Soil CO_2 Flux Sampling and Analysis Plan

Government L Com #001

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02-20-2024

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1.0 Introduction

New Mexico Tech has prepared this sampling and analysis plan (SAP) for surface monitoring activities near the wellbore of Government L Com #001 (API 30-025-25604) to inform potential leakage due to TAG injection occurring at the Red Hills Gas Processing Plant. This SAP was prepared to meet the obligations agreed upon by the New Mexico Energy, Minerals and Natural Resources Department's Oil Conservation Division (NMOCD) and Targa Northern Delaware LLC under CASE NO. 23727, Proposed Alternate Monitoring of Government L Com Well #001. This SAP defines field sampling protocols at the proposed site for the collection and analysis of soil CO_2 flux and includes sampling locations and occurrences, quality control, data review procedures, and reporting.

2.0 General Site Description

2.1 Operations

Targa is currently authorized by the New Mexico Oil Conservation Commission (NMOCC) to inject up to 13 million standard cubic feet per day (MMSCFD) of treated acid gas (TAG) into well RH AGI #1 (API 30-025-40448) at the Red Hills Gas Plant located near Jal in Lea County, New Mexico. Injection in RH AGI #1 was first reported with the New Mexico Oil and Gas Division (NMOCD) in 2018, and in 2023 a total of 385,187 thousand cubic feet (MCF) or 1.06 MMSCFD of CO_2 rich (≈ 85% CO_2 and 15% H_2S) TAG was injected (NMOCD, 2023).

2.2 Geology

The target intervals for RH AGI #1 are the Bell Canyon and Cherry Canyon formations of the Delaware Mountain Group at a depth of approximately 6,200 to 6,530 ft. The combined Bell-Cherry Canyon is composed of >95% medium- to very fine-grained poorly cemented sandstone and siltstones with local tongues of interbedded carbonates (Montgomery et al., 1999, Dutton 2008, Ge et al., 2022). The sandstone also contains numerous channels as well as widespread sand sheets with little cement. Injection into the Bell-Cherry Canyon is contained by approximately 4,000 feet of evaporite and minor carbonate deposits of the lower Rustler, Salado, and Castile formations, and the Lamar Limestone which act as an excellent seal and should ensure no upward migration of fluids from the injection horizon (Jones, 1960; Anderson et al., 1972; Madsen and Raup, 1988; Powers and Holt, 1999).

2.3 Current Monitoring Efforts

In support of the TAG injection program underway in the RH AGI#1 a Monitoring, Reporting, and Verification (MRV) plan was submitted and approved by the EPA according to 40 CFR 98.440 (c)(1), Subpart RR of the Greenhouse Gas Reporting Program (GHGRP) for the purpose of qualifying for the tax credit in section 45Q of the federal Internal Revenue Code. This MRV plan includes multiple monitoring techniques which are being implemented by New Mexico Tech to identify potential leakage of CO_2 and/or brine from the injection horizon into the overlying formations and to the surface. These include seismic data collection and interpretation, groundwater sampling and analysis, and CO_2 soil-flux measurements at 32 locations surrounding the injection well. The use of

a variety of techniques allows Targa to a) continually characterize the interaction between the subsurface and surface at Red Hills, b) develop a baseline/early injection window of these parameters at the injection site, c) determine and address anomalies in environmental conditions which may be related to leakage, d) support the accuracy of the volume of CO_2 sequestered annually.

3.0 Sampling

3.1 Monitoring Adjustment

To constrain possible leakage of TAG from the wellbore of Government L Com #001, CO_2 flux will be monitored in 10 locations within a 50 ft radius of the well. The monitoring network will be strategically placed in the following manner: 1 collar at the wellbore, and 3 collars each at radiuses of 6, 28, and 50 ft (Figure 1; Table 1). This refined network will ensure that any changes in CO_2 concentration at the surface near this well are properly captured. In addition, portable hydrogen sulfide (H_2S) and methane (CH_4) monitors will be deployed during each CO_2 soil flux sampling event.

3.2 Soil CO_2 Flux Background

Soil CO_2 flux data serves as a means for assessing potential migration of CO_2 through the soil and its escape to the atmosphere and is defined as the concentration of CO_2 that crosses a soil surface boundary in a unit of time, usually a second (μmol m−2 s−1; Carmen et al., 2019). To collect CO_2 soil flux at the proposed site near Government L Com #001, we will use a LI-COR LI-8100A flux chamber which uses a closed-chamber accumulation method (Madsen et al. 2009) where air is circulated from a sealed ≈ 8 in. diameter chamber to an infrared H_2O - CO_2 analyzer. Exponential and linear regressions of the CO_2 concentration versus time are used to determine the initial CO_2 concentration and to calculate flux. Typically, the flux calculated by the two regression methods are similar.

3.3 Sampling Overview

At the inception of the first measurement campaign, 10 PVC soil collars (8in diameter) will be installed at the proposed site in accordance with the LI-8100A specifications. These measurement locations are expected to remain generally consistent between sampling events (Figure 1). Any large patches of vegetation will be removed within a 4 ft radius of each new collar location. Soil CO_2 flux will be collected three times in year one, and then semiannually. Samples will be collected during appropriate weather, not occurring directly following any rain events and generally at the same time of day for each event. Because CO_2 soil flux is being collected on ≈ 6 -8 week intervals in the existing network a baseline which identifies seasonal and other variation at the Red Hills AGI site is being fully established. Data from the first few sampling events at the proposed site will be compared to results from other stations within the existing network and to historical data to determine if any surface impacts from prior operations in Government L Com #001 continue to affect the soils gas concentration. If anomalies are found in the initial sampling events then a report will immediately be sent to the OCD detailing findings with recommendations. If values are within the normal range of existing CO_2 flux data in the region, then sampling will proceed as directed and one annual report will be compiled and sent to the OCD as described in the following sections. During collection of CO_2

flux at the proposed site, portable hydrogen sulfide (H_2S) and methane (CH_4) monitors will also be deployed. Any detection of H_2S or CH_4 in the air will be immediately reported.

If an increase in either CO_2 flux or H_2S concentration is found at the surface location of Government L Com #001, monitoring locations and frequency will increase accordingly. Should CO_2 soil flux or ambient H_2S concentration continue to increase and present an environmental or public health threat, Targa will cooperate with the OCD to ensure any necessary remediation efforts are put into place.

3.4 General Sampling Methods

Soil CO_2 flux measurements will be subsequently made by placing the LI-8100A chamber on the soil collars and using the integrated iOS app to input relevant parameters, initialize measurement, and record the system's flux and coefficient of variation (CV) output. The soil collars are left in place such that each subsequent measurement campaign will attempt to use the same locations and collars during data collection. The measurement procedures for gathering data at each location are as follows:

- The soil collar depth (from the soil surface to the top of the collar) is measured, recorded, and input into the LI-8100A measurement parameter definition via the iOS app
- The chamber is attached to the soil collar
- Measurements are initiated using an observation length of 1.5 minutes
- Output data for CO_2 flux and the coefficient of variation are recorded
- Raw data is transferred to a computer and observed for outliers using Li-COR's SoilFluxPro 4 software.

Based on changing environmental conditions, some of the collars may require reseating, replacement, or slight movement during measurement campaigns. Because reseating/replacing could influence the measurement, flux data will not be recorded for any collars that are reseated or replaced during that campaign. QA/QC protocols will be taken to meet Li-COR's instrument and process specifications. When an anomalous flux well outside typical values for the area is acquired, an additional measurement will be taken to confirm its reliability. If the second value is more representative of the flux in the region then it will be used. If the second value is consistent with the first measurement then the two will be averaged. This protocol allows for more certainty in the flux at those locations where initial values may be corrupt.

LI-COR LI-8100A CO_2 soil flux detectors are calibrated initially where additional calibrations are typically unnecessary. However, if readings become problematic, the instrument will be sent to LI-COR to be adjusted and recalibrated. H_2S detectors will be calibrated based on the specific model guidelines.

3.5 Reporting

The findings of the monitoring events shall be organized into a written report to be submitted to the OCD using the following protocols:

- If needed a report of the first sampling event which indicates that measurements are not acceptable based on the previously established baseline which includes seasonal variations

- Otherwise, an annual report that incorporates findings from each sampling event

- Reports will include:

    - A copy of the SAP approved by OCD
    - Time and location for each CO_2 soil flux station and a map showing the location of the sampling stations relative to the surface location of the well
    - Calibration results from H_2S monitors when applicable
    - Recommendations of the sampling event

- The report shall be submitted to the OCD using Form C-103 (General Subsequent). Approval of the C-103 shall constitute acceptance of the report as complete. Targa will notify OCD of any anomalies which would indicate that there is detectable concentration of H_2S in the ambient samples or significant increases in CO_2 soil flux at any location.

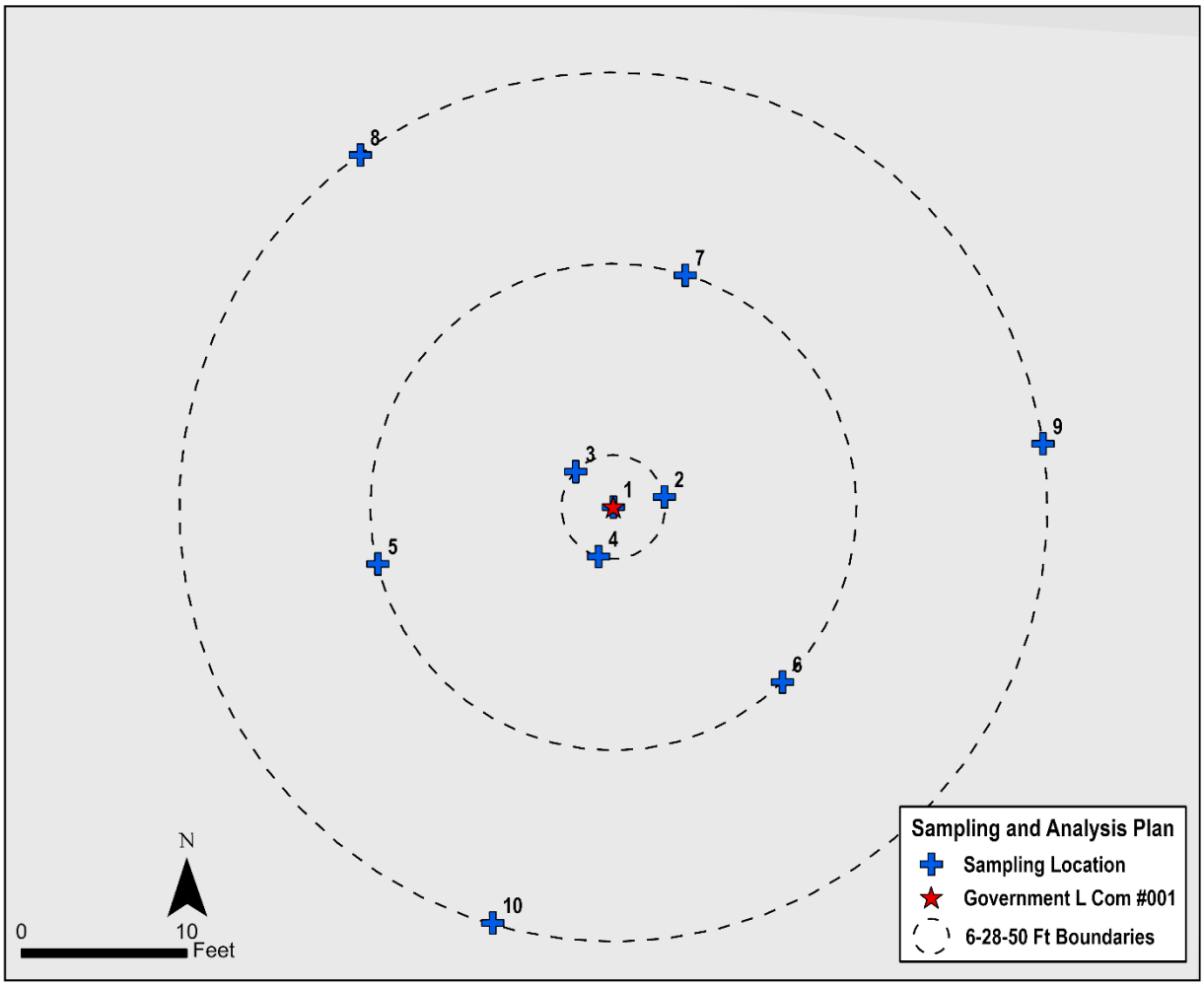

Figure 1. CO_2 flux sampling locations within a 50 ft radius of Government L Com #001 well where 1 collar is at the wellbore, and 3 collars each are placed at radiuses of 6, 28, and 50 ft.

Table 1. Surface locations of CO_2 flux stations within 50 ft of Government L Com #001

Station	Latitude_WGS84	Longitude_WGS84
1	32.2194038	103.506868
2	32.2194054	103.506858
3	32.2194095	103.506875
4	32.219396	103.506871
5	32.2193951	103.506912
6	32.219376	103.506837
7	32.2194404	103.506854
8	32.2194598	103.506915
9	32.2194133	103.506788
10	32.2193383	103.506891

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CONDITIONS

Action 326478

CONDITIONS

Operator: Targa Northern Delaware, LLC. 110 W. 7th Street, Suite 2300 Tulsa, OK 74119	OGRID: 331548
	Action Number: 326478
	Action Type: [C-103] Sub. General Sundry (C-103Z)

CONDITIONS

Created By	Condition	Condition Date
mgebremichael	None	4/10/2024