



Core Energy, LLC

Northern Niagaran Pinnacle Reef Trend (NNPRT) – Subpart RR Annual Report

Reporting Period: 1-1-2021 to 12-31-2021

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

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GHGRP ID: 545462
Facility Name: Core Energy Otsego County EOR Operations
Facility Address: 597 Kubacki Road, Gaylord, MI 49735
Reporting Period: January 1, 2021 to December 31, 2021
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Certification by Designated Representative: Katherine Dungey

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, 294,785 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). During the 2020 reporting period, 237,220 metric tonnes of CO₂ were produced (received from this source). During the 2021 reporting period, 259,781 metric tonnes of CO₂ were produced (received from this source), which reduced the working inventory down to 1,002,256 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 2021 reporting period and outlines it's planned response to possible CO₂ losses.

Potential Leakage Pathway	Monitoring Activities and Frequency	Planned Response
Existing Wellbores (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 Wellbores (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 Wellbores	Daily inspections of wellheads.	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 CO₂. Coriolis mass flow meters were used to measure the mass of CO₂ received, CO₂ injected, and CO₂ 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. % CO₂) 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 CO₂ at the surface, if any, was determined using various methods, corresponding to where in the CO₂ EOR operations the leakage pathway existed. Core Energy used Subpart W methodology (40 C.F.R. Part 98) to estimate the mass of CO₂ emissions from equipment leaks. Core Energy metered the volume of CO₂ leakage from the wet and dry vents at the Dover 36, Bagley 11, and Chester 16 CPFs. Core Energy estimated the mass of CO₂ lost during the routine paraffin cutting on producing wells by incorporating the size of the lubricator bottle, cutting tools, and the CO₂ volume factor at each well's wellhead conditions at the time of cutting. The total mass of CO₂ from surface leakage from these three methods was incorporated into the term CO_{2 FP} in Eqn. RR-11 of the MRV Plan. In addition to these three methods, Core Energy also calculated the mass of CO₂ 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 CO₂ entrained in the oil ("X" in Eqn. RR-9) was calculated to be 404 metric tonnes, which was added to the mass of CO₂ produced (i.e. CO_{2,w} in Eqn. RR-9) 311,032 metric tonnes, yielding a total mass of CO₂ produced (i.e. CO_{2p} in Eqn RR-9) in 2021 of 311,435 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 CO₂. During 2021, no other leaks were detected.

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

During 2021, 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. Pursuant to Section 2.5.2 of the approved MRV Plan, Core Energy commenced injection into the Dover 12 Unit via the Axford Henry 1-12 Well (UIC Class II Permit: MI-137-2R-0035) within an existing reef (Dover 12) already included in the approved MRV Plan. During the reporting year 2021, the Dover 12 reef was moved from the MMA to the AMA (pursuant to Sections 2.5.5, 3.1, and 3.2 of the approved MRV Plan).
- B. Pursuant to Section 2.5.2 of the approved MRV Plan, Core Energy added the Borowiak 7-6, a producing well into the Chester 5 reef, a reef that has been active and in the AMA since the inception of the MRV Plan. The produced CO₂ mass associated with the well is accounted for through the Dover 36 CPF in the same manner as other wells that are a part of the Chester 5 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 2021 reporting period, there were no anomalies detected.

VI.) Description of Surface CO₂ Leakage:

During the reporting year 2021, 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 CO_{2E} in Eqn. RR-11 was zero).