

## RED TRAIL ENERGY CCS PROJECT

## ACTIVITY FAQs

FACT SHEET

INTEGRATED CARBON CAPTURE AND STORAGE FOR NORTH DAKOTA ETHANOL PRODUCTION

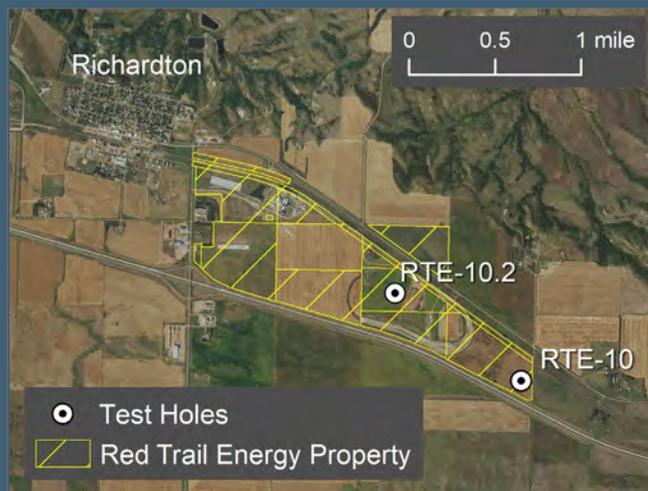
## Geology Study – Drilling Down at Red Trail Energy

Two test holes were drilled on Red Trail Energy property east of Richardton, North Dakota, to provide rock samples (called core) and geologic data as part of the Red Trail Energy carbon capture and storage (CCS) project. Field preparations began in December 2019 for the first hole, which was completed in April 2020. The second hole was completed in October 2020. No CO<sub>2</sub> was injected during either of these tests.

## What Was the Benefit of Drilling a Test Hole?

Information collected from this research activity was added to results from the geophysical survey and existing information to help scientists verify that the deep rock formations underlying the study area will safely and permanently store CO<sub>2</sub> from the local ethanol plant. In addition, this information was necessary to prepare the required state permits for CO<sub>2</sub> injection and storage.

*Two 1.3-mile-deep test holes drilled on Red Trail Energy property east of the ethanol plant provided samples and other data to help determine whether the potential storage zones are suitable for permanent CO<sub>2</sub> storage. Under this research activity, Red Trail Energy obtained permits from state, county, and local officials to perform the test.*



## What Precautions Were Taken?

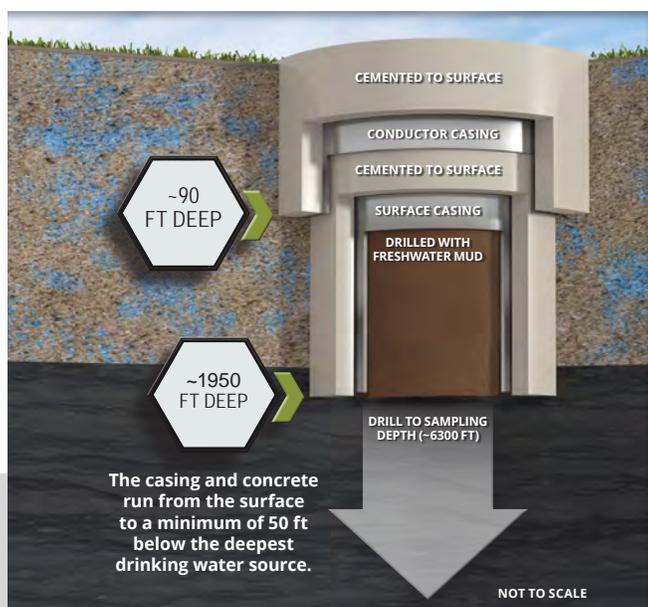
Land and groundwater resources were protected by impermeable barriers installed prior to and during drilling (illustrated at right).

## What Did Researchers Learn?

In the several months following the drilling activity, the rock cores, geologic fluids, and wireline logging data were analyzed and incorporated into the computer model of the subsurface developed with the geophysical survey. Using the results, geologists have determined that the rock layers meet the criteria for safe, permanent geologic storage of CO<sub>2</sub> from the ethanol plant.

## What Is Carbon Capture and Storage, or CCS?

CCS captures CO<sub>2</sub> from industrial processes before it is emitted by the plant, transports the CO<sub>2</sub> to an injection site, and injects the CO<sub>2</sub> deep underground for safe, permanent storage in a suitable rock layer. CCS is best-suited for large stationary facilities such as ethanol plants, coal-fired power plants, cement plants, oil and gas refineries, and agricultural processing plants.



*As required under the permit to drill, groundwater resources were protected during drilling by the use of freshwater drilling mud, then by layers of steel casing and concrete. The casing and cement remain as permanent protection for groundwater; see "Drill the Hole" on the back page for more details.*

## What Were the Basic Steps for This Activity?

Drilling, sampling, and data collection followed the same practices and procedures used to characterize the geology of hydrocarbons, coal, and water resources in North Dakota.

**Obtain Permits** – Drilling the holes for geologic research required permits from the North Dakota Industrial Commission Oil and Gas Division. The permits ensured that proper steps were taken to protect groundwater. The permit for drilling one hole was granted in December 2019. The second permit was granted in September 2020.

**Prepare Drill Site** – Pad preparation entailed leveling and laying aggregate on an area of land approximately 400 × 400 ft to make a flat, stable work area for drilling equipment. Each pad took 10–14 days to complete and created an impermeable barrier to protect the land and groundwater. These barriers remain in place.

**Drill the Hole** – Drilling was completed in four stages. Stage 1 involved digging a hole 90 ft deep, which was lined with steel pipe (conductor casing) and coated with concrete to the surface. Step 2 involved drilling a hole to 100 ft below the bottom of the freshwater zone (~1950 ft). Using freshwater drilling mud prevents groundwater contamination. The hole was fitted with steel pipe (surface casing), the outside of which was cemented from the bottom to the surface to protect drinking water during subsurface activities. Stage 3 continued drilling



*Wireline logging collected data about the rock layers, their fluids, and their pressures.*

to a depth of nearly 5000 ft (into the overlying shale seal above the potential zone for storage). Stage 4, the coring stage, involved collecting multiple cylinders of rock called cores, which were cut using a special hollowed-out drill bit. Stages 3 and 4 were repeated for the second target zone, yielding a total of about 930 ft of core.

**Gather Downhole Data** – After the core samples were removed, a truck with specialized instruments ran sensors into the hole, a technique called wireline logging. This standard drilling industry practice collected data about the rock layers, their fluids, and their pressures.

**Close the Hole** – After data collection was completed, the test hole was sealed temporarily to maintain integrity while data and rock core analysis were performed.



*Multiple cylindrical rock samples called cores were retrieved from the bottom 930 ft of the hole using a specialized coring drill bit.*

The ultimate goal of the **Red Trail Energy Carbon Capture and Storage (RTE CCS) Project**, a multiphase research and development effort, is to create the first integrated CCS system in North Dakota. Led by the Energy & Environmental Research Center at the University of North Dakota, with support from Red Trail Energy, the Industrial Commission of North Dakota Renewable Energy Program, and the U.S. Department of Energy, technical partners in this research include Trimeric Corporation, Schlumberger Carbon Services, and Computer Modelling Group.

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