July 25, 2019

Ms. Karlene Fine
Executive Director
North Dakota Industrial Commission
State Capitol, 10th Floor
600 East Boulevard Avenue
Bismarck, ND 58505-0310

Dear Ms. Fine:


Attached is the subject report for the period of April 1, 2019, through June 30, 2019, that shows the progress that has been made with partners of this project.

Thank you for funding this work. If you have any questions, please contact me by phone at (701) 777-5013 or by e-mail at kleroux@undeerc.org.

Sincerely,

Kerryanne M. Leroux
Principal Engineer, Subsurface R&D

KML/kal
Attachment

c/att: Andrea Holl Pfennig, NDIC
INTEGRATED CARBON CAPTURE AND STORAGE FOR NORTH DAKOTA ETHANOL PRODUCTION – PHASE III

Quarterly Progress Report

(for the period of April 1, 2019, through June 30, 2019)

Prepared for:

Karlene Fine

North Dakota Industrial Commission
State Capitol, 14th Floor
600 East Boulevard Avenue, Department 405
Bismarck, ND 58505-0840

Project Period: December 1, 2018 – May 31, 2020
Contract No. R-038-047

Prepared by:

Kerryanne M. Leroux

Energy & Environmental Research Center
University of North Dakota
15 North 23rd Street, Stop 9018
Grand Forks, ND 58202-9018

July 2019
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INTEGRATED CARBON CAPTURE AND STORAGE
FOR NORTH DAKOTA ETHANOL PRODUCTION– PHASE III

ACCOMPLISHMENTS

Summary

The Energy & Environmental Research Center (EERC), in partnership with the North Dakota Industrial Commission (NDIC); North Dakota ethanol producer, Red Trail Energy (RTE); and the U.S. Department of Energy (DOE), is conducting the third phase (Phase III) of a multiphase research and development effort to create the first integrated carbon capture and storage (CCS) system in North Dakota for the reduction of carbon emissions from ethanol production and capitalize on evolving low-carbon fuel (LCF) markets. The ultimate goal of this effort is implementation of a small-scale (<200,000 metric tons, or tonnes, CO₂ per year) commercial CCS system at an industrial fuel production facility to generate a reduced-carbon ethanol fuel applicable for LCF programs. Actions this quarter toward supporting continuation of the CCS effort at the RTE site include the following:

- Hosted a Trimeric–RTE meeting on May 22 to review the draft capture system bid package; as of the June end, two out of three vendor bids have been received for the potential liquefied CO₂ system, with the third vendor expected to respond by early July.

- Completed RTE Sampling Event 1, conducted in the project study area May 17–29. All analyses will be completed and RTE Sampling Event 2 will be conducted next quarter.

- Data processing is about 75% completed from the seismic acquisition survey conducted in March 2019 at the RTE site; began evaluating data to integrate with modeling-simulation efforts from Phase I.

- Generated a detailed approach and time line for potential future stratigraphic test hole drilling, coring/testing/logging, and Class VI well completion.

- Provided technical support to RTE regarding a formal response to the IRS-45Q Request for Comments.

- Prepared outreach materials for RTE’s presentation at the April 2019 Stark County and city of Richardton commission meetings, providing information on the seismic survey and sampling events, including the RTE CCS fact sheet, updated Geophysical Survey FAQs and Sampling FAQs, and media packets with a press release for any press attending the meeting.

- Next quarter, meetings with both North Dakota Department of Mineral Resources (DMR) and California Air Resources Board (ARB) have been scheduled to discuss detailed plans and a path forward for CCS implementation, and preparations will begin for a follow-up community open house.
Major Goals of the Project

The ultimate goal of this effort is implementation of a small-scale (<200,000 tonnes CO₂ per year) commercial CCS system at an industrial fuel production facility to generate a reduced-carbon ethanol fuel applicable for LCF programs. To achieve that goal, the EERC, in partnership with NDIC; North Dakota ethanol producer, RTE; and DOE, is conducting the third phase (Phase III) of a multiphase research and development effort to create the first integrated CCS system in North Dakota for the reduction of carbon emissions from ethanol production and capitalize on evolving LCF markets.

Accomplishments under These Goals (for the reporting period)

Specific research objectives for this subtask are 1) generation of site-specific CO₂ capture process designs to obtain engineering design bids, 2) collection of baseline monitoring and site characterization data to determine potential future well locations, 3) creation of draft CCS North Dakota permitting documents, 4) maintaining up-to-date understanding of requirements from evolving CO₂ markets/incentives, and 5) execution of county- and community-level outreach to support stakeholder and community acceptance of implementing an integrated CCS effort. In summary, Phase III will generate CO₂ capture process designs, conduct baseline monitoring and reservoir characterization, conduct outreach activities, draft permits related to the North Dakota Class VI program, and continue assessment of evolving CO₂ markets. This will facilitate the collection of the data necessary to advance the RTE case study to the next phase of development toward CCS implementation.

Task 1.0 – Develop CO₂ Capture Process Design Package (PDP)

A process design package (PDP) will be prepared for a potential CO₂ capture facility integrated with industrial fuel production at the RTE site. Project partner, Trimeric Corporation (Trimeric), will generate the PDP, which includes process flow diagrams (PFD), heat and material balances (HMB), and piping and instrumentation diagrams (P&IDs). Trimeric will then use these data to develop facility costs and vendor recommendations.

Significant accomplishments for Task 1.0 during the reporting period include the following:

- EERC and Trimeric assisted RTE in coordinating a detailed, formal CO₂ stream analysis, conducted by Airborne International April 1–5; results will help refine equipment specifications.

- Trimeric provided PFD, HMB, P&IDs, and utilities documents for team review; upon RTE request, alternative refrigerants to ammonia, such as propane and R507, are being considered.

- The EERC hosted Trimeric and RTE at a May 22 meeting to review the capture system predesign for the bid package; RTE provided a preferred list of instrumentation/equipment brands for inclusion in the bid package.
As of the June end, two out of three vendor bids have been received for the potential liquefied CO$_2$ system; the third vendor is expected to respond by early July.

**Task 2.0 – Initiate Monitoring and Characterization Plans**

Defining the natural variability of near-surface environments will assist in generating formal monitoring plans. Improving structural characterization will aid in determining potential well locations. These proposed activities reduce geologic uncertainty of the storage complex for the preparation of a compliant CCS permit package.

Significant accomplishments for Task 2.0 during the reporting period include the following.

**Subtask 2.1 – Near-Surface Monitoring**

- Finalized internal near-surface sampling plan to include isotope analyses and frequency.
- Conducted on-site reconnaissance to verify GPS (global positioning system) locations of chosen soil gas sampling locations; updated maps for sampling team.
- Completed RTE Sampling Event 1, May 17–29:
  - Completed preparations and logistics for sample collection and team travel.
  - Conducted internal training for field personnel regarding calibration procedures, field readings, sampling equipment, etc.
  - Collected eight soil gas samples for field meter readings, gas chromatography (GC), and isotope analyses (Figure 1).
  - Collected two groundwater samples for field parameter readings, and submitted to respective laboratories for water chemistry and isotope analyses; the water analyses conducted at the EERC have been completed.
  - Entered field meter readings for both soil gas and groundwater into results summary spreadsheet; expecting soil gas and Isotech results by mid-July.

**Subtask 2.2 – Reservoir Characterization**

- Data processing is about 75% completed from the seismic acquisition survey conducted in March 2019 at the RTE site; regularly discussed data processing results with processing company, including quality and data processor parameter decisions.
- Ensured post-survey reporting was completed to satisfaction, contacting state seismic inspector and assisting RTE with generating draft post-survey reporting affidavit.
Began evaluating the seismic data to integrate with modeling-simulation efforts from Phase I to inform potential future well placement discussions:

- Identified a well within the study region to integrate with the seismic data to determine horizons and identify structure and geobodies.

- Updated Broom Creek geologic model: 1) integrating Inyan Kara, Swift, Broom Creek, and Amsden seismic horizons; 2) upscaling facies, petrophysical, and pressure properties from the Phase I model; and 3) creating properties for the proposed injection well location; exported for simulation (e.g., 70% sandstone with P50 petrophysics and 60% sandstone with P10 petrophysics).

- Created a new Inyan Kara geologic model 1) integrating seismic horizons, 2) integrating data based on well log signatures, and 3) including multiple point statistics; exported for simulation.
Developed feature polygons and calculated thicknesses from seismic results for subsequent modeling updates. Interburden formations were modeled with seismic interpretation polygons to create a new interburden porosity property that integrates seismic feature interpretations.

- Conducted an internal risk assessment (update subsurface sections from Phase I) based on recent seismic results and implications for potential future well locations.

**Task 3.0 – Prepare CCS Permit Application Package**

Draft documentation will be prepared to satisfy a storage facility permit and a permit to drill (a stratigraphic test hole) compliant with North Dakota regulations. The storage facility permit covers multiple design aspects such as technical evaluation, area-of-review delineation, a corrective action plan, an emergency and remedial response plan, a casing and cementing program, a testing and monitoring plan, a well-plugging plan, and a postinjection site care and facility closure plan. Pertinent storage facility permit sections will be addressed using data available. The permit to drill a stratigraphic test hole will be prepared with project data such that drilling can commence at the onset of potential Phase IV.

Significant accomplishments for Task 3.0 during the reporting period include the following:

- Conducted literature review for required plans (e.g., corrosion monitoring, wellbore corrective action, site safety, etc.) such as ADM’s U.S. Environmental Protection Agency (EPA)-approved Class VI Emergency & Remedial Response Plan and several safety plans provided by RTE.

- Initiated the following Class VI permit drafts:
  - Leak Detection and Corrosion Monitoring
  - Emergency and Remedial Response Plan
  - Testing and Monitoring Plan
  - Subsurface Leak Detection and Monitoring Plan
  - Worker Safety Plan
  - Well construction and completion checklist to assist with future well designs

- Generated a detailed approach and time line for potential future stratigraphic test hole drilling, coring/testing/logging, and Class VI monitoring well completion (especially noting long-lead time items).

**Task 4.0 – Evaluate Economic Viability**

The status of LCF programs and other evolving incentives will be assessed. A cost–benefit analysis will be performed to determine the impact of CCS-related incentives and/or LCF programs with CCS integration. Requirements from LCF/incentive programs and how they can potentially be incorporated into CCS permits will be evaluated to inform how project state regulators might enable participation in out-of-state programs.
Significant accomplishments for Task 4.0 during the reporting period include the following:

- Participated in California ARB LCFS (Low-Carbon Fuel Standard) workshop webinar, “Discuss Potential Amendments to the Low Carbon Fuel Standard Regulation” on April 5.
- Developed technical language to assist RTE with responding to the IRS Request for Comments on 45Q regulations.
- Estimated detailed drilling/completion expenses for a potential stratigraphic test well completed as a Class VI monitoring or injection well.

**Task 5.0 – Execute Public Outreach Plan**

Public outreach will provide informational and educational materials related to the proposed characterization and monitoring activities as well as support local public acceptance of a potential CCS effort at the RTE site. Specific stakeholder groups will be targeted for engagement such as landowners and residents, local and regional officials, and educators.

Significant accomplishments for Task 5.0 during the reporting period include the following.

- Completed Sampling FAQs sheet and updated the Geophysical Survey FAQs sheet.
- Prepared packets for the Stark County and city of Richardton commission meetings, including the RTE CCS fact sheet, updated Geophysical Survey FAQs and Sampling FAQs, and media packets with a press release for any press attending the meeting.
- Prepared slides for Dickinson Middle School Career Fair held on April 12.
- Completed outreach tracking form for project documentation.
- Completed landowner site access agreement letters for sampling activities with accompanying maps and fact sheets.

**Task 6.0 – Management and Reporting**

This task includes managing project activities and ensuring coordination and planning of the project with participants and sponsors.

Significant accomplishments for Task 6.0 during the reporting period include the following.

- Updated detailed time lines and Gantt chart on interactive project calendar via SmartSheet.
- Hosted a Trimeric–RTE meeting on May 22 to review the draft capture system bid package.
- Provided weekly updates to project team.
Plan for the Next Reporting Period to Accomplish the Goals

All activities will continue progressing toward project goals. Final vendor quotes of major equipment for the capture system will be compiled and reviewed. Results from RTE Sampling Event 1 will be compiled, and RTE Sampling Event 2 will be conducted, collecting groundwater and soil gas samples for laboratory analyses. Seismic data processing will be completed, as well as technical interpretation/evaluation of the results. Meetings have been scheduled with both North Dakota DMR and California ARB to discuss detailed plans and a path forward for CCS implementation. Public outreach materials will be updated, and preparations will begin for a follow-up community open house.

PARTNERS AND FINANCIAL INFORMATION

This project is sponsored by the NDIC Renewable Energy Program, RTE, and DOE. Table 1 shows the budget of $2,650,000 for this project and expenses through the reporting period.

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PRODUCTS

**Publications, Conference Papers, and Presentations**

- The outreach package (detailed above) was presented by RTE at the April 2019 Stark County and city of Richardton commission meetings, providing information on the seismic survey and sampling events

**Web Site(s) or other Internet Site(s), Technologies or Techniques, Inventions, Patent Applications, and/or Licenses**

- Updated the project webpage to include an announcement that near-surface sampling has begun in the study area, adding the newly generated Sampling FAQs sheet: www.undeerc.org/RedTrailEnergy.

CHANGES/PROBLEMS

None.