[redacted]

UIC CLASS VI GEOLOGIC STORAGE OF CO_2 PERMIT APPLICATION

Loving CCS Hub

[redacted]
Loving County, Texas

Section 5: Pre-Operational Testing Program

[40 CFR §146.82(c)]

Prepared for:

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5.0 PRE-OPERATIONAL TESTING PROGRAM [40 CFR 146.82(c), 146.87]

This section features the pre-operational testing to be undertaken by Milestone prior to commencing injection. Permit **Section 6** details monitoring activities to be undertaken after injection commences. Testing in this section is meant to act as a baseline for all subsequent monitoring activities.

During, and prior to, the drilling and construction of the Class VI injection wells, Milestone will run appropriate logs, surveys and tests to determine or verify the depth, thickness, porosity, permeability, and lithology of, and the salinity of any formation fluids in all relevant geologic formations to ensure conformance with the injection well construction requirements under § 146.86 and to establish accurate baseline data against which future measurements may be compared.

5.1 Initial Reporting Requirements

Per 40 CFR 146.87(a), within six (6) months after completion of drilling operations of any wells that penetrate the injection interval, Milestone will submit to the UIC Director a descriptive report prepared by a knowledgeable log analyst, or petrophysicist, that includes an interpretation of the results of logs, core analysis, water testing, seismicity, and any additional tests required by the Director.

[redacted]

5.2 Initial Near Surface Water Testing

[redacted]

n **Table 5-1** and permit **Section 13 Appendix C-QASP**. [redacted] permit **Section 1**.

[redacted]

5.2.1 Sampling and Analytical Methods

[redacted] Prior to sampling, the well will be purged of any fluid stored in the wellbore. [redacted]

[redacted] they should also be tested within the groundwater samples to detect any concentrations beyond the baseline. Results from the samples will be maintained in an electronic database. All samples will be individually numbered, and EPA/TCEQ best practices will be used.

5.2.2 Laboratory Chain of Custody Procedures

Water samples will be sent to a third-party commercial water testing laboratory. Standard chain-of-custody procedures will be followed, and records will be maintained to allow a full reconstruction of how the samples were collected, stored and transported, including any problems encountered.

5.3 Testing and Logging During Drilling and Completion Operations

5.3.1 Ancillary Testing during Drilling Operations Prior to TD

Table 5-2 reflects tests and logs that will be conducted during drilling, casing installation and after casing installation in accordance with the testing required under 40 CFR 146.87(a) and (c).

Per 40 CFR 146.87 (a)(1), deviation measurements will be conducted approximately every [redacted]

[redacted]

[redacted]

[redacted]

5.3.2 Wireline Logging Program

Per 40 CFR 146.87(a)(2)(i) and 40 CFR 146.87(a)(3)(i), before casing is installed, openhole log data will be acquired reflecting in-situ, structural, stratigraphic, physical, chemical, and geomechanical information for [redacted].

Milestone will [redacted] advanced logs and Mechanical integrity logs (MIT) (**Figure 5-1**).

The logging program consists of [redacted] (**Figure 5-1**).

- [redacted].
- [redacted] necessary to meet the requirements of documents 40 CFR 146.87 and 40 CFR 146.86.

[redacted]

[redacted]

In-situ samples acquired at multiple depths will determine the physical and chemical properties of the water, as well as flowing temperature of the fluid. [redacted]

[redacted].

5.3.2.1 Surface and First Intermediate Logging Program

The surface and intermediate hole logging program, as shown in **Table 5-3**, [redacted]

[redacted]

5.3.2.2 Second Intermediate Logging Program

[redacted] shown in **Table 5-4**, [redacted]

[redacted]

[redacted]

[redacted]

5.3.2.3 Program Production Hole Logging Program

The production hole logging program includes the following logs and their main objectives, as shown in **Table 5-5** and **Figure 5-1**. [redacted]

[redacted]

Formation testing will take pressure tests, fluid samples and finally minifrac the formation at the [redacted]

Cement will be evaluated for bond, consistency and height using [redacted]

[redacted]

[redacted]

5.3.3 Formation Fluid Testing

Prior to setting the production casing string, samples of formation fluid will be obtained by [redacted]

Milestone will work with logging vendors to utilize the best possible approach to formation testing design. [redacted]

- [redacted]
- [redacted]
- [redacted]

Per 40 CFR 146.87(d)(3), all samples will use rigorous fluid testing programs that include cations, anions, salinity, specific conductance, hydrogen isotopes, oxygen isotopes, and carbon isotopes as well as additional parameters. [redacted] (**Table 5-6**).

Per 40 CFR 146.87(c) Milestone will record the fluid temperature, pH, conductivity, reservoir pressure, and static fluid level of all tests during field operations.

[redacted]

5.3.4 Minfrac Testing

Per 40 CFR 146.87 (d)(1), during the openhole logging program and prior to any stimulation work, a minifrac test will be completed to measure the fracture gradient of the confining and various injection unit(s) in [redacted] This test will be conducted using a formation pressure and fluid recovery tool. [redacted]

5.3.5 Initial Mechanical Integrity Demonstration and Hydrologic Testing

Table 5-7 is a summary of the Mechanical Integrity Tests (MIT) and pressure fall-off tests to [redacted]

[redacted]

All tests will utilize the latest EPA guidelines. See permit **Section 6** and **Section 13 Appendix C: QASP** for pressure fall-off testing procedures and guidelines.

[redacted]

Per 40 CFR 146.87 and 40 CFR 146.89, the planned cased-hole logs that will be run include several tools meant to establish baselines for future mechanical integrity monitoring. [redacted]. Future logging of this unit, [redacted]

5.4 Coring Testing Program [146.87 (b)]

5.4.1 Core Acquisition

Core acquisition is planned to include [redacted] in **Table 5-8**. [redacted]

[redacted]

[redacted] Depths of coring intervals are illustrated in **Figure 5-1.**

[redacted]

5.4.2 Special Note on [redacted]

[redacted] [40 CFR 146.95] and [40 CFR 146.95a]. [redacted] under [40 CFR 146.95 and 146.95a] [redacted] See permit **Section 1.4** for additional information on the base of USDW in the region.

5.4.3 Core Analysis Program

As part of the appraisal well program within the [redacted] core and reservoir fluid analysis programs are planned. The core and fluid analysis programs are meant to help minimize the risk and reduce the uncertainties within the subsurface data and provide a complete dataset for second generation static and dynamic models. [redacted]

The objective of the core and fluid analysis program is to close data gaps that impact the three principal drivers (i.e., capacity, injectivity and containment) for confirming the Siluro-Devonian and Ellenburger as a safe and secure CO_2 sequestration complex within the area. Based on log analysis results this campaign may be amended to include additional tests. The data gathering campaign is designed to:

a) [redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]
[redacted]ty information
h) Further constrain mineralogy and fracturing.

[redacted]

[redacted]

[redacted]

5.4.4 Phase I: Core Analysis, Fluid Characterization, Core Description and Petrography

The main objective of this phase is to evaluate the integrity of the core and characterize [redacted] depicted in **Figure 5-2**.

a) [redacted]

[redacted]

5.4.5 Phase II: Special Core Analysis

[redacted] Workflow diagramed in **Figure 5-3**.

Reservoir [redacted]

- [redacted]

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted] city.

Seal Characterization:

- [redacted]
- [redacted]
- [redacted]
- [redacted]
- [redacted]

[redacted]

5.5 Initial Seismicity Monitoring

Before injection well drilling operations commence, [redacted] in permit **Section 1**.

[redacted] See permit **Section 6** for more information on seismicity monitoring and magnitude of completeness modeling in the area.

5.6 Artificial Penetration Search

[redacted]

[redacted].

See permit **Section 1** for additional information on the locations of t[redacted]

[redacted]