

BEFORE THE INDUSTRIAL COMMISSION
OF THE STATE OF NORTH DAKOTA

CASE NO. 28848
ORDER NO. 31453

IN THE MATTER OF A HEARING CALLED ON A MOTION OF THE COMMISSION TO CONSIDER THE APPLICATION OF RED TRAIL ENERGY, LLC REQUESTING CONSIDERATION FOR THE GEOLOGIC STORAGE OF CARBON DIOXIDE IN THE BROOM CREEK FORMATION FROM THE RED TRAIL ENERGY, LLC ETHANOL FACILITY LOCATED IN SECTIONS 9, 10, 11, 12, 13, 14, 15, 22 AND 23, TOWNSHIP 139 NORTH, RANGE 92 WEST, STARK COUNTY, NORTH DAKOTA PURSUANT TO NORTH DAKOTA ADMINISTRATIVE CODE SECTION 43-05-01.

ORDER OF THE COMMISSION

THE COMMISSION FINDS:

- (1) This cause came on for hearing at 9:00 a.m. on the 12th day of August, 2021.
- (2) Red Trail Energy, LLC (Red Trail) made application to the Commission for an order authorizing geologic storage of carbon dioxide from the Red Trail ethanol facility in the amalgamated storage reservoir pore space of the Broom Creek Formation, in portions of Sections 9, 10, 11, 12, 13, 14, 15, 22, and 23, Township 139 North, Range 92 West, Stark County, North Dakota, pursuant to North Dakota Administrative Code (NDAC) 43-05-01, and such other relief as is appropriate.
- (3) Red Trail submitted an application for a Storage Facility Permit and necessary attachments pursuant to NDAC Section 43-05-01-05 and all other provisions of NDAC Chapter 43-05-01 as necessary.
- (4) Case Nos. 28848, 28849, and 28850 were combined for the purposes of hearing.
- (5) Case No. 28849, also on today's docket, is an application filed with the Commission by Red Trail for an order of the Commission determining the amalgamation of storage reservoir pore space, pursuant to a Geologic Storage Agreement for use of pore space falling within portions of Sections 9, 10, 11, 12, 13, 14, 15, 22, and 23, Township 139 North, Range 92 West, Stark County, North Dakota in the Broom Creek Formation, has been signed, ratified, or

approved by owners of interest owning at least sixty percent of the pore space interest within said lands pursuant to North Dakota Century Code (NDCC) 38-22-10.

(6) Case No. 28850, also on today's docket, is a motion of the Commission to determine the amount of financial responsibility for the geologic storage of carbon dioxide from the Red Trail ethanol facility located in portions of Sections 9, 10, 11, 12, 13, 14, 15, 22, and 23, Township 139 North, Range 92 West, Stark County, North Dakota in the Broom Creek Formation, pursuant to NDAC Section 43-05-01-09.1.

(7) Commission staff requested to take administrative notice of the well files and geophysical logs of all wells within or nearby the area of review, to which Red Trail had no objection.

(8) The record in these matters was left open to receive additional information from Red Trail. Such information was received on September 23 and October 18, 2021, and the record was closed.

(9) Pursuant to NDCC Section 38-22-06 and NDAC Section 43-05-01-08: The notice of filing of the application and petition and the time and place of hearing thereof was given, and that at least 45 days prior to the hearing, Red Trail, as the applicant, did give notice of the time and place of said hearing and the Commission has accepted the notice as adequate, and that the applicant did, at least 45 days prior to the hearing, file with the Commission engineering, geological and other technical exhibits to be used and which were used at said hearing, and that the notice so given did specify that such material was filed with the Commission; that due public notice having been given, as required by law, the Commission has jurisdiction of this cause and the subject matter.

(10) The Commission gave at least a thirty-day public notice and comment period for the draft storage facility permit and issued all notices using methods required to all entities under NDCC Section 38-22-06 and NDAC Section 43-05-01-08. Publication was made July 7, 2021, and the comment period for written comments ended at 5:00 PM CDT August 11, 2021. The hearing was open to the public to appear and provide comments.

(11) The Commission received letters of support for the application from RPGM Inc. and the North Dakota Ethanol Council on August 9 and August 11, 2021, respectively.

(12) The Commission received a letter from the State Historical Society of North Dakota on July 15, 2021 indicating it reviewed the application of Red Trail for potential effect for cultural resources and found that there are no significant sites in this area.

(13) The Commission received a letter from Patricia Meyer (Meyer) on July 26, 2021 indicating an interest in the N/2 NW/4, and NE14 [sic] (Commission assumes NE/4) of Section 22, Township 139 North, Range 92 West. Meyer requested a copy of the permit application, the draft permit, and the study done on the subject properties showing why they are suitable for storage of carbon dioxide. Meyer questioned the chances of carbon dioxide seeping into nearby properties, and the impact of the carbon dioxide storage facility on mineral and oil rights. Meyer is opposed until more informed on the storage of carbon dioxide. The Commission notes Meyer is identified as a mineral owner or lessee requiring notification.

The Commission responded to Meyer on July 26, 2021 and provided the website address where the permit application, draft permit, and supporting documents are available free of charge. The response also provided contact information for the Commission and Red Trail.

(14) Red Trail's application provides adequate data to show suitability of the Broom Creek Formation for geologic storage of carbon dioxide in the facility area.

(15) Red Trail's application provides adequate modeling of the storage reservoir for delineation of the facility area, and adequate monitoring to detect if carbon dioxide is migrating into properties outside of the facility area pursuant to NDAC Section 43-05-01-11.4. Vertical release of carbon dioxide is addressed by the application pursuant to NDAC Section 43-05-01-13, and lateral release of carbon dioxide from the facility area is addressed by the application pursuant to NDAC Section 43-05-01-05.

(16) The amalgamated storage reservoir pore space to be utilized is not hydrocarbon bearing as determined from test data included with the application. There has been no historic hydrocarbon exploration, production, or studies suggesting there is an economically profitable supply of hydrocarbons from formations above or below the Broom Creek Formation within the proposed storage facility area. There have not been shallow gas reserves or coal seams identified above the Broom Creek Formation within the proposed storage facility area. There has been historic production along the Heart River Fault outside of the area of review. The lateral extent of the stabilized plume and the pressure differential are minor enough to allow for horizontal drilling for hydrocarbon exploration, under the Broom Creek Formation, without penetrating the stored carbon dioxide.

(17) The Red Trail facility is a dry mill ethanol production plant located in Stark County, North Dakota, near the city of Richardton. Carbon dioxide is emitted from the fermentation process during ethanol production.

(18) Red Trail's facility emits an annual average of 180,000 metric tons of carbon dioxide that is expected to be captured, dehydrated, compressed, transported to a Class VI well by a flow line, and then injected.

(19) The entire length of flow line to be utilized for carbon dioxide transportation from the capture facility to the wellhead falls within the facility area delineation and is under the jurisdiction of the Commission.

(20) Stainless steel FlexSteel will be utilized for the flowline and is rated to 2,900 psi. Maximum surface operating pressure is expected to be 2,250 psi. The line will have an external specialized rubber coating for anti-corrosion and will be trenched in and back-filled by the FlexSteel company.

(21) The flow line will be equipped with a DAS/DTS fiber optic cable to detect leaks, triggering an alarm and automatic shut down of the flow line. The flow line is equipped with automatic shutoff valves at the capture facility and wellhead.

(22) The projected composition of the carbon dioxide stream is greater than 99.9% carbon dioxide with trace quantities of nitrogen and oxygen.

(23) The RTE #10 (File No. 37229) is a stratigraphic test well that was used for reservoir characterization and constructed to Class VI requirements, located 600 feet from the south line and 250 feet from the east line of Section 10, Township 139 North, Range 92 West, Stark County, North Dakota. This well is to be converted to a Class VI injection well.

(24) The RTE #10.2 (File No. 37858) is a stratigraphic test well that was used for reservoir characterization and constructed to Class VI requirements, located 2,296 feet from the north line and 1,043 feet from the west line of Section 10, Township 139 North, Range 92 West, Stark County, North Dakota. This well is to be utilized as a direct method of monitoring the injection zone pursuant to NDAC Section 43-05-01-11.4.

(25) Red Trail created a geologic model based on site characterization as required by NDAC Section 43-05-01-05.1 to delineate the area of review. Data utilized included well log, seismic, and core data. Well log data was used to determine the dominant lithology in the Amsden Formation, the lower confining zone, the Opeche Formation, the upper confining zone, and the Broom Creek Formation, the injection formation. Geostatistics were used to distribute petrophysical properties throughout the confining zones. Seismic data was also used to aid in determining the dominant lithology in the Broom Creek Formation, and to identify spatial trends to reinforce the distribution of properties. Based on the reservoir pressure obtained from the RTE #10 and RTE #10.2 wells and computationally modelled pressures reached through the life of the project, critical threshold pressure will not be reached using conservative values. Critical threshold pressure has the same meaning as pressure front, defined in NDAC Section 43-05-01-01, for area of review delineation purposes. The predicted extent of the carbon dioxide plume from beginning to end of life of the project, at the time that the carbon dioxide plume ceases to migrate into adjacent cells of the geologic model, was used to define the area of review in this case. Time lapse seismic surveys will be used for monitoring the extent of the carbon dioxide plume.

(26) The area proposed to be included within the storage facility area is as follows:

TOWNSHIP 139 NORTH, RANGE 92 WEST, 5TH PM

ALL OF SECTIONS 10, 11, 14 AND 15, THE E/2 SE/4 AND SE/4 NE/4 OF SECTION 9, THE W/2 SW/4 OF SECTION 12, THE W/2 W/2 OF SECTION 13, THE NE/4 AND N/2 NW/4 OF SECTION 22, AND THE N/2 OF SECTION 23.

(27) The Broom Creek Formation, the upper confining Opeche Formation, and the lower confining Amsden Formation are laterally extensive through the area of review.

(28) Core analysis of the Broom Creek Formation shows sufficient permeability to be suitable for the desired injection rates and pressures without risk of creating fractures in the injection zone. Thin-section investigation shows the Broom Creek Formation is comprised primarily of quartz, with minor occurrences of feldspar, dolomite, and anhydrite as intercrystalline porosity cement. Laterally discontinuous carbonate intervals are present consisting of dolostone, quartz, and iron oxides. Microfracture testing in the RTE #10 well at a

depth of 6,432 feet determined the breakdown pressure of the formation to be 7,863 psi, with a fracture propagation pressure of 4,594 psi, and a fracture closure pressure of 3,762 psi.

Core analysis of the overlying Opeche Formation shows sufficiently low permeability to stratigraphically trap carbon dioxide and displaced fluids. Thin-section investigation shows the Opeche Formation is comprised of intervals of silty mudstone, argillaceous siltstone, mudstone, and anhydrite. Microfracture testing in the RTE #10 well at a depth of 6,376 feet determined the breakdown pressure of the formation to be 7,677 psi, with a fracture propagation pressure of 4,874 psi, and a fracture closure pressure of 4,624 psi.

Core analysis of the underlying Amsden Formation shows sufficiently low permeability to stratigraphically contain carbon dioxide and displaced fluids. Thin-section investigation shows the Amsden Formation is comprised of dolomite, anhydrite, sandy dolomite, and shaly sand.

(29) The in-situ fluid of the Broom Creek Formation in this area is in excess of 10,000 parts per million of total dissolved solids.

(30) Investigation of wells within the area of review found no vertical penetrations of the confining or injection zones requiring corrective action. The area of review will be reevaluated at a period not to exceed five years from beginning of injection operations.

(31) The Fox Hills Formation is the deepest underground source of drinking water (USDW) within the area of review. Its base is situated at a depth of 1,757 feet at the location of the proposed injection well, leaving approximately 4,623 feet between the base of the Fox Hills Formation and the top of the Broom Creek Formation.

(32) Fluid sampling of shallow USDWs has been performed to establish a geochemical baseline, with additional baseline sampling proposed for the Fox Hills Formation and other shallow wells under investigation. Future sampling is proposed in Red Trail's application pursuant to NDAC Section 43-05-01-11.4.

(33) Soil sampling has been performed to establish a geochemical baseline and additional sampling is proposed adjacent to the injection well and monitoring well. Future sampling is proposed in Red Trail's application pursuant to NDAC Section 43-05-01-11.4.

(34) The top of the Inyan Kara Formation is at 4,803 feet, approximately 3,046 feet below the base of the Fox Hills Formation and it provides an additional zone of monitoring between the Fox Hills Formation and the Broom Creek Formation to detect vertical carbon dioxide or fluid movement.

(35) No known or suspected regional faults or fractures with transmissibility have been identified during the site-specific characterization. Formation imaging logs run showed fractures in the Opeche Formation to be closed and filled-in by reprecipitated minerals. The Heart River Fault is located 1.4 miles southwest of the area of review boundary and vertically terminates well below the injection and confining formations, creating no risk to containment.

(36) Fluid samples from the Inyan Kara Formation and Broom Creek Formation suggest that they are hydraulically isolated from each other, supporting that the confining formations above the Broom Creek Formation are not compromised by migration pathways.

(37) Apparent thinning in the Opeche Formation isopach map to the west of the proposed storage facility was addressed by supplemental exhibits. Well-control derived isopach mapping indicates a western area of thinning due to an Opeche Formation thickness of 92 feet, apparent in the resistivity log of the Rummel-State 1 (File No. 6797 – SE/4 SW/4 of Section 16, Township 139 North, Range 92 West) due to interpolation of this location's thickness with surrounding wells thicknesses. However, the Opeche Formation thickness is relatively consistent across the area in seismic interpretation.

(38) Salt collapse features were identified in seismic interpretation but did not extend below the Spearfish Formation. Thicker deposition of overlying formation sediments supports the origin of salt collapse features to be dissolution of salt commonly found within the Spearfish Formation.

(39) Geochemical simulation performed with the injection stream and data obtained from the confining and injection zones determined no observable change in injection rate or pressure. Extreme carbon dioxide exposure simulations to the cap rock determined that deterioration compromising confinement would not occur. The modeling was done using a worst-case scenario by assuming that the anhydrite present at the top of the Broom Creek Formation was not present locally.

(40) Risk of induced seismicity is not a concern based on existing studies of major faults within the area of review, tectonic boundaries, relatively stable geologic conditions surrounding the proposed injection site, and the small volume of carbon dioxide to be injected.

(41) NDAC Section 43-05-01-11.3 (3) requires the storage facility operator to maintain pressure on the annulus that exceeds the operating injection pressure, unless the Commission determines that such a requirement might harm the integrity of the well or endanger USDWs. The Commission believes placing this pressure on the annulus will create a risk of micro annulus by debonding of the long string casing–cement sheath during the operational life of the well. A micro annulus would harm external mechanical integrity and provide a potential pathway for endangerment of USDWs.

(42) Both the injection and monitoring wells are equipped with DAS/DTS fiber optic cables enabling continuously monitored external mechanical integrity.

(43) The approval of this application is in the public interest by promoting the policy stated in NDCC Section 38-22-01.

IT IS THEREFORE ORDERED:

(1) The creation of the Red Trail Richardton Ethanol Broom Creek Storage Facility #1 in Stark County, North Dakota, is hereby authorized and approved.

(2) Red Trail Energy, LLC, its assigns and successors, is hereby authorized to store carbon dioxide in the Broom Creek Formation in the Red Trail Richardton Ethanol Broom Creek Storage Facility #1.

(3) The Red Trail Richardton Ethanol Broom Creek Storage Facility #1 shall extend to and include the following lands in Stark County, North Dakota:

TOWNSHIP 139 NORTH, RANGE 92 WEST, 5TH PM
ALL OF SECTIONS 10, 11, 14 AND 15, THE E/2 SE/4 AND SE/4 NE/4 OF SECTION 9,
THE W/2 SW/4 OF SECTION 12, THE W/2 W/2 OF SECTION 13, THE NE/4 AND N/2
NW/4 OF SECTION 22, AND THE N/2 OF SECTION 23.

(4) Injection into the Red Trail Richardton Ethanol Broom Creek Storage Facility #1 shall not occur until Red Trail Energy, LLC has met the financial responsibility demonstration pursuant to Order No. 31455.

(5) This authorization does not convey authority to inject carbon dioxide into the Red Trail Richardton Ethanol Broom Creek Storage Facility #1; an approved permit to inject for the RTE #10 well (File No. 37229) shall be issued by the Commission prior to injection operations commencing.

(6) The authorization granted herein is conditioned on the operator receiving and complying with all provisions of the injection permit issued by the Oil and Gas Division of the Industrial Commission, and complying with all provisions of NDAC Chapter 43-05-01 where applicable, and this order.

(7) Definitions.

“Area of review” in this case means an area encompassing a radius around the facility area of one mile.

“Cell” in this case means individual cell blocks of the geologic model; each cell is approximately 300 feet by 300 feet.

“Facility area” means the areal extent of the storage reservoir as defined in paragraph (3) above, that includes lands within one-half mile of the lateral boundary of the carbon dioxide plume from beginning of injection to the time the carbon dioxide plume ceases to migrate into adjacent geologic model cells.

“Storage facility” means the reservoir, underground equipment, and surface facilities and equipment used or proposed to be used in the geologic storage operation. It does not include pipelines used to transport carbon dioxide to the storage facility under NDCC Section 38-22-02.

(8) The storage facility operator shall comply with all conditions of this order, the permit to inject, and NDAC Chapter 43-05-01, where applicable. Any noncompliance constitutes a violation and is grounds for enforcement action, including but not limited to termination, revocation, or modification of this order pursuant to NDAC Section 43-05-01-12.

(9) In an administrative action, it shall not be a defense that it would have been necessary for the storage facility operator to halt or reduce the permitted activity in order to maintain compliance with this order, the permit to inject, and NDAC 43-05-01, where applicable.

(10) The storage facility operator shall take all reasonable steps to minimize or correct any adverse impact on the environment resulting from noncompliance with this order, the permit to inject, and NDAC 43-05-01, where applicable.

(11) The storage facility operator shall implement and maintain the provided emergency and remedial response plan pursuant to NDAC Section 43-05-01-13.

(12) The storage facility operator shall cease injection immediately, take all steps reasonably necessary to identify and characterize any release, implement the emergency and remedial response plan approved by the Commission, and notify the Commission within 24 hours of carbon dioxide detected above the confining zone.

(13) The storage facility operator shall at all times properly operate and maintain all storage facilities which are installed or used by the storage facility operator to achieve compliance with the conditions this order, the permit to inject, and NDAC 43-05-01, where applicable. Proper operation and maintenance includes effective performance, adequate funding, adequate operator staffing and training, and adequate laboratory and process controls, including appropriate quality assurance procedures. This provision requires the operation of backup or auxiliary facilities or similar systems only when necessary to achieve compliance.

(14) This order may be modified, revoked and reissued, or terminated pursuant to NDAC Section 43-05-01-12. The filing of a request by the storage facility operator for and order modification, revocation and reissuance, or termination, or a notification of planned changes or anticipated noncompliance, does not stay any condition contained therein.

(15) The injection well permit or the permit to operate an injection well does not convey any property rights of any sort of any exclusive privilege.

(16) The storage facility operator shall furnish to the Director, within a time specified, any information which the Director may request to determine whether cause exists for modifying, revoking and reissuing, or terminating this order, or to determine compliance thereof. The storage facility operator shall also furnish to the Director, upon request, copies of records required to be kept by this order, the permit to inject, and NDAC 43-05-01, where applicable.

(17) The storage facility operator shall allow the Director, or an authorized representative, upon presentation of credentials and other documents as may be required by law, to:

- (a) Enter upon the storage facility premises where records must be kept pursuant to this order and NDAC Chapter 43-05-01.
- (b) At reasonable times, have access to and copy any records that must be kept pursuant to this order and NDAC Chapter 43-05-01.
- (c) At reasonable times, inspect any facilities, equipment, including monitoring and

control equipment, practices, or operations regulated or required pursuant to this order, the permit to inject, and NDAC Chapter 43-05-01.

- (d) At reasonable times, sample or monitor for the purposes of assuring compliance, any substances or parameters at any location.

(18) The storage facility operator shall maintain and comply with the proposed testing and monitoring plan pursuant to NDAC Section 43-05-01-11.4

(19) The storage facility operator shall comply with the reporting requirements provided in NDAC Section 43-05-01-18. The volume of carbon dioxide injected, the average injection rate, surface injection pressure, and down-hole temperature and pressure data shall be reported monthly to the Director on or before the fifth day of the second succeeding month once injection commences regardless of the status of operations, until the injection well is properly plugged and abandoned.

(20) The storage facility operator must obtain an injection well permit under NDAC Section 43-05-01-10 and injection wells must meet the construction and completion requirements in NDAC Section 43-05-01-11.

(21) The storage facility operator shall notify the Director at least 48 hours in advance to witness a mechanical integrity test of the tubing-casing annulus in the injection well. The packer must be set within 100 feet of the upper most perforation and in the 13CR-80 casing, as an exception to NDAC Section 43-05-01-11. However, the packer must also be set within confining zone lithology, within carbon dioxide resistant cement, and not interfere down-hole monitoring equipment.

(22) The storage facility operator shall maintain and comply with the prepared plugging plan pursuant to NDAC Section 43-05-01-11.5.

(23) The storage facility operator shall establish mechanical integrity prior to commencing injection and maintain mechanical integrity pursuant to NDAC Section 43-05-01-11.1.

(24) The storage facility operator shall implement the worker safety plan pursuant to NDAC Section 43-05-01-13.

(25) The storage facility operator shall comply with leak detection and reporting requirements pursuant to NDAC Section 43-05-01-14.

(26) The storage facility operator shall implement the proposed corrosion monitoring and prevention program pursuant to NDAC Section 43-05-01-05.1.

(27) The storage facility operator shall maintain financial responsibility pursuant to NDAC Section 43-05-01-09.1.

(28) The storage facility operator shall maintain and comply with the proposed post-injection site care and facility closure plan pursuant to NDAC Section 43-05-01-19.

(29) The storage facility operator shall notify the Director within 24 hours of failure or malfunction of surface or bottom hole gauges in the RTE #10 (File No. 37229) injector.

(30) The storage facility operator shall implement surface air and soil gas monitoring as proposed.

(31) This storage facility authorization and permit shall be reviewed at least once every five years from commencement of injection to determine whether it should be modified, revoked, or minor modification made, pursuant to NDAC Section 43-05-01-05.1(4).

(32) The storage facility operator shall pay fees pursuant to NDAC Section 43-05-01-17 annually, no more than thirty days after the receipt of 26 U.S. Code § 45Q tax credits, unless otherwise approved by the Director.

(33) This order shall remain in full force and effect until further order of the Commission.

Dated this 19th day of October, 2021.

INDUSTRIAL COMMISSION
STATE OF NORTH DAKOTA

/s/ Doug Burgum, Governor

/s/ Wayne Stenehjem, Attorney General

/s/ Doug Goehring, Agriculture Commissioner