



Core Energy, LLC  
Northern Niagaran Pinnacle Reef Trend (NNPRT) - Subpart RR Annual Report  
Reporting Period: 1-1-2019 to 12-31-2019

**Annual Report: 40 C.F.R. 98.446 (Subpart RR)**

Company Name: Core Energy, LLC  
Company Address: 1011 Noteware Dr., Traverse City, MI 49686  
GHGRP ID: 545462  
Facility Name: Core Energy Otsego County EOR Operations  
Facility Address: 597 Kubacki Road, Gaylord , MI 49735  
Reporting Period: January 1, 2019 to December 31, 2019  
Date of Submittal: March 29, 2020

**Report Contact Information:**

Contact Name: Rick Pardini  
Telephone Number: {231}946-2419  
Email Address: [rpardini@coreenergyllc.com](mailto:rpardini@coreenergyllc.com)

Certification by Designated Representative:

*Based on information and belief formed after reasonable inquiry, the statements and information in this report are true, accurate, and complete.*

Alternate Designated Representative: Rick Pardini, Vice-president and Engineering Manager

**I.) Report Summary:**

Core Energy, LLC continued monitoring activities with respect to its Northern Niagaran Pinnacle Reef Trend (NNPRT) CO2 Monitoring, Reporting, and Verification (MRV) Plan. This report represents information related to the aforementioned reporting period. The final MRV Plan was approved (Approval Number-1010117-1) by the US EPA and the decision became effective on October 17, 2018.

Pursuant to Section 7.1 Mass of CO2 Received in the approved MRV Plan, the Dover 36 Facility CO2 had a beginning working inventory of 2,110,000 metric tonnes of CO2. During the 2018 reporting period, 294,784 metric tonnes of CO2 were produced (received from this source). During the 2019 reporting period, 315,958 metric tonnes of CO2 were produced (received from this source), which reduced the working inventory down to 1,499,247 metric tonnes. As stated in the approved MRV Plan, once the working inventory from the Dover 36 Facility CO2 has been depleted, Core Energy will stop reporting the amount of CO2 received (produced) from the Dover 36 Facility .

**II.) Monitoring Activities Table:**

The table summarizes Core Energy's monitoring activities for the 2019 reporting period and outlines it's planned response to possible CO2 losses.

Potential Leakage Pathway	Monitoring Activities and Frequency	Planned Response
Existing Well bores (tubing leak)	Monitor changes in tubing/ annular pressures and rates daily.	If problem detected, injection ceases until MIT restored, Workover would commence within days.
Existing Well bores (casing leak)	Monitor changes in tubing/ annular pressures and rates daily. Routine inspections.	If problem detected, injection ceases until MIT restored, Workover would commence within days.
Existing Well bores	Daily inspections of well heads.	If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.
Surface Equipment, Pipelines	Daily inspections (e.g. vessels, piping, valves).	If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.
Faults and Fractures	Monitor changes in: tubing/ annular pressures and rates daily; Reservoir pressure episodically. No known faults have been identified in reefs under CO2 EOR via seismic analysis.	Injection always done at pressures below that allowed by UIC Permit. If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.
Natural and Induced Seismic Activity	Monitor changes in: tubing/ annular pressures and rates daily; Reservoir pressure episodically. Injection has never caused a seismic event to date and from the US Seismic Hazard Mapping Project, 2014, the chance of such an occurrence in the subject area is very low 0-4%.	Injection always done at pressures below that allowed by UIC Permit. If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.
Lateral Migration Outside of a Reef	Monitor changes in: tubing/ annular pressures and rates daily; Reservoir pressure and material balance review episodically. The geology of the reefs is such that the flanks are overlain by non-porous salts and evaporites; and data from MRCSP work demonstrate containment.	Injection always done at pressures below that allowed by UIC Permit. If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.
Diffuse Leakage Through the Seal	Monitor changes in: tubing/ annular pressures and rates daily; Reservoir pressure and material balance review episodically. The geology of the reefs is such that they are overlain by hundreds of feet of salt, shale, and carbonate; and have been demonstrated as very competent by MRCSP work.	Injection always done at pressures below that allowed by UIC Permit. If problem detected, injection (production) ceases until MIT restored, Workover would commence within days.

**III.) Narrative History of the Monitoring Efforts Performed During Reporting Period:**

As a part of its ongoing CO2 EOR operations, Core Energy routinely collected flow rate, pressure, and gas composition data on wells and at facilities that are subject to the NNPRT CO2 Monitoring, Reporting, and Verification (MRV) Plan. Flow and pressure data were captured daily either electronically or manually via

field operator rounds. Core Energy monitored the flow and pressure data along with daily inspections done at wellsites and facilities as a means to identify anomalies and surface losses of CO<sub>2</sub>. Coriolis mass flow meters were used to measure the mass of CO<sub>2</sub> received, CO<sub>2</sub> injected, and CO<sub>2</sub> produced. Metering protocols used by Core Energy were consistent with industry standards and deployed in conjunction with technical personnel from Emerson and Micro Motion (e.g. ASME standards). The meters operated continually and provided data used in the mass determinations. The meters were maintained in accordance with the manufacturer's guidelines. Fluid composition (e.g. Wt.% CO<sub>2</sub>) was determined quarterly by third party sampling and analysis (i.e. SPL) in accordance with industry standards [e.g. Gas Processors Association (GPA)] and Subpart RR requirements.

Any loss of CO<sub>2</sub> at the surface, if any, was determined using various methods, corresponding to where in the CO<sub>2</sub> EOR operations the leakage pathway existed. Core Energy used Subpart W methodology (40 C.F.R. Part 98) to estimate the mass of CO<sub>2</sub> emissions from equipment leaks. Core Energy metered the volume of CO<sub>2</sub> leakage from the wet and dry vents at the Dover 36 and Bagley 11 CPFs. Core Energy estimated the mass of CO<sub>2</sub> lost during the routine paraffin cutting on producing wells by incorporating the size of the lubricator bottle, cutting tools, and the CO<sub>2</sub> volume factor at each well's wellhead conditions at the time of cutting. The total mass of CO<sub>2</sub> from surface leakage from these three methods was incorporated into the term CO<sub>2</sub> <sub>FP</sub> in Eqn. RR-11 of the MRV Plan. In addition to these three methods, Core Energy also calculated the mass of CO<sub>2</sub> that was entrained in the produced oil and lost as a result of the fluid separation processes in accordance with and as outlined in the approved MRV Plan Section 7.3, term X in Eqn. RR-9. The mass of CO<sub>2</sub> entrained in the oil ("X" in Eqn. RR-9) was calculated to be 161 metric tonnes, which was added to the mass of CO<sub>2</sub> produced (i.e. CO<sub>2,w</sub> in Eqn. RR-9) 352,933 metric tonnes, yielding a total mass of CO<sub>2</sub> produced (i.e. CO<sub>2p</sub> in Eqn. RR-9) in 2019 of 353,094 metric tonnes. Finally, Core Energy monitored and reviewed the data collected to determine if other leaks were evident and if so, to quantify the leakage of CO<sub>2</sub>. During 2019, no other leaks were detected.

**IV.) Description of the Non-material Changes to the MRV Plan Approved by the US EPA:**

During 2019, in accordance with Section 2.5 of the approved MRV Plan, Core Energy made the following changes in its operations, all of which were non-material changes and not requiring a new MRV plan:

- A. Commenced injection into the Chester 16 Unit 8-16 Well (UIC Class II Permit: MI-137-2R-0033) within an existing reef (Chester 16) already included in the approved MRV Plan.
- B. Constructed a new production facility, Bagley 11 CPF, designed to handle the produced flow stream from an existing reef (Bagley 11-14-23) already included in the approved MRV Plan. At this CPF was installed new Coriolis mass flow meters that measure the total mass of CO<sub>2</sub> produced and/or vented at the CPF. During 2019, while the field was still in its initial deposit or fill-up phase, a short period of production was initiated to gather data on the reservoir and facility. After obtaining the necessary data, production was stopped and the producing wells returned to monitoring status while the initial deposit or fill-up phase was resumed.
- C. Based on new information, the Chester 2 Field (an existing reef already included in the MRV Plan) was expanded in size and renamed the Chester 2-IOA Unit per Order No. 08-2019 by the Assistant Supervisor of Wells, from the Department of Environment, Great Lakes, and Energy; Oil, Gas, and Minerals Division; State of Michigan. The addition of this one well changed nothing operationally as it uses the same equipment as the formerly named Chester 2 Reef.

**V.) Narrative History of Monitoring Anomalies That Were Detected:**

Core Energy monitored injection into and production from the reefs subject to the MRV Plan, as a way to detect anomalies in the data that could serve as early indications of potential leakage from the subsurface. During the 2019 reporting period, there were no anomalies detected.

**VI.} Description of Surface CO2 Leakage:**

During the reporting year 2019, there was no surface leakage (i.e. movement of the injected CO2 stream from the injection zone to the surface and into the atmosphere, indoor air, oceans, or surface water or term CO2E in Eqn. RR-11 was zero).