PRODUCTION FACILITY & OUTPUT AUDIT REPORT

For PURO.EARTH

Company / CO_2 Removal Supplier	Red Trail Energy LLC
Production Facility Name	Red Trail Energy Ethanol Production Facility
Production Facility Address	3682 Hwy 8S Richardton, ND 58652
Net Volume of CO_2 Removal	157,592 CORCs
Removal Method	Geologically Stored Carbon
Removal Period	June 2022 – July 2023
Auditor	Bill Chatterton 350Solutions, Inc.

ISSUED: FEBRUARY 16, 2024

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PRODUCTION FACILITY & OUTPUT AUDIT REPORT		
Company: Red Trail Energy LLC	Company Contact: Jodi Johnson, CEO	Audit Team: *Bill Chatterton Tim Hansen, PE
Removal Method: Geologically Stored Carbon		
Report Date: February 16, 2024		
Document No: 350VR-RT-PU2309		
Rev: 1.4 - PUBLIC		

** primary contact/lead author*

1. INTRODUCTION

350Solutions, Inc. was contracted to perform an audit and validation of the production facilities as well as verification of carbon dioxide removal credit (CORC) claims for Red Trail Energy LLC's geologically stored carbon removal process. 350Solutions declares that we are an impartial auditor, free from any conflicts of interest, capable, and qualified to complete this audit according to Puro Standard and related Puro Validation and Verification Body Requirements.

Red Trail Energy LLC (RTE) owns and operates an ethanol production plant near Richardton, North Dakota. The plant complex is situated inside a footprint of approximately 25 acres of land which is part of an approximately 135-acre parcel. The plant was placed into service in January 2007 and is capable of producing in excess of its name-plate production capacity of 50 million gallons of ethanol per year. RTE uses corn as feedstock to produce ethanol at the plant.

RTE is currently operating a carbon dioxide (CO_2) capture and storage (CCS) facility adjacent to the RTE ethanol plant, to ultimately inject about 180,000 tonnes CO_2 annually more than a mile below RTE property for permanent storage. In partnership with the North Dakota Industrial Commission Renewable Energy Program and the U.S. Department of Energy (DOE), the RTE CCS Project was determined a technically viable option for the significant reduction of CO_2 emissions from ethanol production. The project was also supported by the Energy & Environmental Research Center EERC-led Plains CO_2 Reduction (PCOR) Partnership.

TABLE 1. RED TRAIL ENERGY TECHNOLOGY VERIFICATION SUMMARY

Verification Summary	
CO_2 Removal Supplier	Red Trail Energy LLC
Production Facility Name and Registry No.	Red Trail Energy Ethanol Production Plant, GSRN: 643002406801001142
Removal Method	Geologically Stored Carbon
Verified CORCs	157,592
Audit Report Date	February 16, 2024
Site Visit Date	December 21, 2023
Production Facility Location (Address and GPS Coordinates)	3682 North Dakota 8, Richardton, ND 58652 Lat 46.883, Long -102.313
Verification Type	Combined Production Facility Audit and Output Audit for Puro.Earth, including on-site visit and facility audit; Puro Standard General Rules (v3.1), and Geologically Stored Carbon Methodology (Edition 2021)

350Solutions conducted an audit of the process, lifecycle CO_2 emissions assessment (LCA), and other administrative details to verify compliance with the requirements of the Puro.Earth Puro Standard General Rules (Version 3.1) [1] and Geologically Stored Carbon Methodology (Edition 2021) [2]. The audit and verification began with a document review and followed with a site visit on December 21, 2023 at the RTE facility in Richardton, ND, and detailed data audit during and following the site visit.

2. TECHNOLOGY DESCRIPTION[1]

The project captures CO_2 generated by the fermentation process during ethanol production. Fermentation exhaust is cleaned using a water scrubber which separates any remaining ethanol and other impurities to produce a high-purity stream of CO_2. From the scrubber, CO_2 exhaust is sent to compressors to raise its pressure to 325 psi. Upon compression, the CO_2 is dehydrated to remove any remaining water and is then sent to a refrigeration unit where it is subcooled to a liquid at –10°F. The condensed CO_2 is then lightly distilled and pumped through a flowline to an injection well onsite where it is sequestered permanently in the Broom Creek formation. The injected gas has high CO_2 purity (greater than 99.9%) with only trace quantities of nitrogen and oxygen. The process is summarized in Figure 1.

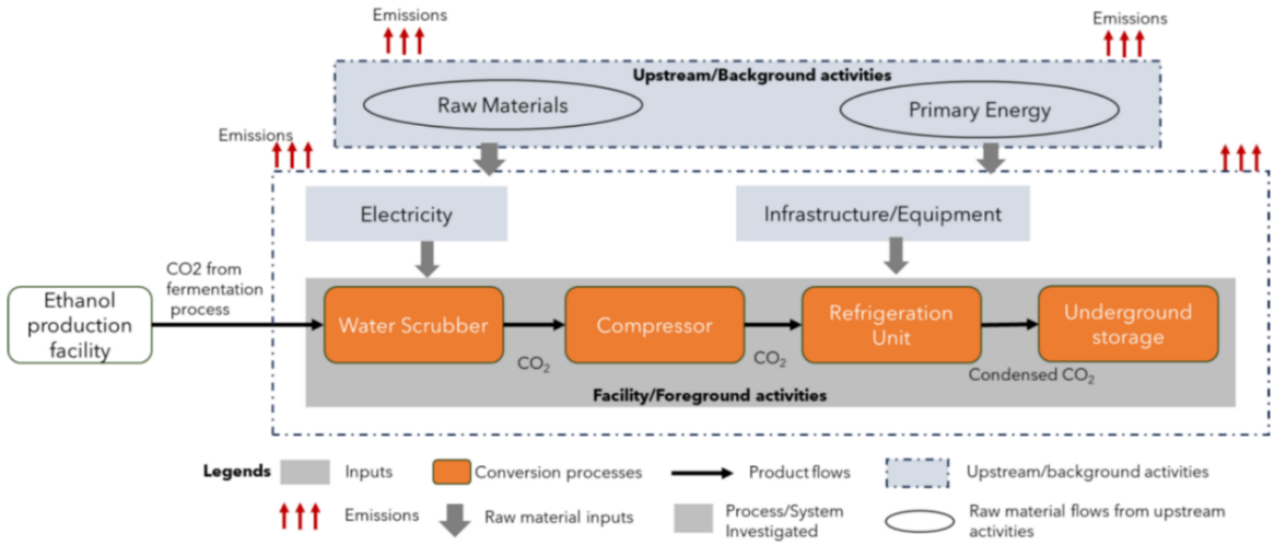

FIGURE 1. RED TRAIL ENERGY CARBON CAPTURE AND GEOLOGICAL STORAGE PROCESS

The land adjacent to RTE is agricultural land that has been farmed since at least 1972 based on direct aerial photography as noted in a Phase I Environmental Site Assessment report. Historically the land has been used for wheat and corn production. Corn production has become predominant since 2007 for ethanol production. Historical records confirm that the adjacent agricultural land was never previously an area of high biodiversity value, nor did it transition from regions with high carbon stock after January 2008. This distinction is crucial per the EU Renewable Energy Directive (RED II). The biomass derived from this land aligns with the sustainability standards set forth by the EU directive on land-use changes.

[1] *Technology Description obtained from Red Trail Energy documents, process descriptions, and specification material.*

In the context of ethanol production, the fermentation process generates biogenic CO_2 when yeast consumes sugars and produces ethanol. To ensure the biogenic origin of the CO_2 captured, Red Trail ran C14 isotope test by following the ISO 13833 that is a standardized method designed to determine the biogenic fraction of mixed CO_2 samples.

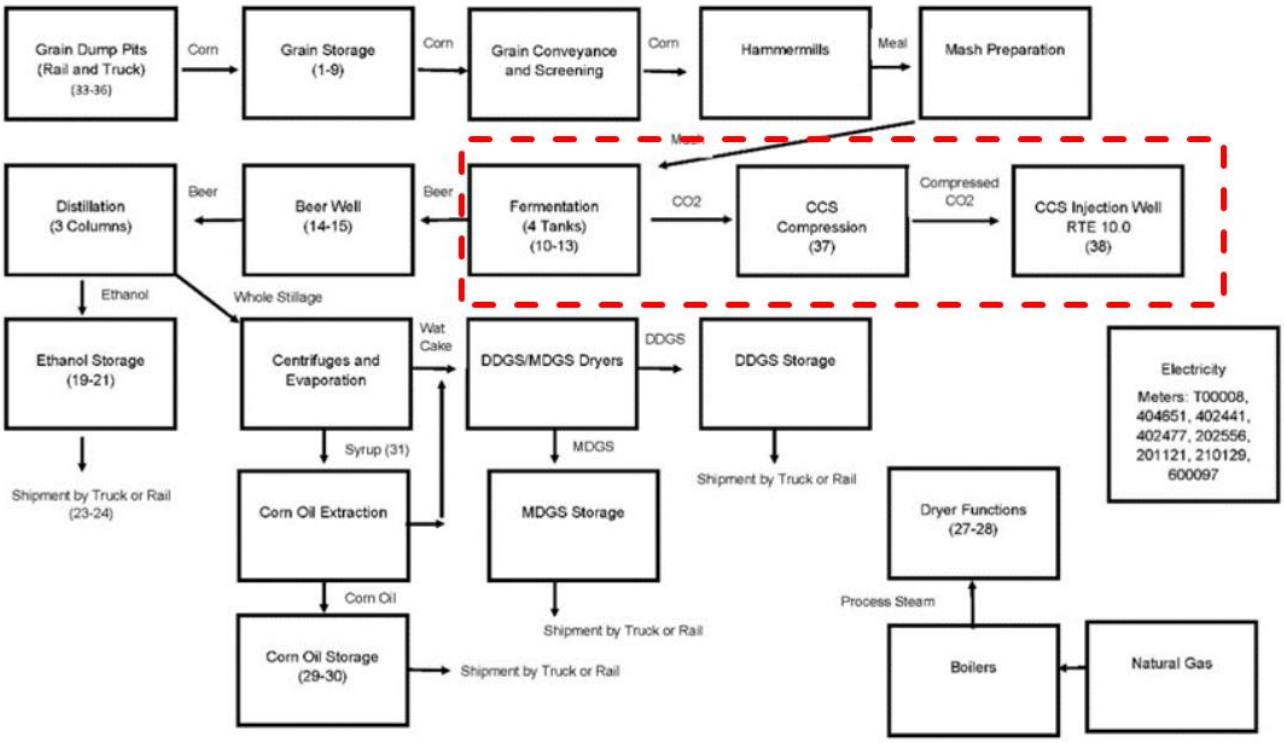

FIGURE 2. RED TRAIL ENERGY ETHANOL PRODUCTION PROCESS FLOW DIAGRAM. BOUNDARY RELATED TO CO_2 CAPTURE AND STORAGE INDICATED WITHIN RED BOX

The captured CO_2 stream is directly injected into the Broom Creek Formation below the project site via the onsite permitted Class VI well (RTE-10). RTE received formal approval of its North Dakota CO_2 storage facility permit (SFP) on October 19, 2021. This approval by the North Dakota Industrial Commission (NDIC) authorizes the geologic storage of CO_2 from the RTE ethanol facility in the amalgamated storage reservoir pore space of the Broom Creek Formation (NDIC Order Nos. 31453 and 31454). North Dakota has the authority to regulate the geologic storage of CO_2 and primacy to administer the North Dakota Underground Injection Control (UIC) Class VI Program (83 Federal Register 17758, 40 Code of Federal Regulations [CFR] 147). The wellhead is shown in Figure 3.

FIGURE 3. **RED TRAIL ENERGY CO_2 INJECTION WELLHEAD**

3. AUDIT SUMMARY

3.1. AUDIT APPROACH

A planned series of audit activities were conducted by 350Solutions to independently validate and verify the production facility, its operations, production and output data, and CORC claims. The audit was conducted following the specifications of Puro General Rules and the Geologically Stored Carbon Methodology. Specific audit activities conducted are summarized in Table 2. A completed Puro Geologically Stored Carbon Methodology Compliance Checklist used during the verification is attached to this report as Appendix 1. Photographs of the facility, equipment, and operations are provided in Appendix 2. Verifier qualifications are attached as Appendix 3.

TABLE 2. AUDIT ACTIVITIES

Date(s)	Verification Activity	Verification Tasks	Documents Reviewed
Dec 14-20, 2023	Introductory Document Review	- Review of LCA and supporting documentation - Review of Puro CORC calculations - Review of facility registries and permits	- Facility Details in Registry - Red Trail Energy,LLC.pdf - Organization Details in Registry - Red Trail Energy LLC - Project_Plan_RTE_FINAL.pdf - _LCA Report RTE 2023_FINAL_A.pdf - RTE – puro_LCA Model – GCS_G.xls - RTE – puro_LCA Result reporting – GSC_B.xls - System boundary-RTE-CCS_11102023.ppt - Enetek explanation of issue with Coriolis meter.pdf - Roughrider Electric 07.31.23.pdf - RTE Information Update 11132023.xls - 1.2 GENERAL ARRANGEMENT DRAWINGS Salof - Buildings square footage.pdf - rte-capture-design-package - pipeline length.pdf - S20007 Red Trail Tagged Equipment 2021.11.10 - Eco.xls - Table 15 - S20007-RTE-Electrical Equipment - Eco.xls - RTE Equipment and Infrastructure Efs - Part 1 and 2.xls - TITLE V PERMIT TO OPERATE - (Current).pdf - CO_2 analysis constitutes from Scrubber 4-2-2019.pdf - Evidence of the permanent storage.doc
Dec 14 – 22, 2023	Data Review (reporting period June 2022 – July 2023)	- Review of raw material sources and sustainability - Review of system inputs and outputs - Review evidence of product output - Review of product properties - Review of product end use - Review of finances and additionality claims	- 03_Puro additionality questions to suppliers v 1.8.doc - 5 Year Projection with CCS.xls, 5 Year Projection without CCS.xls - 45-Q Tax Credit Analysis.doc - Capital Costs CCS Project. xls - Project_Plan_RTE_FINAL-Additionality Addendum.doc - Red Trail Energy Business Feasibility Study PPT 5-2020v3.pdf - Attestation of no double counting or double claiming.pdf - 01_Stakeholder Engagement EERC OutreachToolkit Nov 21.pdf - 01_Stakeholder Engagement Report.doc - 01_Stakeholder Engagement Report - List of Feedback.doc - 01_Stakeholder Engagement Table of Participants.xls - 01_Stakeholder Invitation.xls - RTE Broom Creek Storage Facility Certificates signed 4.4.23.pdf - Voluntary and Obligated Market Allocation Method.doc - Red Trail CO_2 tonnes injected – Platform Update 1.25.2024.xls - RPMG Equalization **.pdf - ETS FTM Reports CAN - **.xls, ETS Load Volume E85 - **.xls
Dec 21, 2023	On-site Visit	- Opening meeting and process walk through - Witness of operations, measurement points, and instrumentation - Review of equipment and calibrations, independent measurement cross checks - Review of intake and production data collection - Confirmation of company and facility administrative details - Confirmation of facility environmental and social safeguards	- Verifier observations of operations, measurement points, and instrumentation (see compliance checklist) - Review of above listed files as needed for clarification - Wellhead flowmeter calibration certificate.pdf - RTE CO_2 Nov 21 2023.pdf (laboratory report)

3.2. PROCESS INPUTS & OUTPUTS

The system boundary for the RTE CCS process starts at the gate of the CO_2 processing facility, first treating the exhaust gas received from the ethanol plant. The ethanol production facility is outside of the system boundary considered for this project. Furthermore, the LCA is carried out considering both (a) upstream or background systems, which are responsible for producing and supplying raw materials (e.g., equipment, infrastructures, fuels) to the CCS-facility, and (b) facility or foreground systems, where actual processing of fermented CO_2 takes place and of which this evaluation is carried upon (see Figure 2).

For geologically stored carbon CORCs, the functional unit is 1 kg of CO_2 captured and stored in a compliant storage site. The injected CO_2 is greater than 99.9% purity and contains some trace quantities of nitrogen and oxygen. The process uses electricity only for operation of equipment.

RTE's CCS process produces very little to no waste products and has very limited emissions of any kind from the facility. Wastes produced from the CCS process (primarily water removed from the captured CO_2 stream) are recycled back to the fermentation process. There are no air emission points outside of process bypass equipment which is not used during normal operations. No bypass or venting events were recorded during the reporting period. All CO_2 capture is processed (water removal, trace organic and inorganic contaminant removal, compression, and liquefaction) and injected at the wellhead. Table 3 summarizes the observed inputs and outputs from the process and typical rates from supplied operational data.

TABLE 3. VERIFIED PRODUCTION FACILITY INPUTS & OUTPUTS

Input/Output	Verified Rate For Reporting Period[1]	Notes (Specifications, source, etc.)
CO_2 injected ($C_{injected}$)	182,007 tonne	Biogenic CO_2 captured from fermentation process and injected during reporting period June 2022 – July 2023, as measured at wellhead (dry basis).
Water	-	Water removed from captured CO_2 recycled to fermentation process.
Electricity use (Blowers, pumps, compressors, chillers, controls)	33,256 MWh	Power consumption during reporting period for all equipment within the CO_2 capture and injection boundary, measured using utility revenue grade metering.
Electrical and mechanical equipment, infrastructure, pipeline, monitoring and injection wells, controls[2]	NA	Basis for LCA emission factors for primary CCS process equipment and infrastructure (Ecoinvent V3.3.1 and GREET 2022 databases used for emission factors and calculation).

[1] CORC calculations are based on the net CO_2 emission rate determined and verified in the LCA for RTE by EcoEngineers. The values of inputs during the reporting period are verified and reported here for completeness.
[2] The materials required for the wellbore construction is estimated based on the wellbore design. For the wellbore construction, carbon resistant cement is assumed as raw materials being used. As the EFs of such materials are not available, the EF of the Portland cement is assumed as a substitute data. Due to the lack of EF data for specific steel grades, generic steel production data for the U.S. is used for pipeline construction and skid production. For the wellbore tubing chromium steel 18-8 data is used in place of 13 Cr.80.

3.3 VERIFIED OUTPUT AND CORCS

Table 4 includes the specific CORCs claimed by RTE for its Richardton facility during the reporting period, as well as the level verified by 350Solutions during the on-site audit and data review.

TABLE 4. VERIFIED CORCS FOR RED TRAIL ENERGY

Performance Metric Name / Description	Verified Value	Data Sources	Reporting Period
Net CO_2 Removal Factor[1]	-0.866	LCA Report RTE 2023_FINAL_A.pdf, RTE – puro_LCA Model – GCS_G.xls, RTE – puro_LCA Result reporting – GSC_B.xls, RTE Information Update 11132023.xls, Red Trail CO2 tonnes injected – Final.xls, RPMG Equalization **.pdf, ETS FTM Reports CAN - **.xls, ETS Load Volume E85 - **.xls	June 2022 – July 2023
CO_2 Captured ($C_{injected}$)	182,007 tonne		
CCS Process emissions ($E_{capture}$, $E_{transport}$, and $E_{injection}$)[2]	22,849 tonne CO_{2e}		
Emissions from construction of CCS equipment ($E_{equipment}$)	1,566 tonne CO_{2e}		
CORCs	157,592 tonne CO_{2e}		
CORCs Retired	44,276 tonne CO_{2e}		

1 *Defined in LCA as carbon intensity (CI): as how many grams of carbon dioxide (CO_2) are released in the entire process of capturing and storing 1 kg of CO_2. A negative number means that carbon is removed/injected more than released/emitted.*

2 *C_{loss} is defined as zero for the CCS process, with CO_2 flow monitoring conducted at the capture point (CO_2 capture at fermentation) and the wellhead injection point.*

RTE reports the amount of CO_2 injected monthly to the North Dakota Industrial Commission (NDIC) for Class VI well compliance. A total of 182,007 tonnes of CO_2 were injected during the reporting period. The project emissions are subtracted from total tonnes injected to arrive at the total net CO_2 removal tonnes. The project emissions and construction emissions equal 24,415 tonnes CO_2 leaving a net of 157,592 CO_2 removal tonnes to be issued as CORCs.

The CORCs are allocated between voluntary carbon markets (VCM) and low carbon fuel markets (LCFS). RTE's sales of ethanol gallons are tracked on a monthly basis and broken down between sales into LCFS - where the carbon tonnes associated with those gallons would be transferred into that market, including the bio-CCS carbon sequestration - and non-low carbon fuel markets where the bio-CCS carbon tonnes are not associated/allocated with those gallons and are available for sale on the VCM. The ethanol gallon sales are used to create a percentage to allocate CORCs.

The monthly sales percentages were used to allocate carbon tonnes on a monthly basis. The allocations, and supporting sales records, are tracked on a monthly basis by RTE in "Red Trail CO_2 tonnes injected –

Platform Update 1.25.2024.xls" which were reviewed and verified during the site visit. Quantification of CORCs eligible for VCM is further illustrated in Figure 4 below.

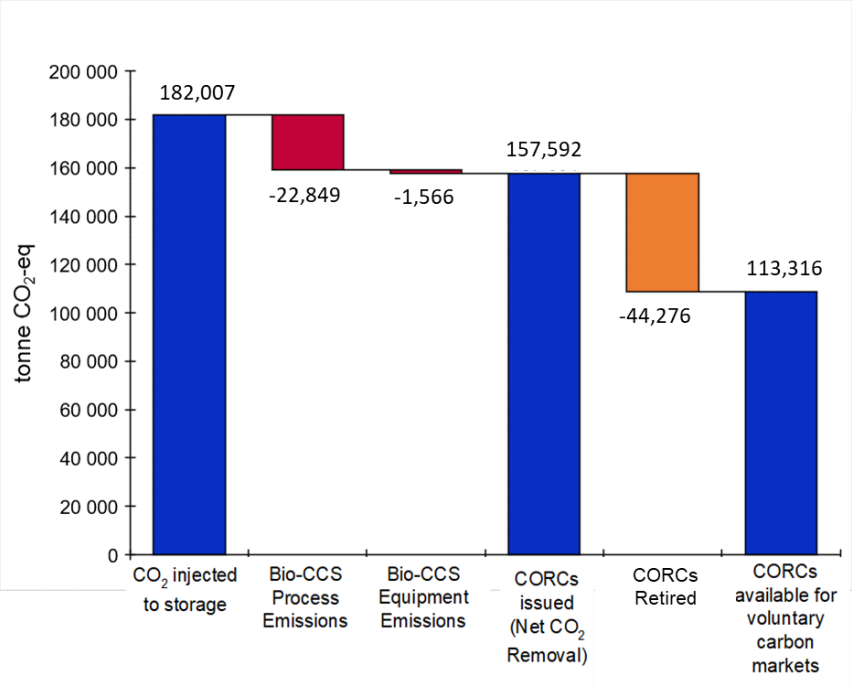

FIGURE 4. QUANTIFICATION OF RED TRAIL ENERGY CORCS FOR THE REPORTING PERIOD

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 and the Geologically Stored Carbon Methodology***

☐ ***Meets the requirements of the Puro General Rules and the Geologically Stored Carbon Methodology with minor modifications***

☐ ***Does Not Meet the requirements of the Puro Standard General Rules and the Geologically Stored Carbon Methodology***

A summary of specific findings associated with each requirement of the Puro Standard and Geologically Stored Carbon Methodology and any identified issues with the audit are summarized below.

TABLE 5. AUDIT FINDINGS

Puro Standard GSC Method. Section Ref.	Audit Verification Topic	Final Findings
1.1.	*Eligible Activity Type*	Acceptable – The site is suitable for geological sequestration of biogenic CO_2 being injected in an NDIC compliant Class VI well.
1.2.	*Eligibility Requirements*	Acceptable – RTE is an LLC registered with the Puro Registry for the listing of CO_2 removal Certificates (CORCs). They achieve this by sequestering biogenic CO_2 from the ethanol production process that would otherwise be vented to the atmosphere. Biogenic CO_2 fraction via carbon isotope (C14) results 99%. RTE has demonstrated conformance to the EU directive RED II as a 1st generation ethanol plant. Environmental assessments and historical records confirm corn as feedstock, and that the associated agricultural land was never previously an area of high biodiversity value, nor did it transition from regions with high carbon stock. RTE has documented committal to disclose fossil energy consumption and maintain level or reduced fossil energy consumption over time.
1.3. *5.1.2* *5.1.3*	*CO2 Removal Supplier*	Acceptable –RTE has contracts with biomass suppliers to demonstrate feedstock sustainability. The facility can record the mass of CO_2 sequestered and demonstrate the mass injected. Facility maintains an NDIC permit showing that the Class VI UIC program meets or exceeds the stringency of the federal EPA Class VI program. The quantification of the CO_2 is finalized by third-party CO_2 purity analysis of representative injection gas samples.
2.	*Point of creation of the CO2 Removal Certificate (CORC)*	Acceptable – Verified accurate monitoring of CO_2 injection rates at point of removal. RTE is the operator of the sequestration site and owner of the contracts for the for the carbon containing waste.
3.1	*Life-Cycle Analysis (LCA) Boundary*	Acceptable - The activity boundary includes all activities existing solely for the purpose of CO2 Removal. The LCA boundary begins with the capture of the carbon containing wastes, includes emissions associated with all equipment and inputs utilized for CO_2 processing and transport, proceeding to the injection site, includes all onsite operations energy usage and emissions, and monitoring of the wells. The upstream production of the carbon containing ethanol product is not included in the LCA since they are not produced for the purpose of sequestration.
3.2 *4.3.3*	*Activity emissions within the LCA boundary*	Acceptable –Onsite energy consumption associated with capture, compression, water removal, liquefaction, and transport to the wellhead is measured and recorded. All emission factors used for associated equipment and activities are lifecycle based, include cradle-to-grave considerations, and are estimated using GREET 2022 and Ecoinvent v3.3.1 databases.
3.3 *4.2.1 – 4.2.5*	*Feedstock emissions within the LCA boundary*	Acceptable – Feedstock emissions are associated with ethanol production and outside of the CCS boundary for CO_2 capture and storage.
3.4	*Equipment/Facility emissions within the LCA boundary*	Acceptable – All emission factors used for associated equipment and activities are included in the LCA GREET 2022 and Ecoinvent v3.3.1 databases. Note that all equipment emissions are accounted for during this reporting period.

3.5	*Emissions outside the LCA boundary*	Acceptable – Emissions associated with operations not purpose built for CO_2 sequestration are outside the boundary.
4.1 *4.3.1* *4.3.2* ***4.4*** ***5.2***	*Net Negative LCA*	Acceptable - RTE has demonstrated an appropriate basis for CORCs according to the Puro Methodology. The LCA was completed and independently verified. The LCA utilizes appropriate system boundaries and results in a net negative LCA.
4.5	*Uncertainty assessment*	Partially Acceptable - RTE uses conservative values in the LCA, however, the uncertainty range of the values was not fully included. Activity supporting measurements (CO_2 capture and injection rates, waste gas CO_2 purity analyses) are conducted using high quality procedures and best practices. A documented uncertainty analysis would improve compliance, see Verifier Checklist-Uncertainty Analysis findings for context.
5.3	*Permanence*	Acceptable – The injection well and storage site are properly permitted and permit compliance demonstrated, Including permanence and monitoring requirements (RTE utilizes state permitted Class VI well for injection of liquid CO_2).
5.4	*Evidence against double counting*	Acceptable – Attestations of RTE sole ownership of CO2 claims provided. No claims of ownership by other parties can be made. Carbon market allocations for ethanol sale compliance obligation claims are quantified, tracked, and reported.

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

4.2. AUDIT ISSUES

Conformance to the Puro Standard and Methodology is demonstrated, no further action is required. Additional information was provided by RTE as requested after the site visit to support all data, claims, and verified CORC values.

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

4.3. RECOMMENDATIONS & OPPORTUNITIES FOR IMPROVEMENT

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

Recommendations for improving the quality of data, accuracy, and verifiability of the LCA and CORC claims in the future include:

- Continue collection of gas samples for CO_2 purity analyses on no less than quarterly intervals. Use results to compile statistical analyses with respect to CO_2 purity variability and adjust sampling intervals accordingly. Currently seven sample analyses average CO_2 = 99.95% with standard deviation 0.064

- Although overall measurement uncertainty, as a function of Coriolis flow meter accuracy and CO_2 analytical results accuracy and variability, is expected to be very low, conduct an uncertainty analysis that will allow the use of error bars around the total reporting period CO_2 injection values for completeness.
- There is significant research underway at the facility related to characterization of the CO_2 storage plume within the Broom Creek formation. If possible, report findings of these efforts as they become available, particularly with respect to verification of the permanence of the storage as it relates to the project.
- Ensure documentation of any changes in operations, equipment, capture and injection rates throughout subsequent reporting periods.

5. REVISION HISTORY

Original date of issue: December 29, 2023

Version	Date Issued	Noted Changes
Draft Versions (v1.0)	December 29, 2023	NA
Draft Version (v1.1)	January 16, 2024	Comments from Puro reviewers, final CORC calculations
Draft Version (v1.2)	January 28, 2024	Comments from RTE reviewers, updated CORC calculations
Draft Version (v1.3)	January 31, 2024	Compilation and incorporation of reviewer comments, redactions for public dissemination
Final Version (v1.4)	February 16, 2024	Final edits from Puro and Red Trail reviewers

REFERENCES

[1] Puro.Earth, *Puro Standard General Rules, Version 3.1, Edition 2023.* https://puro.earth/puro-standard-carbon-removal-credits/

[2] Puro.Earth, *Geologically Stored Carbon Methodology, Edition 2021.* https://puro.earth/articles/beccs-and-geologically-stored-carbon-methodology-webinar-1-616?type=webinars-and-videos

See Appendix 1 for list of specific files reviewed during the verification audit.

APPENDIX 1: PURO.EARTH GEOLOGICALLY STORED CARBON METHODOLOGY AUDIT CHECKLIST

Puro.Earth Storage Facility and Output Audit Geologically Stored Carbon Methodology	
Company Name (Supplier)	**Red Trail Energy LLC**
Audit ID	350PU2309
Audit Inception Date	24 March 2023
Production Facility ID	GSRN 643002406801001142
Production Facility Location	3682 North Dakota 8, Richardton, ND 58652
Auditing Body	350Solutions
Auditor Initials or Name	Bill Chatterton
Auditor QA Initials or Name	Tim Hansen

Checklist Version: 1.1 (February 15, 2023)

Topic Area	Guideline Reference	Requirement	Requirement Met Y/N or Not Applicable (NA)	Compliance Evidence Provided Insert evidence used to verify requirement	Site Visit Findings If applicable	Verification Remarks Insert auditors comments	Value Insert numerical value or description (if applicable)	Units Insert unit (if applicable)
Production Facility Standing Data Confirmation - The following standing data has been collected from Puro and checked for consistency against other evidence:								
Facility Data	Puro General Rules v3.0 (PGR) - 2.2	**Verification of the CO2 Removal Supplier that is registering Production Facility**	Y	Facility Details in Registry - Red Trail Energy, LLC.pdf, Project_Plan_RTE_FINAL.pdf	Red Trail Energy LLC (RTE) owns and operates an ethanol production plant, CO2 capture systems at the plant, and on-site injection of CO2 into storage	RTE is current owner/supplier.		
		A certified trade registry extract (business license/registration, etc.) for the CO2 Removal Supplier	Y	Facility Details in Registry - Red Trail Energy, LLC.pdf, Organization Details in Registry - Red Trail Energy, LLC				
		Evidence of the location of the Production Facility	Y	On-site identification and inspection	Production facility visited and toured			
		Evidence of the Volume of Output for the full calendar year prior to registration	Y	Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE Information Update 11132023.xls	Monthly records of CO2 mass injected, measured using coriolis meter with metrological traceability	14 month perod 6/22 to 7/23 reported 182,000 tonne CO2 injected		
		Evidence of the Removal Method(s) for which the facility is eligible to receive CORCs	Y	Site observation of entire process in operation; Project_Plan_RTE_FINAL.pdf, System boundary-RTE-CCS_11102023.ppt, Puro_LCA Report RTE 2023_FINAL_A.pdf	conforms to requirements of Puro standard and Geoligically Stored Carbon Methodology			
		Evidence of the date on which the Facility became eligible to receive CORCs	Y	Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE Information Update 11132023.xls	Review of operational data during the reporting period			
		If the Production Facility has benefited from public support, evidence to show this	Y	01_Stakeholder Engagement EERC OutreachToolkit Nov 21.pdf, 01_Stakeholder Engagement Report.doc, 01_Stakeholder Engagement Report - List of Feedback.doc		Significant documented outreach and public support campaign.		

Eligibility Checklist								
General Eligibility Requirements	Puro Geologically Stored Carbon Methodology - 2021 - (GSCM) 1.1 Eligible capture & storage types	**The production facility is technologically capable of increasing geologically stored carbon stock by storing CO2 or other GHGs captured directly from atmosphere or from biogenic sources.**	Y	Site observation of entire process in operation; Project_Plan_RTE_FINAL.pdf, System boundary-RTE-CCS_11102023.ppt, rte-capture-design-package - pipeline length.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf	Full tour of production facility including feedstock delivery, ethanol production, CO2 capture from fermentation process, CO2 processing and liquifaction, CO2 transport to well head, and CO2 injection.	RTE owns and operates an ethanol production plant near Richardton, North Dakota, placed into service in January 2007 and is capable of producing in excess of 50 million gallons of ethanol per year. The project captures CO2 generated by the fermentation process . Fermentation exhaust is cleaned using a water scrubber to produce a purity stream of CO2. From the scrubber CO2 exhaust is pressurized, dehydrated cooled, distilled and pumped through a flowline to an injection well onsite where it is sequestered permanently in the Broom Creek formation. The injected gas has high CO2 purity (greater than 99.9%) .		
		The production facility utilizes eligible geological storage type: A. Direct injection of CO2 into geological formations EPA Class VI or EU CCS); B. Injection of carbon containing substance in reservoir (EPA Class I, II); or C. Storage in oil and gas reservoirs as part of EOR+ (EPA Class II well storage with more CO2 injected than CO2e in oil extracted).	Y	Evidence of the permanent storage.doc, TITLE V PERMIT TO OPERATE - (Current).pdf, RTE Broom Creek Storage Facility Certicates signed 4.4.23.pdf, https://www.dmr.nd.gov/dmr/oilgas/ClassVI,	Well heads were physically observed and permits/monitoring reports for the wells were supplied by RTE	RTE utilizes state permitted Class VI well for injection of liquid CO2, see "RTE 10 (WF 37229) – Class VI injection permit"		
		The production facility utilizes eligible carbon capture types: A. Direct air capture; B. Biogenic CO2 from combustion of biomass, bioliquids, or biogas (i.e. BECCS, bio-CCS); C. Biogenic CO2 traction from incineration of biomass mixed with other substances; D. Biogenic CO2 from biogas upgrading process; E. Biogenic CO2 capture from oxidization of biogenic materials in industrial processes; or F. Biogenic carbon-containing substance.	Y	CO2 analysis constitutes from Scrubber 4-2-2019.pdf, Site observation of entire process in operation; Project_Plan_RTE_FINAL.pdf, System boundary-RTE-CCS_11102023.ppt, Puro_LCA Report RTE 2023_FINAL_A.pdf	Type F:Biogenic carbon-containing substance, ethanol production from corn feestock	Type F:Biogenic carbon-containing substance, ethanol production from corn feestock		
	GSCM 1.2.2	**Evidence of geological storage permanence - eligible geological storages are controlled by EU or US laws and authorities or following similar requirements as set out by those legislations (See Row 13)**	Y	Evidence of the permanent storage.doc, TITLE V PERMIT TO OPERATE - (Current).pdf, RTE Broom Creek Storage Facility Certicates signed 4.4.23.pdf, https://www.dmr.nd.gov/dmr/oilgas/ClassVI,	numerous studies underway by EERC and RTE in regard to monitoring the co2 plume,			
	GSCM 1.2.3	**Evidence of biogenic CO2 source sustainability (see also GSCM Section 5.1.3)**	Y	Project_Plan_RTE_FINAL.pdf, Red Trail Energy Businesss Feasibility Study PPT 5-2020v3.pdf, CO2 analysis constitutes from Scrubber 4-2-2019.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf,	Evidence of feedstock sustainability, see Section 2.1.3 of Project Plan	RTE secures and grinds approximately 22 million bushels of corn per year as feedstock for its dry milling process The corn is supplied primarily by farmers and local grain elevators in North Dakota and South Dakota According to the USDA North Dakota and South Dakota produced approximately 455 and 567 million bushels of corn, respectively, in 2019		
	GSCM 1.2.4	**Only biogenic CO2 source is counted if a mixed fossil-biogenic flue gas or similar mixed sources is used**	NA	Project_Plan_RTE_FINAL.pdf, System boundary-RTE-CCS_11102023.ppt, Puro_LCA Report RTE 2023_FINAL_A.pdf	Confirmed biogenic sourced CO2 from ethanol production only			
	GSCM 1.2.5	**The activities should do no net harm to environment, e.g. cause deforestation, loss of biodiversity or to society through loss of arable land and decreased food security, chemical emissions or health risks.**	Y	Project_Plan_RTE_FINAL.pdf (Section 2.1), Evidence of the permanent storage.doc, TITLE V PERMIT TO OPERATE - (Current).pdf, https://www.dmr.nd.gov/dmr/oilgas/ClassVI,		All processes located on RTE property, public outreach activiites completed, fully permitted by relevant jurisdictions, plant has been in production since 2007, and feedstocks are demonstrated sustainable.		
	GSCM 1.3.1, 5.1.3	**The CO2 Removal Supplier is capable of metering CO2e injected reliably and consistently via appropriate metering technology and C content of injected CO2 or biomass stream (see also Section 4)**	Y	Project_Plan_RTE_FINAL.pdf (Section 3), Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE Information Update 11132023.xls, rte-capture-design-package - pipeline length.pdf	Coriolis meters audit and observation, purity analyses. Review of PFD and PID in design package doc	mass flow of CO2 metering is verified acceptable. Purity testing of CO2 is conducted through off-site analysis of collected samples, on a quarterly basis. Laboratory is ISO 17025 accredited.		
	GSCM 1.3.1, 5.2	**The CO2 Removal Supplier is capable of calculating the net CO2 removal using an appropriate lifecycle emissions approach, providing all calculation details, assumptions, and results reliably and consistently**	Y	Project_Plan_RTE_FINAL.pdf (Section 3), Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE Information Update 11132023.xls	review corc calcs in LCA	LCA completed by EcoEngineering. All supporting data provided by RTE and verified by EcoEngineering for use in LCA. LCA approaches and calculations all reviewed and verified.		
	EU directive RED II	**a. The only eligible type of 1st generation ethanol plants are the plants have produced 1st generation ethanol for a minimum of 5 years with the same feedstock and same land use. b. The 1st generation ethanol plant commits to disclose its fossil energy consumption for ethanol production and aim to maintain the same level or reduce the consumption over time.**	Y	Project_Plan_RTE_FINAL.pdf (Section 3), Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE Information Update 11132023.xls	Acceptable	The land adjacent to RTE is agricultural land that has been farmed since at least 1972 based on direct aerial photography as noted in a Phase I Environmental Site Assessment report. Historical records confirm that the adjacent agricultural land was never previously an area of high biodiversity value, nor did it transition from regions with high carbon stock after January 2008. This meets the biomass sustainability requirement as per the EU directive RED II		
Supplier Contractual Arrangements	GSCM 1.3.2, 2.2, 2.3	**The CO2 Removal Supplier can prove with contracts or authorization its sole ownership of the carbon removal attribute of the permanently stored carbon.**	Y	Project_Plan_RTE_FINAL.pdf (Section 1), Red Trail Energy Businesss Feasibility Study PPT 5-2020v3.pdf, Facility Details in Registry - Red Trail Energy, LLC.pdf, Organization Details in Registry - Red Trail Energy, LLC	see permits and project plan	owner of ethanol production and CO2 captured, no outside contracts or agreements		
	GSCM 2.3.2.2, 1.3.2.3, 1.3.2.4	**Where the CO2 Removal Supplier does not manage and own all aspects of the removal process (i.e. capture, transport logistics, injection & storage), evidence is provided for any contracted entities or partners including (1) the CO2 capture operator OR feedstock supplier, (2) the Storage or injection site owner and operator, (3) the logistics / transportation operator that: - each entity is properly registered as a business and a certified trade registry extract (business license or registration) is provided for each; - each entity is properly licensed, permitted, and in compliance with laws of the host country - the entity is in a contractual agreement with the CO2 Removal Supplier with the intent to produce permanent carbon removal and storage - the capture or biogenic source operator has sole ownership of the CO2 or carbon containing substance - the entity attests or is contractually obligated to not claim any carbon removal attributes - contracts require allowance for the auditing of the entity facilities, equipment, and documents for Carbon Removal Certificate issuance purposes - the contract durations are appropriate for the duration of the project, with storage contracts being valid for at least a 5 year period and the storage contract dates align with the permit dates**	Y		All aspects of CO2 production and capture, processing and injection are owned by removal supplier	All corn feedstocks provided by regional growers, contracts are available for review if required.		
	GSCM 1.3.2.3	**The storage facility operator is properly permitted as an eligible facility (See 1.1 Row 13) under relevant national requirements to store the amount of CO2 or carbon containing substance contracted for the life of the project**	Y	Evidence of the permanent storage.doc, TITLE V PERMIT TO OPERATE - (Current).pdf, https://www.dmr.nd.gov/dmr/oilgas/ClassVI,	Fully permitted with North Dakota for storage facilities injection well, as well as operating permits			
Additionality	PGR 2.1.3, Puro Additionality Assessment Requirements v1.0	CO2 Removal Supplier demonstrates 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. - Provide calculated internal rate of return (IRR) for the project (with and without carbon finance) and counterfactual baseline, as well as alternatives, if applicable, that are market relevant - Provide IRR analysis as spreadsheet with all cells, formulas, and assumptions unprotected and available for review - Provide a public version of the IRR analysis, unless clear justification is provided - Utilize CORC prices in the IRR analysis based on the available CORC Index - Provide a sensitivity analysis to demonstrate the impact of variation in key assumptions on the improved IRR - Show that the project is not required by existing laws, regulations, or other binding obligations.	Y	03_Puro additionality questions to suppliers v 1.8.doc, 5 Year Projection with CCS.xls, 5 Year Projection without CCS.xls, 45-Q Tax Credit Analysis.doc, Capital Costs CCS Project. Xls, Project_Plan_RTE_FINAL-Additionality Addendum.doc, Red Trail Energy Businesss Feasibility Study PPT 5-2020v3.pdf	See Puro additionality questions/responses, and financial data with and without CCS, overview at site visit.	Other wastes do not cover the cost of operations.		

Production (Capture & Storage) Facility Checklist (Desktop, Verbal, or Site Visit Confirmation)								
Environmental & Social Safeguards	PGR - 2.1.2 GSCM 1.2.6	**Evidence to demonstrate Environmental and Social Safeguards and proper environmental permitting and practices (e.g. environmental impact statement, air permit, wastewater permit, proper recycling or disposal of solid wastes, and compliance status of all)**	Y	Evidence of the permanent storage.doc, TITLE V PERMIT TO OPERATE - [Current].pdf, https://www.dmr.nd.gov/dmr/oilgas/ClassVI,	Title V permit to operate and appropriate state level permits for geologic storage were provided and confirmed	State level facility permits on the ND Dept of Mineral Resources website include: •Red Trail Richardton Ethanol Broom Creek Storage Facility #1, Stark County oCase 28848 – Certificate, draft permit, fact sheet, and storage facility permit application oOrder 31453 – Geological storage of carbon dioxide oOrder 31454 – Amalgamation of the storage reservoir pore space oOrder 31455 – Determination of financial responsibility oRTE 10 (WF 37229) – Class VI injection permit		
		Evidence is provided that the CO2 Removal Supplier has engaged relevant stakeholders and the public regarding the CO2 removal storage project. This may include, for example, evidence of public notification, public meetings, or input during injection well permitting process, documentation of complaints process, including any complaints and responses, or other similar activities	Y	01_Stakeholder Engagement EERC OutreachToolkit Nov 21.pdf, 01_Stakeholder Engagement Report.doc, 01_Stakeholder Engagement Report - List of Feedback.doc	Public science-based and community-focused outreach efforts by RTE are well documented including stakeholder meetings and Q&A, attendees, and other public outreach activities scheduled throughout CCS implementation	The files sent show the documentation surrounding the public meetings, stakeholder feedback, and RTE responses to stakeholder questions/concerns.		
Lifecycle Analysis / Activity Boundary for Net Negativity	Annex G - 3 (Lifecycle GHG Emissions Boundary & Method	**GHG emissions have to be assessed and reported following the LCA calculation principles of ISO, WRI or PAS2050**	Y	On-site observation of entire process in operation, Puro_LCA Report RTE 2023_FINAL_A.pdf		Verified conformant, used Oregon GREET carbon intensity values		
	GSCM 3.1	**The activity boundary includes all activities existing solely for the purpose of CO2 Removal. These include the carbon capture, transportation and storing into the geological storages, and biomass cradle to gate if biomass is purpose-grown for carbon removal.**	Y	Project_Plan_RTE_FINAL.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf, System boundary-RTE-CCS_11102023.ppt	Viewed and verified during site visit and review of documentation	LCA boundaries start with the capture of CO2 from the ethanol fermentation process and includes CO2e for purification (water organic, and inorganic controls), compression, cooling, geologic injection, and site monitoring.		
	GSCM 3.2, 3.3, 3.4	**Emissions within the activity boundary include: - All activities related to capturing (e.g. capture, liquefaction), - transporting (e.g. through pipelines or by shipping) and - storing (e.g. intermediate storages, injection) of the CO2 - CO2 emissions resulting from these activities; - Purpose-grown biomass (e.g. emissions from cultivation, harvesting and transportation of the biomass cradle-to-gate) if the biomass is solely grown for CO2 removal purposes; - Purpose-built equipment and facilities (e.g. emissions from materials and construction), and; - Other activities that do not exist solely for the purpose of CO2 removal even if they are physically connected to carbon capture.**	Y	Project_Plan_RTE_FINAL.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf, System boundary-RTE-CCS_11102023.ppt	Viewed and verified during site visit and review of documentation	LCA boundaries start with the capture of CO2 from the ethanol fermentation process and includes CO2e for purification (scrubber), compression, cooling, geologic injection, and site monitoring. There are no transportation related emissions within the project boundary		
	PGR 2.1.4	**The Supplier has assessed all potential sources of leakage (i.e. increases in fossil emissions) outside of the project boundary but due to the development and operation of the project. Where identified, leakage sources are quantified and included in the LCA.**	Y	Project_Plan_RTE_FINAL.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf, System boundary-RTE-CCS_11102023.ppt	LCA also accounts for alternative fates of the products such as spreading on crop land, disposal via landfill, etc.	No economic leakage associated with project. An ISO 31000 conformant screening level risk assessment (SLRA) was condcuted to evaluate potential of subsurface leakage. This leakage assessment determined none of the pathways required corrective action and the probability of storage reversals are unlikely.		
	GSCM 3.5	**The LCA boundary does NOT include any of the following: - biomass cradle to gate if NOT purpose grown for carbon removal - emissions from any process creating biogenic carbon to be captured (e.g. waste treatment, bioenergy plant, biogas processing) that do not exist solely for the purpose of CO2 removal**	Y	Project_Plan_RTE_FINAL.pdf, Puro_LCA Report RTE 2023_FINAL_A.pdf, System boundary-RTE-CCS_11102023.ppt	Verified	All CO2 captured and stored by the supplier is byproduct of on-site ethanol fermentation process.		

Evidence of Quantification - Captured & injected CO2	GSCM 4.2.2, 5.1.1	**In the case of direct air capture, the Supplier demonstrates that the origin of their CO2 is atmospheric by providing operational data records that are able to rule out other origins of the CO2.** **- Evidence should include directly measured process data indicating the amount of CO2 captured and the plant performance (i.e. CO2 capture efficiency or CO2 material balance)** **- evidence must demonstrate that the CO2 amount delivered by the DAC plant is not greater than the actual plant performance would allow.**	NA	NA	NA	NA		
	GSCM 1.2.3, 4.2.2, 3.3, 5.1.3	**In the case of biogenic CO2 capture, the biomass is documented as sustainable (e.g. meets the requirements of EU directive REDII for sustainable biomass or similar).** **Where applicable, the monitoring and verification of sustainable biomass is done according to the process determined by RED II directive or similar and as implemented by national authorities, or via similar process if in an area where RED II is not applied.**	Y	Project_Plan_RTE_FINAL.pdf (Section 2.1)	Purchase agreements with regional providers confirmed, copies available if required.	Biomass sourced from land adjacent to RTE, as agricultrural land that has been farmed since at least 1972. Aligns with the sustainability standards set forth by the EU directive on land-use changes		
	GSCM 4.2.2, 5.1.2	**In the case of biogenic CO2 capture, the Supplier utilizes radiocarbon isotope analysis (14C, C-14, Carbon-14) (C14) results based on ISO 13833 or ASTM D6866 methods demonstrating biogenic fraction of the captured CO2.** **- analysis is performed periodically or continuously** **- analysis is performed by qualified persons** **- analysis is performed using properly calibrated equipment** **- for facilities using multiple or variable carbon containing sources, samples should typically be completed for each source type and delivery** **Note: Capture via DAC is excluded from this requirement.**	Y	CO2 analysis constitutes from Scrubber 4-2-2019.pdf, RTE CO2 Nov 21st 2023.pdf, and Email from Puro dated 2/16/2023: "The C-14 test is only needed when it is a mixed source of fossil and biogenic CO2." CO2 analysis constitutes from Scrubber 4-2-2019.pdf	All CO2 from ethanol production process. Biomass is not mixed with anthropogenic carbon.	radiocarbon isotopic analyses conducted by accredited laboratory (Isotech) March 2022. Ongoing periodic CO2 purity GC/MS analyses conducted on quarterly bases by accredited laboratory (Airborne Labs International, ISO 17025). Currently 7 sample analyses average CO2 = 99.95% with standard deviation 0.064	99.9	%
	GSCM 4.2.4	**For EOR+ applications, the CO2e in the extracted oil must be monitored and reported and deducted in the LCA from the total CO2 injected** **- evidence must be provided of accurate measurement of oil produced via EOR activity** **- evidence must be presented regarding total carbon content of the produced oil by appropriate analytical methods, using qualified laboratories and representative samples of produced oil**	NA	NA	NA	NA	NA	
	GSCM 4.2.5, 5.2.2	**The CO2 Removal Supplier has provided the total volume of CO2 captured or amount of carbon containing source (in kg and in kg CO2e) and supporting data and documentation. Documentation should clearly indicate any significant changes in capture process, process upsets, or stops.**	Y	RTE Information Update 11132023.xls, Puro_LCA Report RTE 2023_FINAL_A.pdf, Red Trail CO2 Tonnes Injected - Final 11-30.xls	monthly injection records reviewed, laboratory analyses reviewed.	182,005,000 kg CO2 injected into well during reporting period.	182,007,000	kgCO2e
	GSCM 5.2.3	**The CO2 Removal Supplier has provided the total transported volume of CO2 or carbon containing source (in kg) and supporting data and documentation. Documentation should clearly indicate each amount fed into a pipeline or loaded into a carrier vessel or vehicle AND the amount delivered and handed over to the CO2 Storage Operator.**	NA	NA	NA	Liquified CO2 transported from plant to injection well by pressure, via 4 inch underground pipe, associated emission included in CO2 capture and conditioning processes.	NA	kgCO2e
	GSCM 5.2.4	**The CO2 Removal Supplier has provided the total injected volume of CO2 (in kg CO2e) and supporting data and documentation. The Storage Operator must provide documentation of:** **- the CO2 amount received from the logistics operator** **- the amount of CO2 injected into geologic storage** **- the date of injection of the full amount from the CO2 Removal Supplier (which is the date the amount is eligible for CORCs)**	Y	RTE Information Update 11132023.xls, Puro_LCA Report RTE 2023_FINAL_A.pdf, Red Trail CO2 Tonnes Injected - Final 11-30.xls	All injection measurment systems and records reviewed and verified.	14 month period 6/22-7/23 = 182,007 tonne CO2 stored. Measured continuously throughout reporting period and compiled monthly for reporting. Instrumentation includes two Schneider coriolis meters, one at fermentation capture header and another at wellhead. Meters are ISO 17025 calibration certified to uncertainty of 0.04% of reading.	182,007,000	kgCO2e
Additional Supporting Evidence from CO2 Removal Supplier	GSCM 5.2.1	**GHG emissions are assessed and reported following the LCA calculation principles of ISO, WRI or PAS2050.**	Y	On-site observation of entire process in operation, Puro_LCA Report RTE 2023_FINAL_A.pdf and supporting documents	all equipment and inputs associated with activity included in LCA	Estimated using GREET 2022 and ecoinvent v3.3.1		
	GSCM 5.2.1	**The carbon balance assessment over the life-time of the project (LCA) covers the activity boundary set in GSCM section 3 and has been independently verified.**	Y	On-site observation of entire process in operation, Puro_LCA Report RTE 2023_FINAL_A.pdf		Verified		
	GSCM 5.3	**Evidence of permanent storage is provided, including:** **- shipping documents for the delivery of the captured CO2 or carbon containing source to a properly permitted eligible injection and storage site, indicating it is to be used for permanent storage of carbon** **- documentation that the storage site is classified and permitted under EU CCS Directive or EPA criteria (see GSCM 1.1) or under similar criteria for locations where neither criteria is applicable.**	Y	On-site observation of entire process in operation, Evidence of the permanent storage.doc, 37229 Class VI Permit.pdf	Observation of carbon being injected underground.	Reviewed, approved, and permitted as Class VI injection well activities in the State of North Dakota		
	GSCM 5.4.1	**Verified contracts or attestations of no double counting on the carbon removed by another party or by CO2 Removal Supplier. This should demonstrate that the CO2 removals are solely owned by the supplier. And no claims can be made by other parties. (See GSCM 2.3.2.2)**	Y	Attestation of no couble counting or double claiming 12.1.23.pdf, RTE Broom Creek Storage Facility Certicates signed 4.4.23.pdf, Voluntary and Obligated Market Allocation Method.doc, Red Trail CO2 Tonnes Injected - Final 11-30.xls		Fully certified by authorized supplier representatives. Monthly reporting includes quantification and documentation of total CO2 injected, net CO2 injected for project, and allocations for for ethanol sale compliance obligation claims		
	GSCM 5.4.2	**Attestations of no double counting on the carbon removed by CO2 Removal Supplier. This should demonstrate that** **- the CO2 Removals Supplier does not include the CO2 removals as part of its own carbon balance** **- the Supplier makes no marketing or branding claims or carbon neutrality or net negativity with other services provided by the supplier (such as waste treatment) if the CO2 removal certificates are sold or to be sold.**	Y					
	GSCM 4.5.3	**For EOR+ applications, the CO2e in the extracted oil must be monitored and reported and deducted in the LCA from the total CO2 injected** **- evidence must be provided of accurate measurement of oil produced via EOR activity** **- evidence must be presented regar**	NA	NA	NA	NA		

Quantification and Calculation Checklist - Output Audit								
Verified Calculated Values	GSCM 4.1	**CORCs are calculated in accordance with the GSCM Methodology as CORCs (kgCO2e) = $C_{captured}$ - $E_{project}$ - C_{loss}**	Y	Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE – puro_LCA Model – GCS_G.xls, RTE – puro_LCA Result reporting – GSC_B.xls, Red Trail CO2 Tonnes Injected - Platform Update 1.25.2024.xls	Etransport and Einjection, and Closs are assumed to be negligible (zero).	Though site visit, and review of data collected through period 6/22 to 7/23. Methodology verified conformant to methodology	157590 tonnes net CO2 injected	CORCs
	GSCM 4.4	**$C_{captured}$ = CO2 measured at the capture site (in kg CO2e). Eligible fraction is calculated following Sections 4.2.2-4.2.4. (see rows 34-38)**	Y			capture stated as NA (all CO2 is from on-site fermentation), and reported as CO2 injected	182,007,000	kgCO2e
	GSCM 4.4	**$E_{project}$ = $E_{capture}$ + $E_{transport}$ + $E_{injection}$ + $E_{equipment}$**	Y		includes compression, scrubbing, cooling, and injection energy, and embodied equipment emissions	Verified	24,415	kgCO2e
	GSCM 4.4	**Ecapture = includes all emissions from Capture phase, including energy use in capture, compression, and liquefaction, emissions from purpose grown biomass sourcing and conversion (i.e. to bio-oil), emissions related to capture chemicals (sorbents) or membranes, and system maintenance and regeneration.**	Y		Biogenic CO2 is acquired as waste in an as is form from existing fermentation processes, and does not include upstream LCA considerations	The alternative to sequestration is venting.	22,849	kgCO2e
	GSCM 4.4	**Etransport includes all emissions from transportation of captured CO2 from capture site to injection site, including those associated with vehicle fuel use, pumping energy, etc. Emission factors used should be documented and well accepted.**	Y	NA	No transportation confirmed		included in Ecapture	kgCO2e
	GSCM 4.4	**Einjection should include all emissions associated with injection, such as energy use for compression, pumping, injection, or any intermediate related activities such as storage.**	Y	Puro_LCA Report RTE 2023_FINAL_A.pdf, RTE – puro_LCA Model – GCS_G.xls, RTE – puro_LCA Result reporting – GSC_B.xls, Red Trail CO2 Tonnes Injected - Platform Update 1.25.2024.xls	Confirmed, power meters 202556, 201121, 210129, and 600097 dedicated to CCS operations	Power only, confirmed all relevant equipment included, power meter readings recorded monthly. Power meters are revenue grade utility meters owned and maintained by RoughRider Electric	included in Ecapture	kgCO2e
	GSCM 4.4	**Eequipment should include emissions from construction and delivery of capture and injection equipment, and associated with production and delivery of materials used to manufacture such equipment. Such emissions may be calculated using documented emission factors for the construction and materials processes or via a cost-based emission factor and the equipment capital costs.**	Y		verified all CCS process equipment included	Estimated using GREET 2022 and ecoinvent v3.3.1	1,566	kgCO2e
	GSCM 4.4	**C_{loss} = $C_{captured}$ - $C_{injected}$ Carbon losses are accounted for in the CORC calculation. Cinjected is the amount of carbon measured at the point of injection (for a single user / storage site or with separate injection wells and measurements at a multi user site). For a multi-user injection site where injected amount is not monitored directly or unambiguously (separate from other injections). Cinjected may be calculated based on calculated losses during transportation and injection as $C_{captured}$ $C_{transport}$($C_{etticiencylogistic}$)($C_{etticiencyinjection}$)**	Y		confirmed as no losses, coriolis meter at compression point invalid for certain periods	Verbal confirmation that losses are negligible	0.00	kgCO2e
Calculation Details & Considerations	GSCM 4.3.1	**Emissions from the Project is the sum of GHG emissions from the activity (geo-stored carbon) included within the activity boundary. Those are: direct emissions (scope 1 and 2) from capture, transport and injection as well as emissions from chemicals, membranes and purpose-built equipment including the construction and materials for the equipment.**	Y	Puro_LCA Report RTE 2023_FINAL_A.pdf	No additional carbon sources witnessed.			
	GSCM 4.3.2	**CO2 losses are regarded as any difference between CO2 captured (total in kgCO2e) and CO2 injected to storage (total in kgCO2e) (see section 4.4 calculation parameters). See Row 56**	Y		Onsite observation of the process, verbal confirmation			
	GSCM 4.3.3	**All emissions from energy use are within the activity boundary and are accounted for when quantifying the net CO2 Removal. Energy used for geo-stored carbon activities is not required to be 100 % carbon free.**	Y		Onsite observation of the process, verbal confirmation			
Uncertainty Quantification	GSCM 4.5.1	**If there is uncertainty in measurement of $C_{CAPTURED}$, $C_{INJECTED}$ or $C_{TRANSPORT}$ the lower end of the range is used in the quantification. Document uncertainty value and range.**	N	wellhead Flow meter calibration certificate.pdf, RTE CO2 Nov 21st 2023.pdf	Best practices used for measurement of Ccaptured and Cinjected	Uncertainty analysis not completed. Recommended in future for completeness		
	GSCM 4.5.2	**If there is uncertainty in metering or analyzing the carbon content of carbon-containing substance biogenic fraction of the captured CO2 due to sampling or testing techniques, the lower end of the range is used in the quantification. Document the observed range or uncertainty**	Y	wellhead Flow meter calibration certificate.pdf, RTE CO2 Nov 21st 2023.pdf	Inherent measurement error, process variability, and overall uncertainty is very low.	Uncertainty analysis recommended in future for completeness		

APPENDIX 2: SITE VISIT PHOTOS

Figure A2-1. RTE CCS Processing Facility

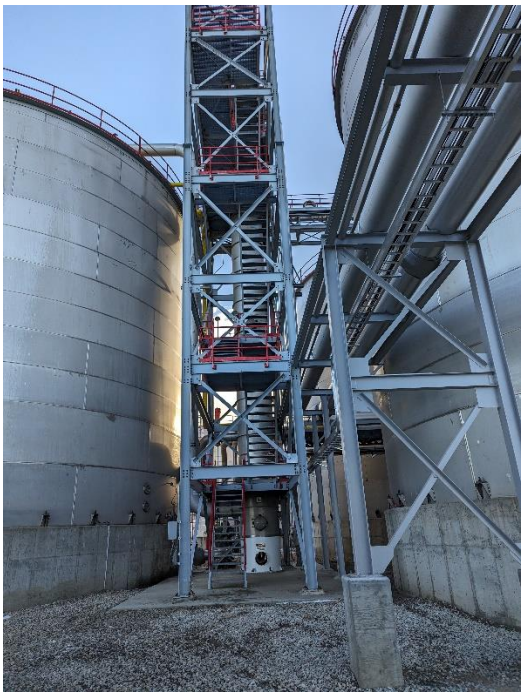

Figure A2-1. RTE CCS Facility: CO_2 Capture Header on Fermentation Vessels

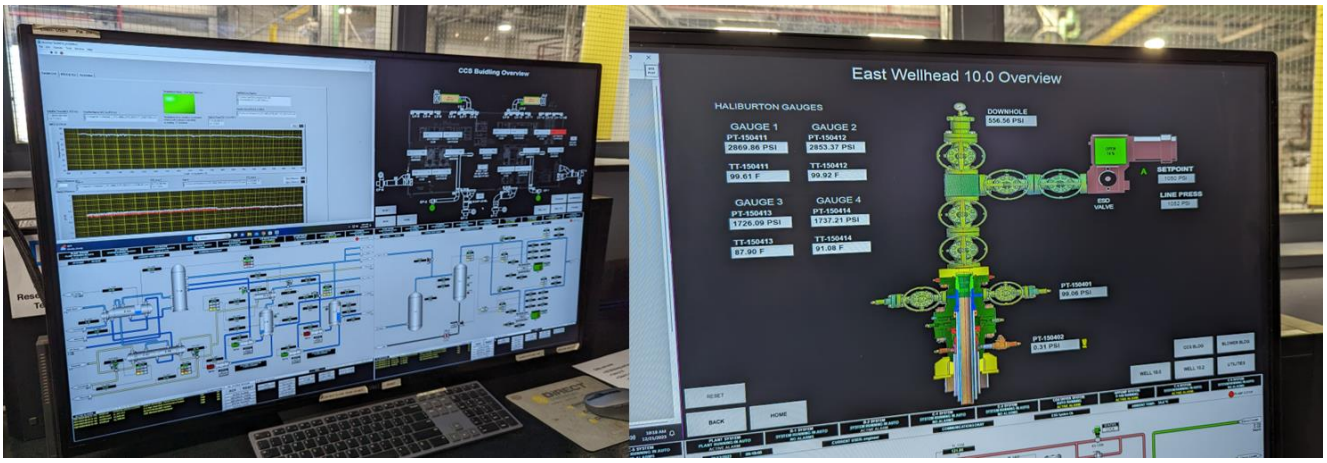

Figure A2-2. RTE CCS Process and Wellhead Control Screens

Figure A2-3. Calibrated Coriolis Meter at Injection Point

Figure A2-4. RTE CO_2 Wellhead

APPENDIX 3: VERIFIER QUALIFICATIONS

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

Verifier Qualifications

Company Name:	**Red Trail Energy, LLC**
Date:	**12/21/2023**

Verifier Name:	**Bill Chatterton**
Company Name (where applicable):	**350Solutions**
Verifier Contact Information:	**bill@350solutions.com, 984-215-0585**
Verifier Address:	**1053 E. Whitaker Mill Rd. Suite 115, Raleigh, NC 27604**
Verifier Scope of Activities:	**Output Audit through review of key technology components, operational data, and documentation.**

Verifier Qualifications	**Criteria Met?**	**Evidence / Notes** *(note how the criteria was met, specific documents - resume/CV, publications, certifications, etc.).*
Verifier has relevant technical knowledge of the type of technology being evaluated and carbon removal processes in general		
A) Does Verifier have:		
1. An in-depth technical knowledge of the technology type under verification;	☑	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 Environmental Technology Verification (ETV) as a Type A (third party) Inspection Body (ANAB Certificate Number: AI-2618). The technical scope of 350's accreditation includes verification of performance and environmental impact as it relates to design, materials, equipment, installation and operations of technologies in the categories of Energy, Clean Production and Process, and Air Pollution Monitoring and Abatement. As documented in 350Solutions' ETV Standard Operating Procedure (ETV QPM 350-223-03), and Quality Systems Procedures for verifier qualifications (QSP-350-005-02), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to verifier qualifications and procedures. These procedures and quality management programs are generally relevant to verification under the Puro.Earth General Standard. Note that verifications completed for Puro.Earth are not equivalent to ISO 14034 verifications. 350 staff have participated in the evaluation and verification of novel technologies that sequester carbon via various methods, including biomass conversion to liquids, solids, and other products which are then permanantly stored in ways such as land application or geologic storage, conversion of captured 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
2. Knowledge of specific risk areas associated with performance of such technologies (i.e. common failure points, performance issues, barriers to scaleup);	☑	
3. Knowledge of the environmental implications related to the use of the technology from a life cycle perspective, such as impact of the technology on lifecycle CO2 emissions and carbon removal;	☑	
4. Knowledge of relevant applicable test methods and standards for evaluating performance or impact of the technology;	☑	
5. Knowledge of relevant calculation, modeling, and statistical methods in order to assess test results and calculations of performance metrics and uncertainty, as applicable;	☑	
6. Knowledge of data quality and data validation approaches, including QA/QC procedures, for example.	☑	
Verifier is a credible independent 3rd party		
B) Is Verifier:		
1. third-party body independent of the team registered for the Puro Earth CORCs;	☑	350Solutions is accredited to ISO/IEC 17020:2012 and ISO 14034 ETV as a Type A (third party) Inspection Body. As documented in 350Solutions ETV Policy Manual (ETV QPM 350-200-03), 350Solutions conforms to the requirements of ISO 17020 Annex A with respect to impartiality for Type A inspections, pursuant to ISO 14034 activities.
2. Not directly involved in the design, manufacture or construction, marketing, installation, use or maintenance of the specific technologies submitted to Puro.Eargh for verification, or represent the parties engaged in those activities.	☑	
3. Not part of a legal entity that is engaged in design, manufacture, supply, installation, purchase, ownership, use or maintenance of the items inspected.	☑	

William Chatterton
350Solutions, Verification Program Manager

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

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

350Solutions: 08-2019 – Present
Verification Program Manager: As Verification Program Manager, Mr. Chatterton manages and executes technology performance demonstrations and verifications of emerging energy (efficiency and green building) and transportation technologies, primarily for U.S. governmental agencies, energy research associations, and state energy agencies. These performance evaluations generally involve evaluation of commercial feasibility, economic impacts (installation, operating, and capital costs, simple payback, and return on investment), environmental impacts (primarily greenhouse gas and criteria pollutant emission reductions), and technology performance. He also manages and monitors 350Solutions' quality management programs and ISO accreditations.

Southern Research Institute: 1999 - 2019
Program Manager, Energy & Environment Technologies: As Program Manager, Mr. Chatterton has managed and executed several technology performance demonstrations and verifications of emerging energy (efficiency and green building) and transportation technologies, primarily for U.S. governmental agencies, energy research associations, and state energy agencies. Mr. Chatterton also has direct experience with management and execution of projects under DOE and DoD grants and contracts. He has recently managed activities on three large DoD projects including Demonstration of a Solar Thermal Combined Heating, Cooling and Hot Water System Utilizing an Adsorption Chiller for DoD Installations, Demonstration and Verification of the Performance of Microturbine Power Generation Systems Utilizing Renewable Fuels, and the Electric Power with Small Scale Organic Rankine Cycle (ORC) Engine/Generator Technology demonstration.

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 26 years of experience in management of energy and environmental technology development and demonstration projects and programs, as well as multimedia environmental engineering efforts. These majority of his recent work has focused on the evaluation of innovative carbon capture, utilization, and removal technologies. Mr. Hansen has led the development and management of large technology evaluation programs in the advanced energy, transportation, and climate change areas.

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 innovations and their impact on the environment and carbon emissions. Provides engineering consulting, testing and evaluation, techno-economic assessment, and other support to companies developing, using, or investing in new clean technology innovations. Manages administrative, business development, and project activities for 350Solutions.

2012-2019: Director - Energy and Environment, Southern Research
Manages scientific and technical staff performing research, development, and evaluation of innovative clean energy technologies. Projects range from $25,000 to $6million in size, and are funded by the US Department of Energy, Department of Defense, and commercial partners. Technical focus areas are conversion of biomass to fuels and chemicals, carbon capture and utilization, energy efficient building technologies and renewable energy generation.

2009-2012: Program Manager – Transportation & Climate Change Technology, Southern Research
2003-2009 Sr. Project Leader, Environmental Engineer, Southern Research
1996-2003 Environmental Engineer, Bensinger & Garrison Environmental

PROJECT EXPERIENCE:
Mr. Hansen has executed several independent technology performance verifications of emerging carbon, energy and transportation technologies, 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 completed clean technology evaluations for the Department of Defense, state energy agencies, commercial clients, investors, and technology developers, involving evaluation of commercial feasibility, economic and environmental impacts, and technology performance. Mr. Hansen served as the Measurement and Verification Program Lead for the NRG COSIA Carbon XPrize – a $20M prize competition for technologies that capture and beneficially utilize CO_2. Mr. Hansen also served as U.S. Technical Expert for the development and implementation of ISO 14034 – Environmental Technology Verification, an international standard, issued in 2016.

350Solutions, Inc. Corporate Experience

350Solutions serves as an independent expert in cleantech, low carbon, and environmental technologies. We provide an unbiased assessment of innovative technologies. 350Solutions is accredited through ANAB under ISO 17020 as an independent inspection body to provide independent technology evaluation services using the ISO 14034 ETV process. In addition, 350Solutions staff include a Certified Measurement and Verification Professional (CMVP for IPMVP) and a North Carolina Registered Professional Engineer (P.E.). 350Solutions ANAB Accreditation certificate is provided below.

ANAB
ANSI National Accreditation Board

CERTIFICATE OF ACCREDITATION

The ANSI National Accreditation Board

Hereby attests that

350Solutions, Inc.
1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604

Fulfills the requirements of

ISO/IEC 17020:2012

and

ISO 14034:2016, Environmental Management - Environmental Technology Verification (ETV)

In the field of

INSPECTION

This certificate is valid only when accompanied by a current scope of accreditation document.
The current scope of accreditation can be verified at www.anab.org.

R. Douglas Leonard Jr., VP, PILR SBU

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

ANAB
ANSI National Accreditation Board

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An inspection body's fulfilment of the requirements of ISO/IEC 17020:2012 means the inspection body meets both the technical competence requirements and management system requirements that are necessary for it to consistently deliver technically valid inspection results (refer to joint ISO-ILAC-IAF Communiqué dated Sept 2013).

ANAB
ANSI National Accreditation Board

SCOPE OF ACCREDITATION TO ISO/IEC 17020:2012

and

ISO 14034:2016, Environmental Management - Environmental Technology Verification (ETV)

350Solutions, Inc.
1053 E. Whitaker Mill Rd., Suite 115
Raleigh, NC 27604
Tim Hansen tim@350Solutions.com
(919) 675-6432

INSPECTION
TYPE A (THIRD-PARTY) BODY

Valid to: **September 25, 2024** Certificate Number: **AI-2618**

General

Products Categories	Range	Stage	Methods and Procedures
Energy Technologies (ET):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP-350-223-02 - *SOP ISO 14034 ETV*
Cleaner Production and Processes (CPP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*
Air pollution monitoring and abatement (APP):	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*
Water monitoring and treatment (WMT)	Performance and Environmental impact as it relates to design, materials, equipment, installation and operations.	Operating	QSP 350-223-02 - *SOP ISO 14034 ETV*

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

R. Douglas Leonard Jr., VP, PILR SBU

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