Carbon Credit Withdrawal Right issued, thereby transferring the right to generate carbon credits from the carbon content of the biochar. Volumes of ba-at-34-2-1 used in composting.</i></p>
				4	Eligibility Checklist

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 Corrective action required
 Not verified
 Not relevant

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				4 Eligibility Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.01 Biochar is used in applications other than energy. (GL Ref. 1.1.1.) <i>The use for energetic purposes of biochar found in processed products (compost) can be discarded. A significant number of bulk sales have been cross-checked for its end use during the onsite visit, attesting that the end use is non-energetic.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.02 Biochar is produced from sustainable forest or waste biomass raw materials (consult positive list of biomasses). (GL Ref. 1.1.2) <i>P500: Grain husks and pulp mud, both residual products; the first originating from grain cleaning (spelt and sunflower), the latter during marmalade production; both included in the EBC list of permissible inputs (Ag-05 & N-07). Supply distances checked for all relevant suppliers (3 for grain husks: Schafler, Consult & Biokorn; 1 for pulp mud: Energie AG). Sample of delivery notes attached. PyroDry: Use of residual wood from compost screening in own premises.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.04 Pyrolysis reactor input fuel for heating is not a fossil fuel. Unless only used for ignition/pre heating or in a mobile unit and the emissions are fully included in the LCA. The use of waste heat from other industrial processes (eg. Biodigesters, cement production) is permitted. (GL Ref. 1.1.4.) <i>P500: Fossil fuel (propane) only used for ignition of the burner, turned off after burner reaches 6-700 degree Celsius (EBC and Puro.earth allow fossil fuels as starter). PyroDry: Fan heater that runs on electricity used during the startup phase during 3-4 hours.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.05 Pyrolysis gases are combusted or recovered. Bio-oil and pyrolysis gases can be stored for later use as renewable energy or materials. (GL Ref. 1.1.5.) <i>For both pyrolysis plants: Pyrolysis gases recovered and combusted in the burning chamber; the generated heat keeps the temperature inside the reactors at the desired temperature.</i>

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 Not verified
 Not relevant

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				4 Eligibility Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.06 The molar H/Corg ratio is less than 0.7. <i>The molar H/Corg ratio significantly below 0.7 for AR-22-FR-041155-01 (ba-at-34-1-4) = 0.21, and AR-23-FR-059763-01 (ba-at-34-2-1) = 0.09.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.07 The biochar produced meets any product quality requirements existing in the jurisdiction where biochar is used and for the specific applications considered (GL Ref 1.1.7). <i>According to analytical report AR-22-FR-041155-01 biochar of ba-at-34-1-4 is classified as EBC AgroBio; according to analytical report AR-23-FR-059763-01 biochar of ba-at-34-2-1 is classified as EBC Agro. Biochar of both plants and batches therefore conform to the highest quality standards.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	4.08 Evidence of safe handling and transport is provided and adequate for the production facility. (GL Ref. 1.1.8.) <i>For both plants, moisture increased up to 30-35% prior to release into the bunker; moisture levels regularly monitored during EBC audits.</i>
				5 LCA Checklist

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 Not verified
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				5	LCA Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.01	<p>LCA complete and shows: carbon footprint of the biomass production and supply , emissions from the biochar production process , carbon footprint of the biochar end use - cradle to grave. (GL Ref. 1.1.3)</p> <p><i>Emissions A1 – A4, B1 & Infrastructure from cradle to grave included. Carbon content provided as part of EUROFINS analytical report AR-22-FR-041155-01 for ba-at-34-1-4, and AR-23-FR-059763-01 for ba-at-34-2-1. Requirement 1.1.6: P500: Priming gas (propane) for ignition only, to heat P500 up to 6-700 degree Celsius before heating through fuel gases take over (puro.earth allows fossil fuels as starter), then priming gas turns off; PyroDry: Fan heater that runs on electricity used during the startup phase during 3-4 hours before heating through fuel gases take over. 1.1.7: Gases recovered, combusted and converted into heat; 1.1.8: Waste heat >> P500: Used to dry the mix of pulp mud and grain husks; further generation of electricity for own premises; PyroDry: Used to dry residual biomass that originate during compost screening; 1.1.9 Carbon content: P500: 72,7% for AR-22-FR-041155-01 (ba-at-34-1-4); PyroDry: 49,3% for AR-23-FR-059763-01 (ba-at-34-2-1; 1.1.10 The molar H/Corg ratio significantly below 0.7 for AR-22-FR-041155-01 (ba-at-34-1-3) and AR-23-FR-059763-01 (ba-at-34-2-1); 1.1.11 The molar O/Corg ratio significantly below 0.4 for AR-22-FR-041155-01 (ba-at-34-1-3) = 0.051, and for AR-23-FR-059763-01 (ba-at-34-2-1) = 0.063</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.02	<p>The CO2 Removal Supplier provides a life cycle assessment (LCA) for biochar activity including disaggregated information on the emissions arising at different stages. The system boundary is set cradle-to-grave and includes emissions from production and supply of the biomass, from biomass conversion to biochar, and from biochar distribution and use. (GL Ref. 3.1)</p> <p><i>LCA provided by VästLCA. The studied system is a cradle-to-grave within a 100-year time boundary. Infrastructure is included. The system boundary of this study accords to the Puro earth requirements.</i></p>

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				5	LCA Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.04	<p>The default baseline emission scenario for the project activity feedstock is zero, which is a conservative assumption since it is not taking into account methane emissions derived from decay of manure or combustion of waste biomass. If a non-zero baseline presented, needs to be accepted by Puro.earth</p> <p><i>The default baseline emission scenario is assumed to be zero.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	5.03	<p>Life cycle assessment (LCA) follows ISO standard, WRI GHG protocol or similar method. (GL Ref. 3.2)</p> <p><i>The carbon footprint calculation for the biochar produced during the validation period uses a life cycle assessment approach as per ISO 14040 and ISO 14044 standards. It further accords to the latest Puro Earth methodology for biochar edition version 3. The LCA was modelled in SimaPro 9.5 using Ecoinvent 3.9.1 and AGRIBALYSE as the databases. For Ecoinvent data sets, the method "IPCC 2021 < global warming potential (GWP100)" is used.</i></p>
				6	Production Facility Checklist (Desktop and Verbal Confirmation).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.01	<p>Evidence of Production Facility eligibility under the general rules of Puro Standard. (GL Ref. 1.2.1)</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching.</i></p>

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 Not verified
 Not relevant

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				6 Production Facility Checklist (Desktop and Verbal Confirmation).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>6.02 The Production Facility demonstrate Environmental and Social Safeguards. (GL Ref. 1.2.2.)</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching.</i></p>

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				6	Production Facility Checklist (Desktop and Verbal Confirmation).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.03	<p>CO2 Removal Supplier shall be able to demonstrate additionality, meaning that the project must convincingly demonstrate that the CO2 removals are a result of carbon finance. Even with substantial non-carbon finance support, projects can be additional if investment is required, risk is present, and/or human capital must be developed. To demonstrate additionality, CO2 removal Supplier must provide full project financials and counterfactual analysis based on Baselines that shall be project-specific, conservative and periodically updated. Suppliers must also show that the project is not required by existing laws, regulations, or other binding obligations. (GL Ref. 1.2.3)</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching. Energy use: P500: No separate metering of electricity used for the pyrolysis unit; consumption calculated based on the yearly operating hours x the hourly consumption as declared by the manufacture (Pyreg); potential inaccuracies hereof do not affect the LCA calculation as the entire electricity consumption of the operator is renewable and produced onsite with solar panels. PyroDry: Electricity for the fan heater metered; consumption covered through own production. P500: Priming gas not metered: invoices of gas purchases available (invoice of gas purchases for entire batch period ba-at-34-1-4 accounted); no gas consumption for PyroDry. Diesel consumption for telescopic handler based on electronic fuel recording system. Estimated 66% of the consumption allocated to biomass and biochar handling.</i></p>

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 Not verified
 Not relevant

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				6 Production Facility Checklist (Desktop and Verbal Confirmation).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>6.04 The Production Facility's documentation system is accurate and reliable (GL Ref. 1.2.4)</p> <p><i>Waste heat is used to dry the mix of pulp mud and grain husks, as well as other residual biomass that do not qualify for composting and are being sold to co-generation plants.</i></p> <p><i>Energy use: No separate metering of electricity used for the pyrolysis unit; consumption calculated based on the yearly operating hours x the hourly consumption as declared by the manufacture (Pyreg); potential inaccuracies hereof do not affect the LCA calculation as the entire electricity consumption of the operator is renewable and produced onsite with solar panels.</i></p> <p><i>Priming gas not metered: invoices of gas purchases available (invoice of gas purchases for entire batch period ba-at-34-1-4 accounted).</i></p> <p><i>Diesel consumption for telescopic handler based on electronic fuel recording system. Estimated 66% of the consumption allocated to biomass and biochar handling). Methane emissions accounted for.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>6.05 The quantity of the biochar produced and sold is quantified and documented in a reliable manner (GL Ref. 1.2.4)</p> <p><i>No activities are reported in A1 as biomass used in both plants is considered waste.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>6.06 Relevant meters are in place and they are calibrated (GL Ref. 1.2.4)</p> <p><i>Supply distances checked for all relevant suppliers (3 for grain husks: Schafler, Consult & Biokorn; 1 for pulp mud: Energie AG) on googlemap. Sample of delivery notes attached. Fuel used based on Ecoinvent 3.9.1: Market for Transport, freight, lorry 7.5-16 metric ton, EURO6.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<p>6.07 The emissions from the cultivating, harvesting and transporting of the biomass are estimated and calculated in a reliable manner (GL Ref 1.2.4)</p> <p><i>No additional buffer required.</i></p>

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 Not relevant

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				6	Production Facility Checklist (Desktop and Verbal Confirmation).
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.08	<p>The energy use of the Production Facility can be quantified and the emissions from the process calculated (GL Ref. 1.2.4)</p> <p><i>P500: Waste heat is used to dry the mix of pulp mud and grain husks, PyroDry: Waste heat is used to dry the residual woody biomass from compost screening.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	6.09	<p>The auditor goes through the Quantification of CO2 Removal requirements with the CO2 Removal Supplier, so that the Supplier is able to calculate the CO2 Removal independently in its Output Report</p> <p><i>Proof of product quality: EUROFINS laboratory analyses AR-21-FR-041077-02 for ba-at-34-1-4 and AR-23-FR-059763-01 for ba-at-34-2-1. Proof of output volume: P500: The period comprises 12 months since the end of the previous validation period (16.09.21 to 31.08.22), corresponding to the batch ba-at-34-1-4; biochar is being used entirely in compost manufacturing. Sales instead of production figures have been considered. PyroDry: Validation comprises the period from 01.09.23 to 19.12.23, corresponding to batch ba-at-34-2-1. Proof of sales: Reported volumes for ba-at-34-1-4 have been sold as per sales overview (see attached). Reported volumes for ba-at-34-2-1 used for composting. Proof of no double counting: For ba-at-34-1-4 written declaration of buyer available, Carbon Credit Withdrawal Right issued, thereby transferring the right to generate carbon credits from the carbon content of the biochar. Volumes of ba-at-34-2-1 used in composting.</i></p>
				7	Calculation Checklist

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 Corrective action required
 Not verified
 Not relevant

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				7	Calculation Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.01	<p>Qbiochar = Quantity of biochar produced and sold to end user. (dry char) (GL Ref. 4.2.)</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.02	<p>FpTHTs = $c + m \times H / C_{org}$ (GL Ref. 4.2.)</p> <p><i>Provided in the Gross embodied CO2 calculator at given soil temperature and selected time horizon = 0.9027 for P500 / = 0.9564 for PyroDry.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.03	<p>C Biochar = carbon content of biochar (GL Ref. 4.2.)</p> <p><i>Proof of C-content: Carbon content provided as part of EUROFINS analytical report AR-22-FR-041155-01 for ba-at-34-1-4, and AR-23-FR-059763-01 for ba-at-34-2-1. The C-content used in the Gross Embodied CORC calculator for PyroDry was not corresponding with the value indicated in the reference analysis AR-23-FR-059763-01 for ba-at-34-2-1, but stemming from a preliminary non-referential analysis. The Corg value was later adjusted (55% to 49,3%).</i></p> <p><i>The C-content used in the Gross Embodied CORC calculator for PyroDry is not corresponding with the value indicated in the reference analysis AR-23-FR-059763-01 for ba-at-34-2-1. An updated CORC calculation must be submitted.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.04	<p>Estored = biochar carbon storage = $Q_{biochar} \times C_{biocharorg} \times F_{pTHTs} \times 44/12$ (GL Ref. 4.2.)</p> <p><i>Provided in the respective Gross Embodied CORC calculator for each of the plants (attached). The CORC calculator was updated in the course of the present validation to reflect the actual quantities produced during the extended crediting period.</i></p>

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 Not verified
 Not relevant

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				7	Calculation Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.05	<p>Ebiomass = LCA emissions of production and supply of biomass (GL Ref. 4.3.)</p> <p><i>3 sources of energy use identified: electricity, priming gas, diesel for telescopic handler, two of which need to be accounted for net emissions!</i></p> <p><i>Energy use: consumption calculated based on the yearly operating hours x the hourly consumption as declared by the manufacture (Pyreg); potential inaccuracies hereof do not affect the LCA calculation as the entire electricity consumption of the operator is renewable and produced onsite with solar panels. Electricity use of PyroDry metered.</i></p> <p><i>Priming gas not metered: invoices of gas purchases available. Diesel consumption for telescopic handler: Based on electronic fuel recording system. 66% of the consumption allocated to biomass and biochar handling (conservative estimation).</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.06	<p>Eproduction = LCA emissions from biochar manufacturing (GL Ref. 4.4)</p> <p><i>Waste heat leakage not taken into account because generation of heat for premises is not factored into net CO2e gains in the LCA calculation. Methane emissions accounted for.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.07	<p>Euse = LCA emissions of the use of biochar, including distribution up to the point of final use (GL Ref 4.5)</p> <p><i>P500: Grain husks and pulp mud, both residual products; the first originating from grain cleaning (spelt and sunflower), the latter during marmalade production. PyroDry: Residual woody biomass from compost screening. Emissions from harvesting accounted for in upstream business activities.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.08	<p>CORCs = Estored - Ebiomass - Eproduction - Euse</p> <p><i>146,424 CORC to be issued for batch ba-at-34-1-4 during production period 01.09.22 to 31.08.23. 168.755 CORC to be issued for batch ba-at-34-2-1 during production period 01.09.23 to 19.12.23.</i></p>

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 Not verified
 Not relevant

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				7	Calculation Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.09	Quantity of CORCs (in evidence). <i>146,424 CORC to be issued for batch ba-at-34-1-4 during production period 01.09.22 to 31.08.23. 168.755 CORC to be issued for batch ba-at-34-2-1 during production period 01.09.23 to 19.12.23.</i>
<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	7.10	Confirm consistency. <i>All inconsistencies on the operator's side have been resolved with the responsible project manager. Potential inconsistencies and/or mistakes on the LCA provider's side cannot be tracked due to the lack of calculatory paths.</i> <i>Potential inconsistencies and/or mistakes on the LCA provider's side cannot be tracked due to the lack of calculatory paths. The LCA/LCIA must be crafted in such a way that calculatory paths can be followed up by validation.</i>
				8	Site Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.01	The raw material is of eligible type and sustainably sourced (GL Ref. 1.1) <i>P500: Grain husks and pulp mud, both residual products; the first originating from grain cleaning (spelt and sunflower), the latter during marmalade production; both included in the EBC list of permissible inputs (Ag-05 & N-07). Supply distances checked for all relevant suppliers (3 for grain husks: Schafler, Consult & Biokorn; 1 for pulp mud: Energie AG). Sample of delivery notes attached. PyroDry: Use of residual wood from compost screening in own premises.</i>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.02	The LCA specifics and emissions boundary are consistent with observations on site (GL Ref. 1.1)
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.03	There are no fossil fuels used to heat the pyrolysis reactor (GL Ref. 1.1) <i>P500: Fossil fuel (propane) only used for ignition of the burner, turned off after burner reaches 6-700 degree Celsius (EBC and Puro.earth allow fossil fuels as starter). PyroDry: Fan heater that runs on electricity used during the startup phase during 3-4 hours.</i>

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 Not verified
 Not relevant

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				8	Site Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.04	<p>Pyrolysis gases are recovered in the biochar production process (GL Ref. 1.1)</p> <p><i>For both pyrolysis plants: Pyrolysis gases recovered and combusted in the burning chamber; the generated heat keeps the temperature inside the reactors at the desired temperature.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.05	<p>Evidence of safe handling and transport of the biochar (GL Ref. 1.1)</p> <p><i>P500: Waste heat is used to dry the mix of pulp mud and grain husks, PyroDry: Waste heat is used to dry the residual woody biomass from compost screening.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.06	<p>Biochar is used in applications other than energy (GL Ref. 1.1)</p> <p><i>Carbon content: P500: 72,7% for AR-22-FR-041155-01 (ba-at-34-1-4); PyroDry: 49,3% for AR-23-FR-059763-01 (ba-at-34-2-1).</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.07	<p>The molar H/Corg ratio is less than 0.7</p> <p><i>The molar H/Corg ratio significantly below 0.7 for AR-22-FR-041155-01 (ba-at-34-1-3) and AR-23-FR-059763-01 (ba-at-34-2-1).</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.08	<p>Confirm how the Production Facility documents the quantity of biochar produced and sold</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching.</i></p>

O.K
 Corrective action required
 Not verified
 Not relevant

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				8	Site Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.09	<p>Confirm that the Production Facility's documentation system is accurate and reliable</p> <p><i>In the absence of individual big bag weighing, tonnage data relies on different measurements, specific to each of the pyrolysis plants. For P500: Carried out on a sample basis: (a) On the production report the hourly output weight is determined (in kg) and then extrapolated via operating hours; (b) on the sales overview the weight is determined through occasional measurement of 1 m3 big bags. Sample measurement are recorded but compromise objective means of verification; to turn calculations objective, the bulk density of the analytical certificate AR-22-FR-041155-01 is being considered. PyroDry: Automatized weighing of the biochar at the outlet prior to quenching.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.10	<p>Confirm that appropriate metering infrastructure is present and calibrated correctly to determine production output</p> <p><i>See 8.08</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.11	<p>Confirm that appropriate metering infrastructure is present to quantify the energy use of the Production Facility</p> <p><i>No separate metering of electricity used for the pyrolysis unit; consumption calculated based on the yearly operating hours x the hourly consumption as declared by the manufacture (Pyreg); potential inaccuracies hereof do not affect the LCA calculation as the entire electricity consumption of the operator is renewable and produced onsite with solar panels. PyroDry: Electricity for the fan heater metered; consumption covered through own production. P500: Priming gas not metered: invoices of gas purchases available (invoice of gas purchases for entire batch period ba-at-34-1-4 accounted); no gas consumption for PyroDry. Diesel consumption for telescopic handler based on electronic fuel recording system. Estimated 66% of the consumption allocated to biomass and biochar handling.</i></p>

O.K.
 Corrective action required
 Not verified
 Not relevant

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				8	Site Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.12	<p>Confirm the calculations that are used to quantify emissions from the process. These account for: - the energy (e.g. waste heat) created by the biochar - the energy source used in the production process</p> <p><i>Waste heat is used to dry the mix of pulp mud and grain husks, as well as other residual biomass that do not qualify for composting and are being sold to co-generation plants.</i></p> <p><i>Energy use: No separate metering of electricity used for the pyrolysis unit; consumption calculated based on the yearly operating hours x the hourly consumption as declared by the manufacture (Pyreg); potential inaccuracies hereof do not affect the LCA calculation as the entire electricity consumption of the operator is renewable and produced onsite with solar panels.</i></p> <p><i>Priming gas not metered: invoices of gas purchases available (invoice of gas purchases for entire batch period ba-at-34-1-4 accounted).</i></p> <p><i>Diesel consumption for telescopic handler based on electronic fuel recording system. Estimated 66% of the consumption allocated to biomass and biochar handling). Methane emissions accounted for.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.13	<p>Confirm the process that is in place to quantify emissions from the harvest of raw materials. These account for: - forest biomass vs biomass from other waste</p> <p><i>No activities are reported in A1 as biomass used in both plants is considered waste.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.14	<p>Confirm the process that is in place to quantify emissions from the transport of raw materials to the Production Facility.</p> <p><i>Supply distances checked for all relevant suppliers (3 for grain husks: Schafler, Consult & Biokorn; 1 for pulp mud: Energie AG) on googlemap. Sample of delivery notes attached. Fuel used based on Ecoinvent 3.9.1: Market for Transport, freight, lorry 7.5-16 metric ton, EURO6.</i></p>
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.15	<p>The Production Facility demonstrate Environmental and Social Safeguards</p> <p><i>The molar O/Corg ratio significantly below 0.4 for AR-22-FR-041155-01 (ba-at-34-1-3) = 0.051, and for AR-23-FR-059763-01 (ba-at-34-2-1) = 0.063</i></p>

O.K.
 Corrective action required
 Not verified
 Not relevant

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				8	Site Visit Checklist
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	8.16	<p>Confirm the CO2 removals are a result of carbon finance</p> <p><i>The background system data quality assessment has provided optimal results, therefore no extra buffer was added. The data uncertainty has not been assessed in this report as the goal is to produce a fixed number for CORC issuance (the mean), and the spread above and below the mean is irrelevant. However, as all figures comes from direct measurements, the uncertainty should be low.</i></p>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8.17	<p>The requirements for Quantification of CO2 Removal have been explained to the Supplier by the Auditor for the purpose of compiling the Output Report</p> <p><i>Done on behalf of the LCA supplier.</i></p>
<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	8.18	<p>Confirm the process that is in place to collect and maintain proofs as per Section 5 of the Biochar Guidelines. - Proof of sustainability of raw material for forest biomass (FSC, SFI, PEFC, other certifications) - Proof of sustainability of raw material for waste biomass - LCA data for biomass and biochar production, supply and use, including climate change impact and the contribution of each life cycle stages - Proof of product quality: laboratory analysis of total organic carbon content, hydrogen content and H/Corg - Proof of production volume: documentation for the whole period and methodology applied to calculate the dry mass of biochar produced. - For mobile units or carbonizer operator: proof of load cell measurement of the biochar for the whole period, and water input measurement. - Proof of end use of biochar: offtake agreement, shipment, and other records indicating the intended use of biochar. - Justification on the soil temperature selected for the calculation of the biochar sequestration. - Proof of sales - Proof of no double counting/C positive marketing.</p> <p><i>See 3.01</i></p>
				9	Overall conclusion

O.K
 Corrective action required
 Not verified
 Not relevant

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				9	Overall conclusion
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	9.01	<p>Overall conclusion:</p> <p><i>The validator confirms that the LCA calculation for crediting period for ba-at-34-1-4 (01.09.22 – 31.08.23) and crediting period for ba-at-34-2-1 (01.09. - 19.12.23) provide a credible and faithful account of output volumes and emissions, and thus of declared carbon dioxide removals eligible for CORC as stated in the Output statement. Non-compliances from last validation have been lifted (methane measurements; bulk density for non-grinded biochar available). The validator is confident that the conservativeness has been applied to a sufficient degree to say that declared CO2 removals are fully justified.</i></p>

The Right to be Heard

The undersigned has reviewed the outcome of the audit documented in this report and confirms the completeness and accuracy of the information provided in the audit and the content of this report.

He/ she has taken note of the non-conformities, measures, deadlines and sanctions described in this report.

The undersigned has the option of submitting a counter-notification in writing to bio.inspecta AG within three working days of receipt of this report. If no reply is received within this period, the contents of this report shall be deemed to be acknowledged.

Frick, 29.02.2024

Riedlingsdorf, 06.03.2024

bio.inspecta AG / q.inspecta GmbH
International Department

Sonnenerde GmbH



Philipp Seitz

name, first name MOISL ELIAS

Auditor

function QUALITY MANAGEMENT

Auditor's evaluation and recommendation

Non-compliance	Corrective action	Deadline
Puro.earth - Biochar Methodology None		