

Part 98 Mandatory Greenhouse Gas Reporting
Subpart RR – Geologic Sequestration of Carbon Dioxide
Annual Monitoring Report (Revision)

Reporting Period: January 1 – December 31, 2022

Archer Daniels Midland Company (ADM)
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40 CFR Part 98, Section 446, Paragraph (f)(12)

- (i) A narrative history of the monitoring efforts conducted over the previous calendar year, including a listing of all monitoring equipment that was operated, its period of operation, and any relevant tests or surveys that were conducted.

ADM is operating under a Monitoring, Reporting, and Verification (MRV) Plan CCS2 for carbon capture and sequestration at its ADM Decatur location. The plan lists several monitoring efforts with associated monitoring equipment and its period of operation. It also lists tests and/or surveys that must be conducted in the previous calendar year. The monitoring and testing efforts conducted over the previous calendar year include:

- **Continuous monitoring of injection pressure, annulus pressure, and temperature monitoring at the injection well;**
- **Groundwater quality monitoring in the local drinking water strata, the lowermost underground source of drinking water (USDW), and the strata immediately above the Eau Claire confining zone;**
- **External mechanical integrity testing (MIT) and, when required, pressure fall-off testing at the injection well;**
- **Plume and pressure front monitoring in the Mt. Simon using direct and indirect methods (i.e., brine geochemical monitoring, pulse neutron / RST logs, VSP and 3D seismic surveys).**

ADM began injection of carbon dioxide on April 7, 2017 and has continued to operate the monitoring equipment for the duration of injection. ADM utilizes equipment that is recommended by the manufacturers of the equipment for this particular operation and the equipment is calibrated and maintained based on the manufacturer's recommendations. The methodologies utilized for mechanical integrity testing and plume and pressure front monitoring have been approved by the United States Environmental Protection Agency (USEPA).

- (ii) A description of any changes to the monitoring program that you concluded were not material changes warranting submission of a revised MRV plan under §98.448(d).

ADM has reviewed the MRV Plan and is updating it based on plume front delineation revisions and various leakage pathways identified in the reporting year. The revised MRV Plan will be submitted as required in the Electronic Greenhouse Gas Reporting Tool (e-GGRT).

- (iii) A narrative history of any monitoring anomalies that were detected in the previous calendar year and how they were investigated and resolved.

There were no anomalies that directly affected emissions of carbon dioxide. However, there was intermittent monitoring data obtained from a single verification well instrument which started on September 14, 2020. This does not materially affect our ability to monitor injection activities because ADM maintains contemporaneous monitors for the injection well.

- (iv) A description of any surface leakages of CO₂, including a discussion of all methodologies and technologies involved in detecting and quantifying the surface leakages and any assumptions and uncertainties involved in calculating the amount of CO₂ emitted.

ADM detected leakage of CO₂ from components associated with the Illinois Industrial Carbon Capture and Sequestration (IL-ICCS) project in the previous calendar year. One of the leaks was detected on Verification Well #2 on June 28, 2022 and it was estimated, using Crane No. 410 - Flow of Compressible Fluids, that 1.3 metric tons of CO₂ vented during the event from the monitoring well equipment*. Also, ADM conducted several maintenance activities that resulted in vented CO₂ from the injection wellhead equipment with an estimated quantity of 1089.7 metric tons of CO₂ vented*. The method used to calculate emissions from maintenance activities at the injection well was Crane No. 410 - Flow of Compressible Fluids. Additionally, venting of CO₂ occurred from the wellhead annulus tank vent valve as a controlled mechanism to maintain annulus pressure and those CO₂ emissions were estimated to be 16.36 metric tons*. The method used to calculate the annulus tank emissions came from the Emerson Control Valve Handbook 5th Edition for choked control valves and compressible fluids. To estimate fugitive CO₂ emissions from component surface leakages, ADM utilized a Velocicalc 9565 analyzer with 982 probe to physically monitor the components (i.e., valves, connectors, etc.) on the injection system in 2019. The highest concentrations that were recorded on a sample set of components were used to calculate total emissions. These values were entered into an equation which included total component counts to calculate total fugitive emissions. Since no EPA methodology exists for estimating these CO₂ emissions, ADM used EPA Emissions Estimation Protocol for Petroleum Refineries Leak Rates for Synthetic Organic Chemical Manufacturing Industry (SOCMI) which estimates Total Organic Content (TOC) rather than CO₂. The total amount of CO₂ leakage based on this methodology was calculated to be 0.707 metric tons*. These emissions were calculated in 2019 and will be used to estimate emissions in subsequent years since the operating conditions have not changed from year to year. Also, no visual leaks were observed during the monthly inspections required by the monitoring plan.

Lastly, ADM detected a subsurface leakage of CO₂ at the Verification Well #2. The quantity of the leak was estimated using a derivative of the Bernoulli equation. This estimate may have a margin of error due to input parameter uncertainties and so a Monte Carlo simulation was performed to calculate the statistical mean leakage quantity of 307 metric tons. The leakage is vertical and contained in the subsurface at this time. It will be vented to the atmosphere in a controlled manner when installing replacement equipment as a permanent solution. The leakage at Verification Well #2 was a confined event. The temporary measures taken to isolate the CO₂ leakage included installation of tubing and cement plugs to prevent further leakage. A downhole flow control valve and two wellhead valves at surface were also closed to prevent further leakage.**

*CO_{2FI} = Total annual CO₂ mass emitted (metric tons) from equipment leaks and vented emissions of CO₂ from equipment located on the surface between the flow meter used to measure injection quantity and the injection wellhead, for which a calculation procedure is provided in subpart W of this part.

**CO₂ = Total annual CO₂ mass emitted (metric tons) by surface leakage in the reporting year.