

petra nova

ANNUAL REPORT: 40 C.F.R. 98.446 (SUBPART RR)

Company Name: Petra Nova Parish Holdings LLC
Company Address: 3040 Post Oak Boulevard, Suite 1600
Houston, TX 77056

GHGPR ID: 575661
Facility Name: Petra Nova West Ranch
Facility Address: P.O. Box 308
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Reporting Period: January 1, 2023 – December 31, 2023
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Executive Summary

Petra Nova Parish Holdings LLC (Petra Nova) began monitoring efforts pursuant to the West Ranch Oil Field CO₂ Monitoring, Reporting, and Verification (MRV) Plan on October 5, 2021. The MRV plan was approved by EPA effective October 5, 2021. The MRV plan identification number is 1013810-1. The data filed associated with this report covers the period from January 1, 2023, through December 31, 2023.

Summary of Monitoring Activities

The below table summarizes Petra Nova's Monitoring Program to track CO₂ losses. The summary table includes potential leakage pathways, the monitoring activities designed to detect those leaks, and locations.

Potential Leakage Pathway	Monitoring Program	Monitoring Location
Diffuse leakage through the Anahuac Shale	SCADA Surveillance	Wellhead to formation
Faults and fractures	SCADA Surveillance	Wellhead to formation
Natural and induced seismic activity	SCADA Surveillance	Wellhead to formation
Failure of zonal isolation in existing wells	SCADA Surveillance	Wellhead to formation
Failure of zonal isolation in new well construction	SCADA Surveillance	Wellhead to formation
Drilling through the CO ₂ area	SCADA Surveillance	Wellhead to formation
Lateral migration outside the West Ranch Oil Field	SCADA Surveillance	Wellhead to formation
Pipeline/surface equipment	SCADA Surveillance Visual Inspection	Production wellhead through recycle facility to injection wellhead

Narrative History of the Monitoring Effort Conducted

CO₂ EOR operation in the West Ranch Oil Field started in December 2016. Although new CO₂ supply from the Petra Nova CCS facility ceased on May 1, 2020, EOR activity continues at West Ranch using recycled CO₂. CO₂ supply from the Petra Nova CCS facility resumed on Sep 7, 2023.

As part of ongoing operations, Petra Nova collected, through the oil field operator, and monitored the pressure data of inactive monitoring wells, as well as the flow, pressure and gas composition data from CO₂ injection wells and production wells, through continual and automated measurements and daily well inspection and maintenance.

In 2023, there was CO₂ Received (CO_{2T,r}). The flow rate of CO₂ Recycled (CO_{2,u}) and CO₂ Produced (CO_{2,w}) were the same in Petra Nova's MRV plan because both were measured at the same flow meters. There are two volumetric flow meters, which are monitored through SCADA (Supervisory Control and Data Acquisition system), and the flow rates are compiled quarterly. The flow meters are calibrated according to manufacturer recommendation and the calibration and accuracy requirements in 40 C.F.R. Part 98.3(i), and also in compliance with National Institute of Standards and Technology (NIST). Composition measurement was

done three to four times per month at the flow meters' location. The quarterly CO₂ concentrations reported in Subpart RR are volume-weighted averages.

The oil field operator used 40 C.F.R. Part 98 Subpart W and engineering estimates to calculate emissions from the surface equipment at the West Ranch Oil Field. The emissions are included in the mass balance equation under Equation RR-11 as below.

- CO_{2FI}: equipment leaks and vented emissions from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead; and
- CO_{2FP}: equipment leaks and vented emissions from equipment located on the surface between the production wellhead and the flow meter used to measure production quantity.

Non-Material Changes to EPA-Approved MRV Plan

There are no non-material changes to Petra Nova's EPA-approved MRV plan for the 2023 reporting period.

Narrative History of Monitoring Anomalies Found

Petra Nova monitored both injection into and production from the reservoir as a means of early identification of potential anomalies that could indicate leakage from the subsurface. For the 2023 reporting period, no monitoring anomalies were found at West Ranch Oil Field.

Description of Surface Leakage

Field personnel at the West Ranch Oil Field routinely conducted visual inspections of surface facilities and wellheads during the reporting period. These inspections included review of tank levels, equipment status, lube oil levels, pressures and flow rates throughout the facility, inspections for valve leaks, verification that injectors were on the proper WAG (Water Alternating Gas injection) schedule, wellheads and valves, flowline, and general observation of the facility for visible CO₂ or fluid line leaks. The emissions are included in the mass balance equation under Equation RR-11 as below.

- CO_{2E}: surface leakage in the reporting year

For the 2023 reporting period, the oil field operator conducted multiple well flow back operations with CO₂ release to improve injectivity of the injectors. Released gas flow volume from a well at each operation is assumed 800Mscf, and CO₂ concentration measured at the HP separator is used to calculate CO₂ emission volume by the flow back operations. There was also CO₂ releases during the maintenance of facility used for a certain CO₂ processing. The released gas flow rate was measured vortex flow meter at upstream of the off-gas pipeline, and samples were taken at near the vortex flow meter to measure CO₂ concentration. Then, CO₂ emission volume of each event was calculated. The estimate volume of CO₂ vented during the operations were 90.1 and 40.5 metric tons respectively, and the combined volume consist of CO_{2E}, the surface leakage.