PRE-OPERATIONAL TESTING PLAN
40 CFR 146.82(a)(8), 146.87

Project Name: Pineywoods CCS Hub

Facility Information

Facility Contact: Pineywoods CCS, LLC
14302 FNB Parkway
Omaha, NE 68154

RRC Organization
Report Number: in process

Entrance Location: 30° 3'45.96"N, 94°33'14.78"W

Well Locations: Liberty and Hardin Counties, Texas

Well Name	Latitude (dms)	Longitude (dms)
PW-1	30° 2'1.24"N	94°31'16.30"W
PW-2	30° 3'45.96"N	94°33'14.78"W
PW-3	30° 6'7.27"N	94°31'27.22"W
PW-4	30° 7'58.94"N	94°31'28.79"W

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List of Acronyms/Abbreviations

AOB-(#)	Above-Zone Observation Well number
AOR	Area of Review
CBL	Cement Bond Log
CCS	Carbon capture and storage
CO_2	Carbon dioxide
EPA	Environmental Protection Agency
ft	Feet

FTS	Flow through sampler
IPW-(#)	In-Zone observation well number
MEM	Mechanical Earth Model
MIT	Mechanical Integrity Test
NMR	Nuclear magnetic resonance
PNC	Pulsed Neutron Capture Log
psi/psig	Pounds per square inch, gauge
psia	Pounds per square inch, absolute
psi/ft	Pounds per square inch per foot
PW	Pineywoods CCS Hub
PW-(#)	Pineywoods CCS Hub injection well number
SAPT	Standard annular pressure test
SP	Spontaneous potential
TVD	True Vertical Depth
UIC	Underground Injection Control
UOB-(#)	Underground Source of Drinking Water Observation Well number
USDW	Underground Source of Drinking Water
XRD	X-ray diffraction

A. Overview of Pre-Operational Testing Plan

The **Pre-Operational Testing Plan** will be implemented to obtain the chemical and physical characteristics of the injection and confining zones and to meet the testing requirements of 40 CFR 146.87 and 16 TAC 5.203(f) and the well construction requirements of 40 CFR 146.86. This plan will include a combination of logging, coring, formation hydrogeologic testing (e.g., a pump test and/or injectivity tests), and other activities during the drilling and construction phases of the proposed observation and CO_2 injection wells listed in **Table 1** at the Pineywoods CCS Hub in Liberty and Hardin Counties, Texas (**Figure 1**).

The **Pre-Operational Testing Plan** will determine or verify the depth, thickness, mineralogy, lithology, porosity, permeability, and geomechanical information of the primary confining zone (Anahuac Marine Shale), the secondary confining zone (Marg A Shale), and the injection interval (Frio Formation). In addition, formation fluid characteristics will be obtained from the Frio Formation to establish baseline data against which future measurements may be compared after the start of injection operations. A total of 24 injection and observation wells will be drilled (**Table 1**). PW-2 will be drilled first and will be used to obtain site characterization data for the Pineywoods CCS Hub. The results of the testing activities will be documented in a report and submitted to the UIC Program Director within 60 days after the well drilling and testing activities have been completed.

Pineywoods CCS, LLC will take sidewall core and acquire logs from PW-2. Pineywoods CCS, LLC will bypass taking whole-core from PW-2 due to the risk of wellbore washouts and the amount of previous coring available in the area (see **Section C** for details).

Similarly, injection fall-off testing would be conducted in PW-2. These tests are used to determine reservoir and confining unit fracture gradients. Detailed geomechanical information gained from core and log analysis will be input into a 1-dimensional Mechanical Earth Model (1-D MEM) to provide understanding of formation mechanical properties and fracture gradients of the Frio Formation and its confining units.

Pineywoods CCS, LLC will rely on information from geologic and petrophysical tests in PW-2 to satisfy the Class VI rule requirements for drilling and constructing injection wells at the Pineywoods CCS Hub. Pineywoods CCS, LLC will use the Anahuac Marine Shale and Frio Formation sidewall core samples collected from PW-2 to satisfy the requirement of 40 CFR 146.87(b). Additional details are provided in the subsequent sections of this plan to describe the rationale for opting to forego whole coring and fracture testing activities in the proposed PW-2.

A total of four injection wells (PW-1, PW-2, PW-3, and PW-4) are planned to be drilled at the Pineywoods CCS Hub (**Figure 1**). Wireline testing for the in-zone monitoring wells will be identical to PW-2 except for the collection of sidewall cores and fluid samples, which will only be collected in PW-2.

Table 1: List of all wells for the Pineywoods CCS Hub.

Well Types	Well Acronym	CCS System Zone	Zone Formation	Zone Depth (ft SSTVS)	Quantity
Shallow Groundwater	**GW (1-7)** GW-1, GW-2, GW-3, GW-4, GW-5, GW-6, GW-7	Shallow USDW	Pliocene *(Chicot Aquifer)*	<575	Up to 7
Deep Observation	**UOB (1-6)** UOB-1, UOB-2, UOB-3, UOB-4, UOB-6	Lowermost USDW	Upper Miocene *(Evangeline Aquifer)*	Base 2,100	6
Above-Zone Observation	**AOB (1-3)** AOB-1, AOB-2, AOB-3	1st Permeable Zone	Lower Miocene 1	4,700-4,810	3
In-Zone Observation	**IPW (1-4)** IPW-1, IPW-2, IPW-3, IPW-4	Reservoir	Lower Frio	7,100-6,000	4
Injection	**PW (1-4)** PW-1, PW-2, PW-3, PW-4	Reservoir	Lower Frio	7,100-6,000	4

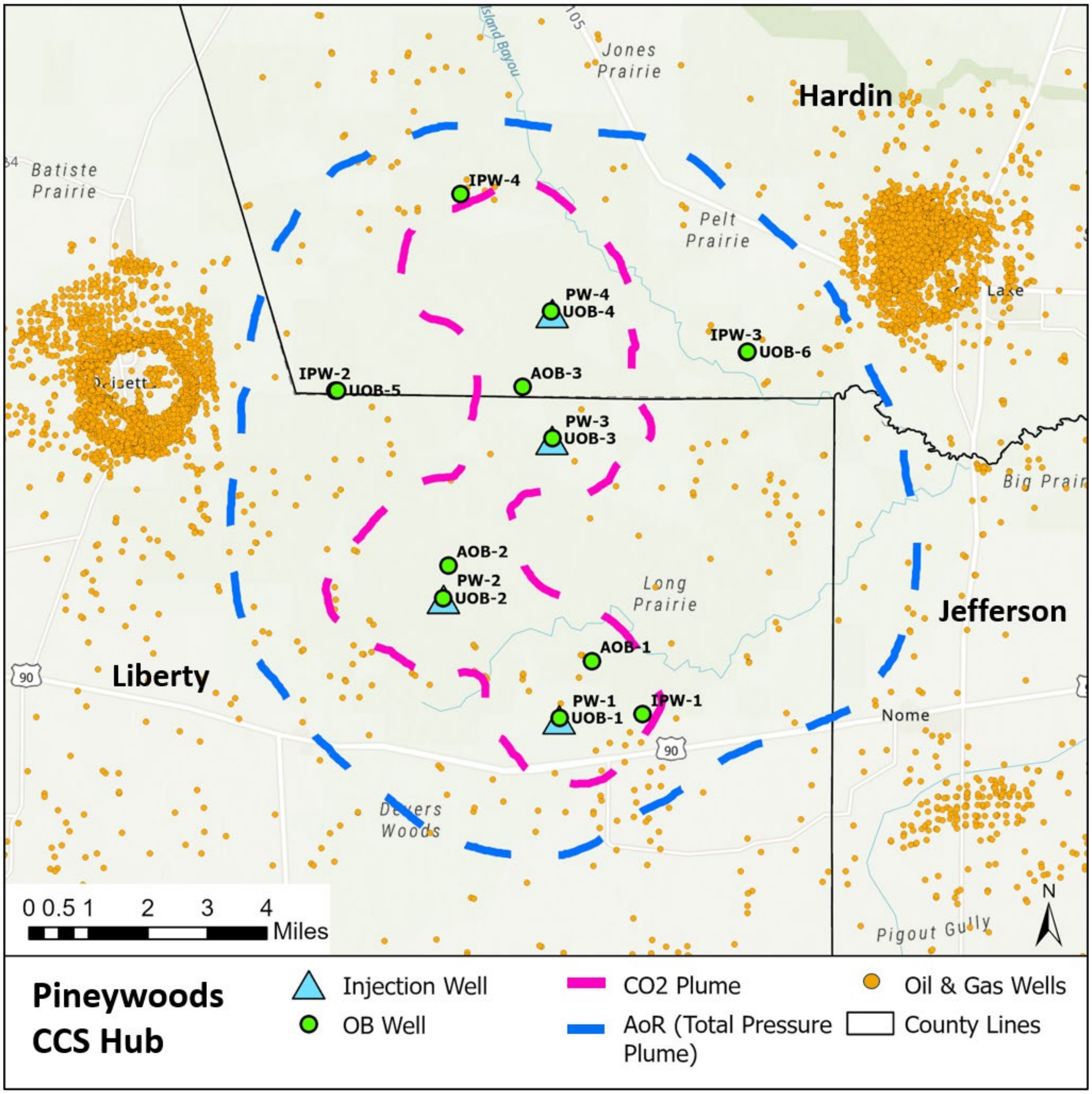
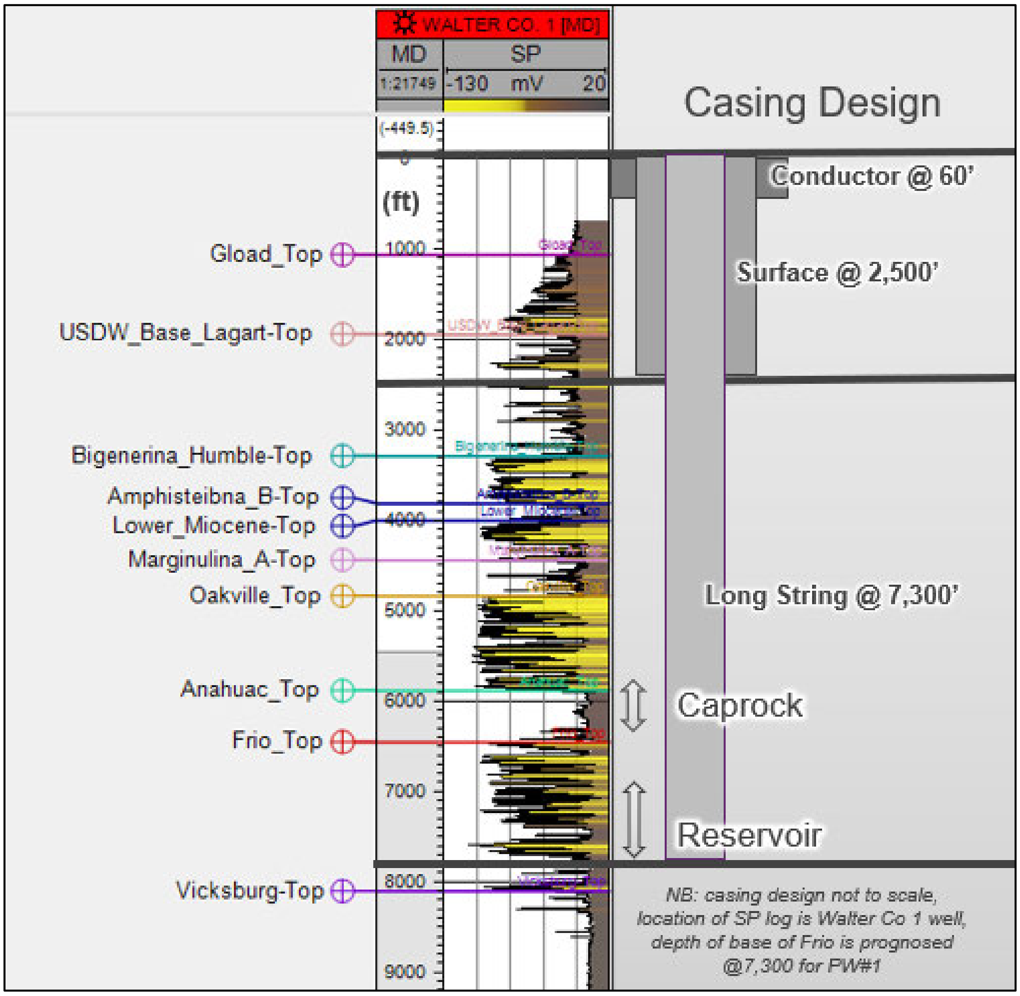


Figure 1: Locations of proposed injection and observation wells at the Pineywoods CCS Hub

B. Wireline Logging

Open-borehole logs will be collected in PW-2 to obtain in-situ structural, stratigraphic, physical, chemical, and geomechanical information for the confining zones and the injection zone. Logs, surveys, and tests will be used to ensure conformance with the injection well construction requirements according to 40 CFR 146.86 and establish accurate baseline data for future comparison. Open-borehole characterization logs will be obtained after reaching the surface casing point within long-string casing point (i.e., total borehole depth) in the vertical borehole (**Figure 2**).



Note: depths are approximate because the Walter Co. 1 well is offset approximately 12 miles directly east from PW-2.

Figure 2. Casing intervals for PW-2, including conductor, surface and long-string depths.

Wireline logging will be completed in all injection (PW-1, PW-2, PW-3, PW-4) and in-zone observation (IPW-1, IPW-2, IPW-3, IPW-4) wells to verify depth placement of the injection and monitoring intervals. A description of each logging method that Pineywoods CCS, LLC will include in its logging program at all injection and in-zone observation wells includes:

Open Hole Logs

- **Geologic Description (Mud Log)** – Provides a continuous visual description of the drill cuttings-based lithology of the formations as the well is drilled. Physical cuttings sample datasets are typically collected and cataloged every 20-50 ft for future assessment. Mud logs are also used to evaluate any hydrocarbon or natural gas shows encountered while drilling the well.
- **Triple Combination** – Includes gamma-ray/spontaneous potential, porosity, and resistivity logs.

- **Acoustic Scanning Log (i.e., Dipole Sonic)** – This acoustic log measures elastic properties axially, radially, and azimuthally to support geomechanical, geophysical, fractures, and petrophysical modeling. Furthermore, sonic logs, like compressional sonic (DT), can be used along with density logs for preparing synthetic seismic logs.
- **Formation Micro Imager** – Provides micro-resistivity formation images when using water-based mud. Borehole images can reveal bedding planes and associated contacts, fractures (open, healed, and induced), and reservoir textures (sedimentary structures). A multi-arm caliper run with this tool provides information on hole shape and is used for subsurface stress analysis. The tool also provides borehole inclination and azimuthal information which complement the deviation check surveys taken while drilling the well.
- **High-Definition Nuclear Magnetic Resonance** – This log provides nuclear magnetic resonance (NMR) measurements of the buildup and decay of the polarization of hydrogen nuclei (protons) in the liquids contained in the pore space of rock formations. One key measurement provided by this log is the total formation porosity. Permeability and effective porosity can be estimated from the free-fluid to bound-fluid ratio and the pore-size distribution. NMR measurement can also be used for fluid identification because this log also provides a hydrogen index measurement.
- **Pulsed Neutron Spectroscopy** – This logging tool is used for measurements and definitions of mineralogy and matrix properties of injection and confining zones. The data from spectroscopy logging can be used to estimate mineral-based permeability, determine well-to-well correlations from geochemical stratigraphy, and determine sigma matrix for case hole and open hole sigma saturation analysis, among others. Elemental analysis or similar processing of these logs yields the volumetric proportions of mineral composition and pore fluids. For example, these logs can reveal the relative proportions of clay minerals, quartz, calcite, and fluid volume in the formation.
- **Wireline Formation Testing** – This wireline tool suite has the capacity to collect reservoir pressure measurements, static fluid levels and fluid samples that can be kept at formation pressures representative of downhole conditions. The tool can also be run to conduct a *mini-frac* test. These tests provide fracture pressure estimates and far field stress directions (in conjunction with the formation micro imager). Wireline test data can be used as calibration for other stress measurements (sonic logs).

Cased Hole

- **Ultrasonic Imaging Tool** – This log can provide estimates of well integrity and zonal isolation through measurement of cement acoustic impedance. The information from this log can be used to create maps of the casing integrity and cement, to identify corrosion or casing damage, and determine if there is solid (cement), liquid, or gas in between the casing and formation. Modern acoustic cement-evaluation tools, such as ultrasonic logs, are comprised of monopole (axisymmetric) transmitters (one or more) and receivers (two or more). They operate on the principle that acoustic amplitude is rapidly attenuated in good cement bond but not in partially bonded or free pipe. The ultrasonic tool can also provide a casing thickness interpretation.
- **Cement Bond Log (CBL)** – CBL tools use sonic waves to interrogate the integrity of the well's cement. CBLs use acoustic transmitters and receivers to measure signal attenuation to provide a measure of how well the casing and the cement are bonded. CBLs provide an

indication of the cement-to-formation bond in the form of a variable density log. Typically, CBLs provide an average measurement but they can also provide maps where logging tools with multiple transmitters and receivers on pads are used.

- **Temperature Logging Surveys** – The temperature log provides a subsurface temperature profile necessary for characterizing in-situ conditions. Temperature logging is used to identify the top of cement after cementing to help ensure wellbore integrity.

Table 2 lists the various Surface and Long String Casing wireline logging tools that will be deployed in the injection (PW-1, PW-2, PW-3, PW-4) and in-zone observation (IPW-1, IPW-2, IPW-3, and IPW-4) wells.

Table 2: Wireline logging program for PW-1, PW-2, PW-3, PW-4, IPW-1, IPW-2, IPW-3, and IPW-4.

Depth Interval (ft)	Log	Purpose/Comments
Surface Casing		
0 – 2,200	Mudlog	Monitor and ensure uninterrupted drilling process as well as provide lithologic information while drilling
0 – 2,200	SP/Resistivity	Characterize basic geology (Lithology, formation tops)
0 – 2,200	Cement Bond Log	Evaluate cement integrity
Long String Casing		
2,200-7,900	Mudlog	Monitor and ensure an uninterrupted drilling process as well as provide lithologic information while drilling
2,200-7,900	Temperature Log	Determine natural geothermal gradient outside well for comparison to future temperature logs for external mechanical integrity evaluations. Baseline log is run a minimum of 30 days after drilling and casing/ cementing the well because temperature anomalies due to circulation of drilling fluid and/or open-borehole injection testing will persist for several weeks to months.
2,200-7,900	Borehole Profile/Caliper	Evaluate borehole condition prior to cementing
2,200-3,500	Nuclear Magnetic Resonance Tool	Enhanced characterization of geologic and geomechanical properties that control injectivity and caprock/seal integrity.
3,500-7,900	Triple Combination/Pulsed Neutron Spectroscopy	Characterize basic geology (Gamma Ray, Resistivity, Porosity, Mineralogy)
3,500-7,900	Formation Micro Imager	Enhanced characterization of geologic and geomechanical properties that control injectivity and caprock/seal integrity.

Depth Interval (ft)	Log	Purpose/Comments
3,500-7,900	Dipole Sonic	Determine the reservoir fracture pressure gradient and geomechanical properties of the confining and injection zones
2,200-7,900 (cased hole)	Cement Bond Log/Ultrasonic/Temperature	Evaluate cement integrity, internal and external casing condition

C. Coring

Due to the risk of wellbore washouts and the amount of previous coring available in the area, Pineywoods CCS, LLC will forego collecting whole core in PW-2. Instead, whole core analysis from the DOE-sponsored Frio Brine Pilot Project in Liberty County approximately 20 miles southwest of the Pineywoods CCS Hub (see Figure 8 in Narrative for precise location) will be used. In the Frio Brine Pilot Project, 1,600 tons of CO_2 were injected 1,500 m below surface into a high permeability brine-bearing sandstone of the Frio Formation, the same proposed injection interval as the Pineywoods CCS Hub (Hovorka, et al., 2005). The whole core taken at the Frio Brine Pilot Project has had extensive testing performed on it (Hovorka, 2006) and would be comparable to any whole core taken from the Pineywoods CCS Hub.

Pineywoods CCS, LLC will attempt to collect approximately 50 rotary sidewall cores in PW-2. The planned distribution of these 50 sidewall cores is provided in **Table 3**. These sidewall cores will be preserved on-site and shipped to a commercial core testing/analysis laboratory for analysis. Properties analyzed will include routine core analysis (porosity, permeability, grain density and residual fluid saturation). Specialized core analysis, including X-ray diffraction (XRD) for mineralogical analysis and capillary pressure will be conducted on selected whole core samples. If the wireline formation tests fail to determine injection and confining zone mechanical properties, core plug mechanical property tests (e.g., triaxial tests) may be conducted to determine these properties and to estimate fracture pressure. The wireline and/or core mechanical property results will be used to calibrate wireline logs.

Table 3: Planned Sidewall Core Collection by Formation in PW-2.

Formation	# of Core Plugs
Upper Anahuac	5
Anahuac Marine Shale	5
Lower Anahuac Massive Sand	5
Upper Frio	15
Middle and Lower Frio	20
TOTAL	**50**

D. Fluid Sampling

The analysis of reservoir fluid samples will be used to satisfy the requirement of 40 CFR 146.87(c) and ensure that baseline geochemical properties are established for the Frio Formation across the AOR for the Pineywoods CCS Hub. Pineywoods CCS, LLC will collect fluid samples from PW-2 for the Frio Formation. Any fluids introduced into the formation during drilling, borehole conditioning, cementing, perforation acid treatment, and/or formation (injection) testing would first need to be removed before representative formation fluid samples can be collected. Consequently, Pineywoods CCS, LLC will attempt to collect fluid samples during the active drilling phase using a Wireline Formation Testing tool rather than collect samples after well completion. The in-zone fluid samples from PW-2 will be collected using a formation testing tool while the hole is open. If fluid samples cannot be taken via the formation testing tool, fluid samples can be collected after well completion by swabbing fluid or pumping through tubing with a packer set just above the perforated interval. After an appropriate volume of fluid is swabbed from the well, samples can be taken via a slickline deployed tool, such as a Kuster Flow Through Sampler (FTS) or equivalent. Both fluid sampling methods will sample reservoir pressure and static fluid levels.

The analytic and field parameters for fluid sampling are presented in **Table 4**. These parameters are consistent with the fluid sampling analysis and processes that are detailed in the **Testing and Monitoring Plan** and the **Quality Assurance Surveillance Plan** associated with this permit. Pineywoods CCS, LLC will also collect hydrogeologic data from the extensive wireline program, as discussed in **Section B** of this plan.

Table 4: Summary of analytical and field parameters for fluid sampling in the Frio Formation injection interval

Parameters	Analytical Methods
Frio Formation (Injection Interval)	
Cations: Al, Ba, Mn, As, Cd, Cr, Cu, Pb, Sb, Se, and Tl	ICP-MS, EPA Method 6020
Cations: Ca, Fe, K, Mg, Na, and Si	ICP-OES, EPA Method 6010B
Anions: Br, Cl, F, NO_3 and SO_4 Dissolved CO_2	Ion Chromatography, EPA Method 300.0 Coulometric titration, ASTM D513-11

Parameters	Analytical Methods
Total Dissolved Solids	Gravimetry, APHA 2540C
Water Density	Oscillating body method
Alkalinity	APHA 2320B
pH (field)	EPA 150.1
Specific conductance (field)	APHA 2510
Temperature (field)	Thermocouple

E. Mechanical Integrity Testing

Pineywoods CCS, LLC will conduct tests and run logs as needed to demonstrate the internal and external mechanical integrity of all injection wells prior to initiating CO_2 injection, satisfying the hydrogeologic testing requirements under 40 CFR 146.87(e). Internal mechanical integrity refers to the absence of leaks in the tubing, packer, and casing above the packer. External mechanical integrity refers to the absence of fluid movement/leaks through channels adjacent to the injection wellbore that could result in fluid migration into an USDW.

Prior to drilling out the plug on each casing string, a casing pressure test will be conducted. The test will be designed not to exceed the rated pressure of the casing. Per 16 TAC 3.13(a)(5), surface casing should be tested to a pressure calculated by multiplying the casing string length in True Vertical Depth (TVD) by a factor of 0.5 psi per foot. The maximum pressure, unless otherwise ordered, is 1,500 psi. Per 16 TAC 3.96, long string casing will be tested at 1,500 psi or 0.2 psi/ft, not to exceed 1,500 psi).

If a decline in pressure greater than 10% within the first 30 minutes of testing is noted, or if other indications of a leak are indicated, then the casing string will be recemented or repaired, or have an additional casing string run. Once remedial measures have taken place, the pressure test will be conducted again. After cementing the casing strings, drilling will not commence until a time lapse of 12 hours under pressure has passed. All casing pressure tests will be recorded in the driller's log (16 TAC 3.13(a)(5)).

Pineywoods CCS LLC shall notify RRC of a failed test. In the event of a pressure test failure, completion operations may not re-commence until RRC approves a remediation plan, the operator successfully implements the plan, and the operator conducts a successful pressure test (16 TAC 3.13(a)(5)).

After the completion of all injection wells (PW 1-4), which includes the installation of tubing, packer, and annular fluid, a test of each well's internal mechanical integrity will be performed by conducting a standard annular pressure test (SAPT). The annular pressure test is a short-term test wherein the fluid in the annular space between the tubing and casing is pressurized, the well is shut-in (temporarily sealed up), and the pressure of the annular fluid is monitored for any changes.

The initial annulus pressure test will be designed pursuant to 16 TAC 3.9 (12). The test will include pressurizing the fluid-filled annulus to the maximum authorized injection pressure or 500 psig, whichever is less, and monitoring the pressure throughout a 30-minute test period. A passed test is one where the applied test pressure stabilizes within 10% of the required test pressure for the testing period whereas a failed test is one where there is a 10% or greater loss of the applied pressure.

During the active CO_2 injection phase, internal mechanical integrity will be continuously monitored by the well annular pressure maintenance and monitoring system, as discussed in more detail in the **Testing and Monitoring Plan**.

Pineywoods CCS, LLC will also employ various methods to demonstrate external mechanical integrity upon the completion of all injection wells and prior to the start of injection operations. Pineywoods CCS, LLC will run DTS temperature surveys on all injection wells in order to demonstrate external mechanical integrity to provide confidence that there are no pathways for potential CO_2 or brine migration through the wellbore, casing, or cement prior to injection operations, satisfying the requirement of 40 CFR 146.87(a)(4).

F. Fracture Pressure of Injection and Confining Zones

As discussed above, PW-2 will be drilled and completed with limited testing after open hole logs are gathered. This will help limit borehole rugosity and provide the highest probability of achieving a mechanically sound cement installation. As such, Pineywoods CCS, LLC does not intend to complete an open-hole fracture pressure test in PW-2. Alternatively, prior to installing the long-string casing in IPW-1, Pineywoods CCS, LLC will use the formation testing tool in IPW-1 to conduct formation fracture tests to measure the fracture pressure of the injection formation and the confining unit(s). Then, a *minifrac test* will be used to locally pressure up a small interval in the test formation to the point where it just starts to fracture. This provides the fracture pressure without causing significant damage to the formation being tested.

In addition, to fully satisfy the requirements of 40 CFR 146.87(d), Pineywoods CCS, LLC intends to run a dipole sonic log (Stoneley wave analysis) in PW-2 which will allow calculation of the injection and confining zone reservoir fracture pressure.

G. Hydrogeologic Testing

After PW-2 is complete, including perforating the injection interval and installing the injection tubing and packer, Pineywoods CCS, LLC intends to run an injection test on the Frio Formation to determine the large-scale composite injectivity (transmissivity) of the injection interval and possible presence of nearby hydrogeologic boundaries (**Table 5**). The injectate for this test will be produced Frio Formation water (brine) from PW-2 or fresh water which will serve as a proxy for CO_2 injection. Pineywoods CCS, LLC intends to use the extensive wireline logging program to support and corroborate the hydrogeologic properties that are collected via direct fluid sampling from the injection zone. Additionally, Pineywoods CCS, LLC will collect reservoir pressure from the Frio Formation in PW-2 during the injectivity test.

Table 5: Composite Injectivity Evaluation Testing Program

Test	Description	
Frio Formation Composite Injectivity Evaluation	Objectives	**Primary objective:** To determine the large-scale transmissivity of the Frio Formation and possible presence of nearby hydrogeologic boundaries using produced reservoir brine from PW-2 or fresh water and provide direct information about the injectivity potential of the Frio Formation or a selected portion of it.
	Test/Depth Zone	The Frio Formation. Approximate depth interval 3,500-7,900 ft measured depth. Alternatively, this test may be conducted on one or more discrete depth intervals within the Frio Formation.
	Test Activity/ Summary	The injection tubing and packer would be set just above the top of the Frio Formation inside the casing string. After the packer is in place, a constant-rate injection utilizing produced reservoir brine from PW-2 or fresh water will be conducted. At the end of injection, the recovery pressure for the composite zone will be monitored for a period approximately 1.5 times or more of the injection period.

A pre-operation injection and pressure fall-off test will serve as the baseline test for establishing reservoir and well conditions for comparison to results of subsequent pressure fall-off tests conducted during the operational period (i.e., during CO_2 injection). Specifically, this comparison is intended to confirm that the pressure increase within the injection interval is less than predicted and ensure that the modeled parameters used in the **Area of Review and Corrective Action Plan** modeling analysis represent actual conditions.

The pressure fall-off tests will be conducted according to the EPA Region 6 *UIC Pressure Falloff Testing Guideline, Third Revision (2002)*. These guidelines define a pressure fall-off test as a pressure transient test that consists of shutting in an injection well after a period of prolonged injection and measuring the pressure fall-off. The fall-off period is a replay of the injection test preceding it; consequently, it is affected by the magnitude, length, and rate fluctuations of the injection period. Fall-off testing analysis provides reservoir and well parameters, including transmissivity, storage capability, skin factor, and well flowing and static pressures. Establishing a baseline value for these parameters will be useful for identifying changes in the well and/or reservoir properties after CO_2 injection begins; for example, an increasing skin factor may be indicative of formation damage which signals a need for well remediation while a decreasing skin factor may indicate near-wellbore cleanup.

The baseline pressure fall-off test will be conducted as part of the post-completion injectivity testing (e.g., constant-rate injection test conducted as either a single-well test and/or multi-well interference test) discussed in section **H Stimulation Program**.

H. Stimulation Program

The need for considerable well stimulation to enhance the injectivity potential of the Frio Formation, such as hydraulic fracturing, is not anticipated. Modeling based on data collected from the geologic site characterization and the experience gathered from the DOE-sponsored Frio Brine Pilot Project has concluded that the injection zone is of high quality due to the relatively high porosity and permeability of the Frio Formation. More information regarding the reservoir properties can be found throughout the **Application Narrative**.

However, if there is a need to bypass near-wellbore drilling induced damage, perforations may be flushed with an acid mixture. The acid reacts with the carbonates in the well cement and drilling fluids that may clog the perforations. To further ensure the acid cleans all perforations, soluble ‘perf balls’ may be pumped to divert fluid from high flow perforations to those with flow constrictions. These ‘perf balls’ temporarily seal perfs, then dissolve completely to leave clear access to the formation. A proposed well stimulation plan is shown below.

1. Move in and rig up service rig, water tanks, pressure control equipment, and mud pump.
2. Fill tanks with fresh water; mix in potassium chloride salt (KCl) to increase the fluid density above reservoir pressure which prevents back flow.
3. Pump KCl brine water mix to kill well.
4. Trip in hole with work string and circulate hole with KCl brine mixture.
5. Rig up acid pumper, bulk acid truck, piping, and ball diverter.
6. Pump approximately 500 gals of acid (typically HCl or HF, 7.5 to 15% concentration) at 3 to 8 barrels per minute, dropping water soluble balls every minute. The number of soluble balls will slightly exceed the number of perforations in the wellbore casing. The final acid type concentration and volume will be determined from modeling of the reactions between the acid and the mineralogy we encounter during drilling.
7. Displace acid to perforations; shut in well to let acid work and perf balls dissolve, approximately 30-60 minutes.
8. Pump KCl brine into formation.
9. Trip work string out of hole, rig down service rig and ancillary equipment. Reconnect flowlines/electronics as necessary.

I. Schedule

Pineywoods CCS, LLC will provide the UIC Program Director with the opportunity to witness all logging and testing by this subpart. Pursuant to 40 CFR 146.87(f), Pineywoods CCS, LLC will submit a schedule of such activities to the UIC Program Director 30 days prior to conducting the first test and submit any changes to the schedule 30 days prior to the next scheduled test. The scheduled testing will be developed within 90 days following the permission for the construction of the proposed injection well.

J. Reporting

Pursuant to CFR 146.87(a), Pineywoods CCS, LLC will provide the UIC Program Director with a descriptive report(s) prepared by a knowledgeable analyst(s) that includes an interpretation of the results of the casing and cement integrity, well logging, well testing, and core data for each injection well. These report(s) will include:

- The date and time of each pressure test, the date of well bore completion, and the date of installation of all casings and cements, including chart results and interpretations of each cement bond log, cement pressure tests, and any supplemental well data,
- Interpretation of the well logs by a log analyst, including any assumptions, determination of porosity, permeability, lithology, thickness, depth, and formation fluid salinity of relevant geologic formations, and any changes in interpretation of site stratigraphy based on formation testing logs,
- Interpretation of whole and/or sidewall core analysis results, including any changes in interpretation of site stratigraphy based on core analysis, analytical methods, quality assurance information, tabular and/or graphic data, and photographs.
- Reservoir fluid sampling results, including descriptions of the sampling equipment, sampling methodology, sample preservation methods, field and laboratory results, and any changes in interpretation of site stratigraphy based on fluid sample results,
- Reservoir pressure results and geomechanical results to determine injection and confining zone fracture pressure, including type and location of pressure gauge, type of flow meter and calibration records, raw pressure and flow data, and plot of flow rate versus pressure data, and any changes in geomechanical interpretations based on test results, and
- Hydrogeologic test results, including pressure and flow data, testing parameters, discussion of results, and any changes in interpretation of injectivity and storage potential based on injection/fall-off test results.

RRC requires test records to be submitted within 30 days after the testing (16 TAC 5.207(a)(1); see **Section A.6 of the Testing and Monitoring Plan** for details).

References

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